Chapter 1

Taking Web Services for a Test Drive

- What's a Web Service?
- Understanding Operations That Are Well Suited for Web Services
- Retrieving Weather Information
- Using a Web Service 101
- Retrieving Stock Quotes
- Retrieving Book Information
- Retrieving Caller-ID Information
- Retrieving Traffic Information
- Retrieving Airport Information
- Where to Find Web Services on the Web

Unlike most discussions of web services that begin with an examination of the underlying network protocols, this chapter sets aside the underlying details and lets you test drive a variety of web services that other developers have created and made available on the Web. You will first experience many of the web services by using your browser to view active server pages that use the web service to implement their processing. Then, after you understand the operation the service performs, you will create a program that puts the service to use.

This chapter's goal is to give you a hands-on understanding of the types of web services you can create. This chapter makes extensive use of the Microsoft Visual Studio .NET programming environment to create programs that access the web services. You can take advantage of web services using several programming languages. This chapter presents programs and ASP.NET pages written in Visual Basic .NET and C#. If you are not yet programming within the .NET environment, the ease with which Visual Studio .NET lets you integrate web services into your programs should provide you with motivation to migrate to .NET.

In Chapter 2, "Creating Your First Web Services," you will learn that Visual Studio .NET also makes it easy for you to create your own web services. In Chapter 3, "Accessing Web Services from within HTML Pages," you will learn how to create HTML pages that interact with web services from within Visual Basic and applications that incorporate Visual Basic, such as Word and Excel. In later chapters, you will learn how to create and interact with web services using other programming languages such as Java and Perl.

What's a Web Service?

To break complex programs into manageable tasks, programmers make extensive use of *functions.* Each function within a program should perform specific processing (a service). For example, the following C program, Hello.c, uses the `printf` function to display a message to the user:

```
#include <stdio.h>

void main(void)
  {
    printf("Hello, Programming World");
  }
```

In a similar way, the following Visual Basic .NET code fragment, from the program DisplayDateTime.vb, uses the `Now` and `MessageBox.Show` functions to retrieve and then display the current date and time and the `Close` function to close the current form:

```
Private Sub Form1_Load(ByVal sender As Object, ByVal e As _
➥   System.EventArgs) Handles MyBase.Load
```

```
    MessageBox.Show("Current Date and time is: " & Now(), _
       "Display Date & Time")

    Me.Close()
End Sub
```

Think of a web service as a function your programs can use to accomplish specific tasks. Just as a function can receive (and possibly change) parameter values, so too can a web service. Likewise, just as functions often return a value to the calling program, so too can a web service.

To use a function such as `printf` or `MessageBox.Show`, you must know the type of value the function returns as well as the number and types of parameters you can pass to the function. The same is true for a web service.

What makes a web service different from a traditional function is that the code for the web service resides on a remote server. Before a program can use a web service, the PC running the program must have a network connection (a dial-up connection will suffice).

When your program calls a web service (using a function call), your program, as shown in Figure 1.1, will send a network message to the server that specifies the desired service. If the web service requires parameters, the message will include values for each.

After the server completes the web service's processing, the server, as shown in Figure 1.2, will send a network message containing the service's result back to your program.

FIGURE 1.1: To call a web service, a program sends a network message to the server upon which the web service resides.

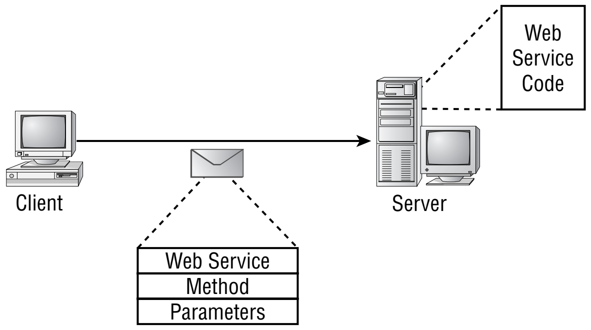
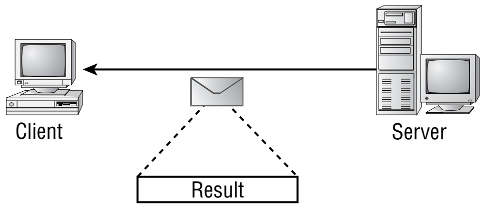


FIGURE 1.2: After the server executes the web service's instructions, the server will send a network message containing the service's result to the calling program.



Because a web service requires the exchange of network messages and because the server that executes the service may be busy performing other tasks, a web service will execute substantially slower than a standard function. Depending on factors such as network traffic, the amount of time a web service will require may vary from one use of the service to the next.

Understanding Operations That Are Well Suited for Web Services

Because network overhead makes a web service execute much slower than a standard function, many operations are not well suited for implementation as a web service. Using a web service to add two numbers, for example, or to calculate a random number, would introduce unnecessary overhead to a program. Such operations are better suited for implementation using standard functions.

Web services, in contrast, are ideal for operations that use data residing at a remote source (most often within a database on a specific server). For example, web services are well suited for the following operations:

- Responding to queries for stock quotes
- Returning information regarding the availability of specific inventory items
- Providing real-time information, such as weather and road conditions
- Offering airline flight arrival and departure information
- Implementing e-commerce operations, such as ticket sales for movies and special events
- Authenticating users or credit-card information

You may be saying to yourself that users already perform such operations on many sites across the Web. Web services provide programmers with a way to integrate these operations into their programs. By using web services to implement common user operations (such as downloading stock quotes, ordering a book, and checking the weather) within your company's website, you can keep users from leaving your website to perform these operations elsewhere. By taking advantage of web services, you can integrate powerful processing developed by other programmers into your applications and web pages.

To help you better understand how web services extend the functionality of the Web into your applications, the remainder of this chapter will let you test drive readily available web services.

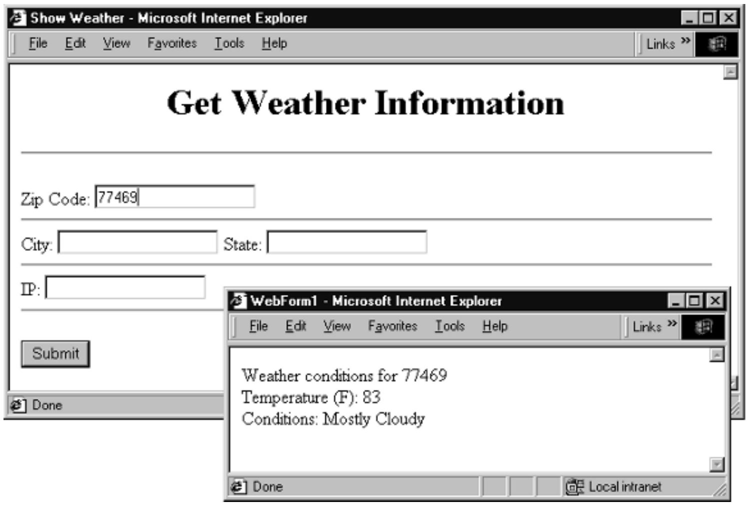
Web Service Updates from This Book's Companion Website

The examples this chapter presents make use of web services existing on the Web at the time of this writing. Over time, the services this chapter presents may change or become unavailable. This book's companion website, which you can find by following the links at `www.sybex.com`, will provide updates to the chapter code as the services change.

From the companion website, you can download the source code for all of the programs and services this book presents. You will find links to other key web development sites too.

Retrieving Weather Information

Each day millions of web users look up weather information. Across the Web, some of the fastest growing websites provide specifics about weather. The HTML file `ShowWeather.html`, which you can find at this book's companion website, creates a form that prompts the user to enter a zip code, city and state, or an Internet protocol (IP) address. After the user enters the data and clicks the Submit button, the user's browser sends the user input to an ASP.NET page that uses a Web service residing on the ServiceObjects website. The FastWeather web service will provide the ASP.NET page with weather data for a specific location. After the ASP.NET page receives the data from the service, it will display the result, as shown in Figure 1.3.


Show Weather - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Links
Get Weather Information
Zip Code: 77469
City:
State:
IP:
Submit
Done
WebForm1 - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Links
Done
Local intranet

Weather conditions for 77469
Temperature (F): 83
Conditions: Mostly Cloudy

FIGURE 1.3: Using a web service to obtain weather data

NOTE The ServiceObjects website provides several powerful web services you can immediately integrate into your applications. Take time now to visit the site at `www.ServiceObjects.com`.

Looking Behind the Scenes at the FastWeather Web Service

To use the FastWeather web service, programs can call one of three methods (functions), passing to the methods the corresponding parameters:

```
string GetWeatherByIP(string IP, string LicenseKey)
string GetWeatherByCityState(string City, string State, string LicenseKey)
string GetWeatherByZip(string Zip, string LicenseKey)
```

Each of the functions, if successful (meaning the program provided a valid IP address, zip code, or city and state combination), will return a structure of type `Weather` that contains the following fields:

```
Weather
   string LastUpdated
   string TemperatureF
   string WindChill
   string HeatIndex
   string Humidity
   string Dewpoint
   string Wind
   string Pressure
   string Conditions
   string Visibility
   string Sunrise
   string Sunset
   string City
   string State
   string Moonrise
   string Moonset
   string Error
```

Note also that each of the FastWeather web service methods requires that you pass a parameter that specifies your license key. If you visit the ServiceObjects website, you can download a trial key that lets you use the service for a specific period of time. If you need unlimited use of the service, you must purchase a license for service from ServiceObjects. The GetWeather.aspx ASP.NET page uses the license key 0, which provides limited use of the service.

The source code in Listing 1.1 implements the ASP.NET page GetWeather.aspx.

Listing 1.1 GetWeather.aspx

```
Public Class WebForm1
    Inherits System.Web.UI.Page

#Region " Web Form Designer Generated Code "
    ' Code not shown.
#End Region

Private Sub Page_Load(ByVal sender As System.Object, _
➥   ByVal e As System.EventArgs) Handles MyBase.Load
  Dim Zip, City, State, IP As String
  Dim WebError As Boolean = False
  Dim QueryPerformed As Boolean = True

  Zip = Request.Form("ZipCode")
  City = Request.Form("City")
  State = Request.Form("State")
  IP = Request.Form("IP")

  Dim WeatherRequest As New net.serviceobjects.ws.FastWeather()
  Dim Weather As net.serviceobjects.ws.Weather

  Try
    If (Zip <> "") Then
      Response.Write("Weather conditions for " & Zip)
      Weather = WeatherRequest.GetWeatherByZip(Zip, 0)
    ElseIf (City <> "") And (State <> "") Then
      Response.Write("Weather conditions for " & City & _
➥          " " & State)
      Weather = WeatherRequest.GetWeatherByCityState(City, _
➥           State, 0)
    ElseIf (IP <> "") Then
      Response.Write("Weather conditions for " & IP)
        Weather = WeatherRequest.GetWeatherByIP(IP, 0)
    Else
      Response.Write("Must specify valid location")
        QueryPerformed = False
    End If

   Catch Ex As Exception
     Response.Write("Web service error: " & Ex.Message)
     WebError = True
   End Try

   If (Not WebError And QueryPerformed) Then
     If (Weather.Error = "") Then
       Response.Write("<br/>")
       Response.Write("Temperature (F): " & _
       Weather.TemperatureF & "<br/>")
```

```
          Response.Write("Conditions: " & Weather.Conditions)
        Else
          Response.Write("<br/>")
          Response.Write("Web service returned an error: " & _
➥            Weather.Error)
        End If
      End If

   End Sub

   End Class
```

As you can see, the code first uses the *Request* object to determine the values the user assigned to the zip code, city, state, or IP fields. To use a web service, a program must create an object specific to the service. The following statement creates a variable named *WeatherRequest* that corresponds to the FastWeather service:

```
Dim WeatherRequest As New net.serviceobjects.ws.FastWeather()
```

Throughout this chapter, you will create similar objects for the different web services. The object name, in this case *net.serviceobjects.ws.FastWeather*, identifies the web service. As you will see when you create a C# program that uses the FastWeather web service, Visual Studio .NET makes it easy for you to determine the object name.

As discussed, the FastWeather web service returns a value of type *Weather* that contains the individual weather fields. The following statement defines a variable to store the Weather structure:

```
Dim Weather As net.serviceobjects.ws.Weather
```

To use a web service, you simply call one of the methods the service provides. In this case, the code uses an `If-Else` statement to determine which method to call based on whether the user specified a zip code, city and state, or IP address. The following statement, for example, calls the service's `GetWeatherByZipCode` method:

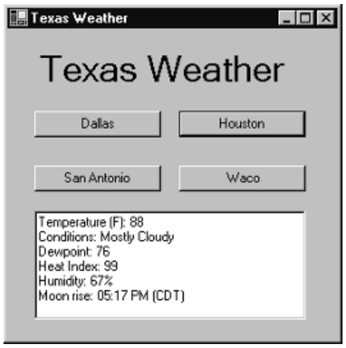
```
Weather = WeatherRequest.GetWeatherByZip(Zip, 0)
```

Note that the code calls the web service methods within a `Try-Catch` block. Most web services will generate an exception when an error occurs. When your programs call a web service, they should always do so within a `Try-Catch` block so your code can detect and respond to an exception generated by the service.

The application uses an ASP.NET page, as opposed to an active server page, because of the ease with which Visual Studio .NET lets developers integrate a web service.

Retrieving Weather Information within a C# Program

Web services exist to help programmers integrate web-based operations into their programs. The Visual Basic .NET program, TexasWeather.vb, displays a form that contains buttons corresponding to Texas cities. After the user clicks a button, the program displays the corresponding weather data, as shown in Figure 1.4.



```
Temperature (F): 88
Conditions: Mostly Cloudy
Dewpoint: 76
Heat Index: 99
Humidity: 67%
Moon rise: 05:17 PM (CDT)
```

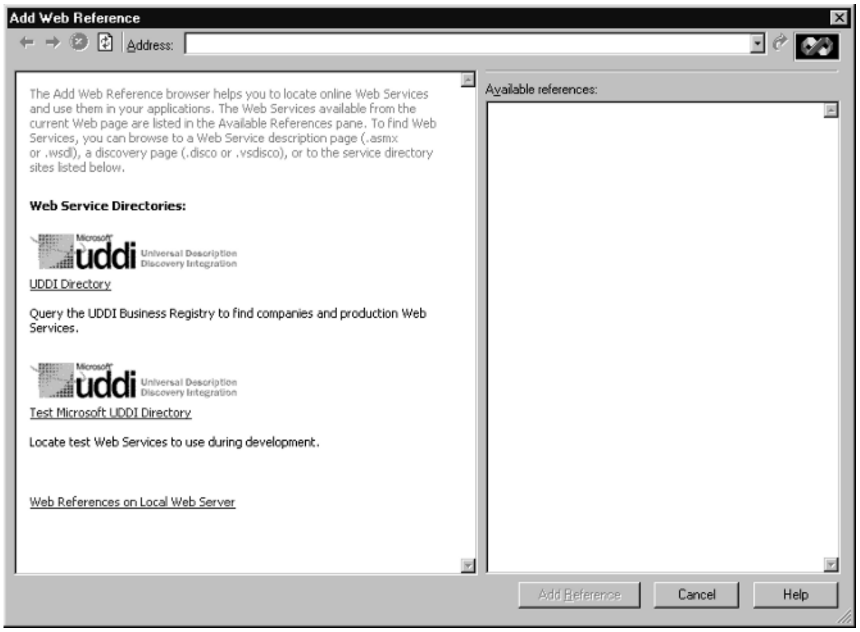
FIGURE 1.4: Using the FastWeather web service within a Visual Basic .NET program

In this case, the program uses only the FastWeather service's `GetWeatherByCityState` method. To create the TexasWeather.vb program, perform these steps:

1. Within Visual Studio .NET, select the File menu New Project option. Visual Studio .NET will display the New Project dialog box.
2. Within the New Project dialog box Project Types list, click Visual C# Projects. Then, within the Templates field, click Windows Application. Finally, within the Location field, specify the folder within which you want to store the program and the program name **TexasWeather**. Select OK. Visual Studio .NET will display a form onto which you can drag and drop the program's controls (label, buttons, and text box).
3. Using the Toolbox, drag and drop the label, buttons, and text box previously shown in Figure 1.4 onto the form.
4. To use a web service, you must assign a Web Reference to the program that corresponds to the object. To do so, select the Project menu Add Web Reference option. Visual Studio .NET will display the Add Web Reference dialog box, as shown in Figure 1.5.

NOTE Over time, the URLs this book uses (such as the one in Step 5) for the WSDL (web service definition language) files that describe a web service may change. See the section "Using a Web Service 101" to determine the URL you should enter for a service's WSDL file within the Add Web Reference dialog box.

FIGURE 1.5:
The Add Web Reference dialog box



The Add Web Reference browser helps you to locate online Web Services and use them in your applications. The Web Services available from the current Web page are listed in the Available References pane. To find Web Services, you can browse to a Web Service description page (.asmx or .wsdl), a discovery page (.disco or .vsdisco), or to the service directory sites listed below.

Web Service Directories:

UDDI Directory

Query the UDDI Business Registry to find companies and production Web Services.

Test Microsoft UDDI Directory

Locate test Web Services to use during development.

Web References on Local Web Server

5. Within the Address field, you must type the URL of a special file (called the WSDL file) that describes the web service. In this case, type **http://ws.serviceobjects.net/fw/FastWeather.asmx?WSDL** and press Enter. The dialog box will load the file's contents. Click the Add Reference button.

6. Select the View menu Code option. Visual Studio .NET will display the program's source code. Within the source code (near the bottom of the GetWeather class definition), add the following program statements:

```
private void GetWeather(String City, String State)
{
   Boolean WebError = false;

   net.serviceobjects.ws.FastWeather WeatherRequest;
   net.serviceobjects.ws.Weather Weather = null;
   WeatherRequest = new net.serviceobjects.ws.FastWeather();

   try
   {
     Weather = WeatherRequest.GetWeatherByCityState(City, _
➥              State, "0");
   }
   catch (Exception Ex)
   {
     textBox1.Text = "Web service error: " + Ex.Message;
     WebError = true;
   }

   if (! WebError)
   {
     if (Weather.Error == null)
     {
       textBox1.Text = "Location: " + Weather.City + "\r\n";
       textBox1.Text = "Temperature (F): " + _
➥           Weather.TemperatureF + "\r\n";
       textBox1.Text += "Conditions: " + _
➥        Weather.Conditions + "\r\n";
       textBox1.Text += "Dewpoint: " + Weather.Dewpoint + "\r\n";
       textBox1.Text += "Heat Index: " + _
➥           Weather.HeatIndex + "\r\n";
       textBox1.Text += "Humidity: " + Weather.Humidity + "\r\n";
       textBox1.Text += "Moon rise: " + Weather.Moonrise + _
➥           "\r\n";
       textBox1.Text += "Moon set: " + Weather.Moonset + "\r\n";
       textBox1.Text += "Pressure: " + Weather.Pressure + "\r\n";
       textBox1.Text += "Sun rise: " + Weather.Sunrise + "\r\n";
       textBox1.Text += "Sun set: " + Weather.Sunset + "\r\n";
       textBox1.Text += "Visibility: " + Weather.Visibility + _
➥           "\r\n";
       textBox1.Text += "Wind: " + Weather.Wind + "\r\n";
       textBox1.Text += "Wind chill: " + Weather.Windchill;
     }
     else
       textBox1.Text = "Web service returned an error: " + _
➥           Weather.Error;
   }
}

private void Form1_Load(object sender, System.EventArgs e)
{

}

private void button1_Click(object sender, System.EventArgs e)
{
   GetWeather("Dallas", "TX");
}

private void button2_Click(object sender, System.EventArgs e)
{
```

```
         GetWeather("Houston", "TX");
      }

      private void button3_Click(object sender, System.EventArgs e)
      {
         GetWeather("San Antonio", "TX");
      }

      private void button4_Click(object sender, System.EventArgs e)
      {
         GetWeather("Waco", "TX");
      }
      }
      }
```

The program provides an event handler that responds to each user button click. Within each handler, the code calls the `GetWeather` function, passing to the function the name of a specific city and the *TX* state abbreviation. Within the `GetWeather` function, the following statements create an object named `WeatherRequest` that the program will use to access the FastWeather web service:

```
net.serviceobjects.ws.FastWeather WeatherRequest;
WeatherRequest = new net.serviceobjects.ws.FastWeather();
```

Again, the FastWeather web service returns a value of type `Weather`. The following statement creates a variable that will hold the specific weather fields:

```
net.serviceobjects.ws.Weather Weather = null;
```

The program calls the web service method `GetWeatherByCityState` within a `try-catch` block to detect any exceptions the web service may generate:

```
try
{
  Weather = WeatherRequest.GetWeatherByCityState(City, _
➥     State, "0");
}
catch (Exception Ex)
{
  textBox1.Text = "Web service error: " + Ex.Message;
     WebError = true;
}
```

Finally, if the web service is successful, the code displays the various weather elements within a text box.

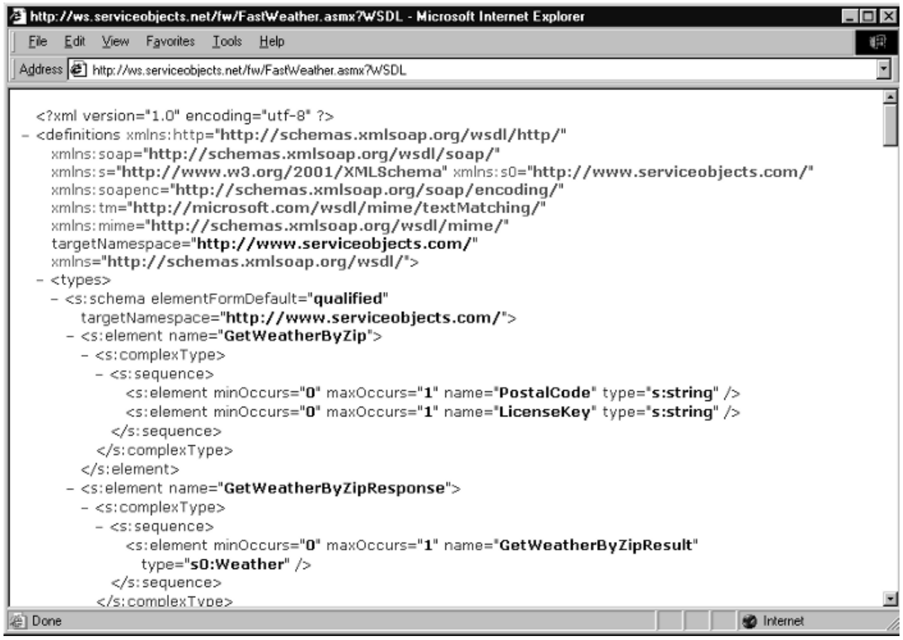
Using a Web Service 101

Using a web service within a .NET program is a straightforward process. To begin, you must add to the program a Web Reference that corresponds to the web service. To do so, you must know the location of the WSDL file that describes the web service.

If you examine websites that make web services available to programmers, you will find that the sites always contain a link to the web service's WSDL file. If you click the link, your browser will display XML-based data that describe the service, similar to that shown in Figure 1.6. XML, as you know, is the Extensible Markup Language that developers use to describe data. Throughout this book, you will make extensive use of WSDL, the web service definition language. For now, think of WSDL as providing a description of the methods (functions) a web service provides, as well as a description of the parameters each method requires.

For now, you can ignore the XML statements that describe the service. Instead, note the Web address that appears within the browser's address field. You can either write down the address or cut and paste the address into the Visual Studio .NET Add Web Reference dialog box.

FIGURE 1.6: Viewing a web service's WSDL file


http://ws.serviceobjects.net/fw/FastWeather.asmx?WSDL - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://ws.serviceobjects.net/fw/FastWeather.asmx?WSDL
Done
Internet

```
  <?xml version="1.0" encoding="utf-8" ?>
- <definitions xmlns:http="http://schemas.xmlsoap.org/wsdl/http/"
    xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
    xmlns:s="http://www.w3.org/2001/XMLSchema" xmlns:s0="http://www.serviceobjects.com/"
    xmlns:soapenc="http://schemas.xmlsoap.org/soap/encoding/"
    xmlns:tm="http://microsoft.com/wsdl/mime/textMatching/"
    xmlns:mime="http://schemas.xmlsoap.org/wsdl/mime/"
    targetNamespace="http://www.serviceobjects.com/"
    xmlns="http://schemas.xmlsoap.org/wsdl/">
  - <types>
    - <s:schema elementFormDefault="qualified"
        targetNamespace="http://www.serviceobjects.com/">
      - <s:element name="GetWeatherByZip">
        - <s:complexType>
          - <s:sequence>
              <s:element minOccurs="0" maxOccurs="1" name="PostalCode" type="s:string" />
              <s:element minOccurs="0" maxOccurs="1" name="LicenseKey" type="s:string" />
            </s:sequence>
          </s:complexType>
        </s:element>
      - <s:element name="GetWeatherByZipResponse">
        - <s:complexType>
          - <s:sequence>
              <s:element minOccurs="0" maxOccurs="1" name="GetWeatherByZipResult"
                type="s0:Weather" />
            </s:sequence>
          </s:complexType>
```

After you add a Web Reference to your program code for the web service, you must then create a corresponding object within your source code. The following statement creates an object that a Visual Basic .NET program can use to interact with the FastWeather web service:

```
Dim WeatherRequest As New net.serviceobjects.ws.FastWeather()
```

After you add a service's Web Reference to your program, Visual Studio .NET will display the reference within the Class View window. As you view the web services within the Class View window, you will find that most web service object names will begin with letter combinations such as *net*. If you simply type the first two letters of the name, Visual Studio .NET usually will display the service's remaining characters, making it very easy for you to enter the correct object names.

Regardless of the web service you want to use from within a .NET program and regardless of whether you are writing the program using Visual Basic .NET and C# or if you are creating an ASP.NET page, the steps you will perform are the same. If your code requires multiple web services, you must perform these steps for each object.

Retrieving Stock Quotes

Across the Web, many websites offer users the ability to retrieve stock information for a specific company. To comply with securities regulations, the stock information is delayed by 15 minutes.

The StockQuote web service, available from the XMethods website at `www.xmethods.com`, retrieves delayed stock prices for the company that corresponds to a stock symbol, such as *MSFT* for Microsoft.

NOTE The XMethods website at `www.xmethods.com` provides many web services you can integrate into your applications. Take time to visit the XMethods website—you will likely find several web services you can put to immediate use.

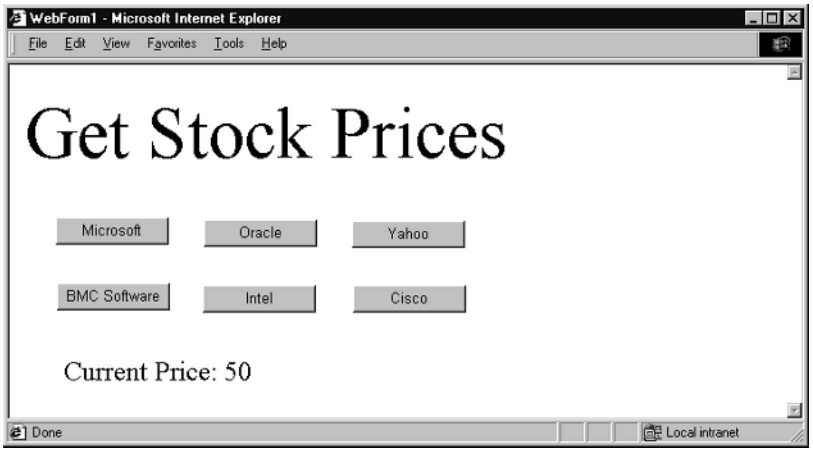
The ASP.NET page StockPrice.aspx, which you can run from this book's companion website, displays the form shown in Figure 1.7 that contains buttons corresponding to several software companies. When the user clicks a button, the page will display the company's (delayed) stock price.

Looking Behind the Scenes at the StockQuote Web Service

The StockQuote web service supports one method, `getQuote`, which returns a value of type `Float` that corresponds to a company's stock price. Your programs pass the stock symbol, such as *MSFT* for Microsoft, to the method as a parameter:

```
float getQuote(string symbol)
```

FIGURE 1.7: Using the StockQuote web service to retrieve stock prices


WebForm1 - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Microsoft
Oracle
Yahoo
BMC Software
Intel
Cisco
Done
Local intranet

Get Stock Prices

Current Price: 50

If the symbol your program passes to `getQuote` is invalid, `getQuote` will return the value *-1*. The source code in Listing 1.2 implements the ASP.NET page StockPrice.aspx.

Listing 1.2 StockPrice.aspx

```
Public Class WebForm1
  Inherits System.Web.UI.Page
  Protected WithEvents Label1 As System.Web.UI.WebControls.Label
  Protected WithEvents Button1 As System.Web.UI.WebControls.Button
  Protected WithEvents Button2 As System.Web.UI.WebControls.Button
  Protected WithEvents Button3 As System.Web.UI.WebControls.Button
  Protected WithEvents Button4 As System.Web.UI.WebControls.Button
  Protected WithEvents Button5 As System.Web.UI.WebControls.Button
  Protected WithEvents Label2 As System.Web.UI.WebControls.Label
  Protected WithEvents Button6 As System.Web.UI.WebControls.Button

#Region " Web Form Designer Generated Code "
    'Code not show
#End Region

  Private Sub Button1_Click(ByVal sender As System.Object, _
➥    ByVal e As System.EventArgs) Handles Button1.Click
      ShowStockPrice("MSFT")
  End Sub

  Private Sub Button2_Click(ByVal sender As System.Object, _
➥    ByVal e As System.EventArgs) Handles Button2.Click
      ShowStockPrice("ORCL")
  End Sub
```

```
    Private Sub Button3_Click(ByVal sender As System.Object, _
➥      ByVal e As System.EventArgs) Handles Button3.Click
        ShowStockPrice("YHOO")
    End Sub

    Private Sub Button4_Click(ByVal sender As System.Object, _
➥      ByVal e As System.EventArgs) Handles Button4.Click
        ShowStockPrice("BMC")
    End Sub

    Private Sub Button5_Click(ByVal sender As System.Object, _
➥      ByVal e As System.EventArgs) Handles Button5.Click
        ShowStockPrice("INTC")
    End Sub

    Private Sub Button6_Click(ByVal sender As System.Object, _
➥      ByVal e As System.EventArgs) Handles Button6.Click
        ShowStockPrice("CSCO")
    End Sub

    Private Function ShowStockPrice(ByVal Symbol As String) _
➥      As String
        Dim StockQuote As New _
➥     net.xmethods.services.netxmethodsservicesstockquoteStockQuoteService()_
        Dim Price As String

        Price = StockQuote.getQuote(Symbol)

        Label2.Text = "Current Price: " & Price
    End Function

End Class
```

As you can see, the code provides event handlers for each of the buttons. Within the handler, the code calls the `ShowStockPrice` function, passing to the function a stock symbol that corresponds to a specific company. Within the `ShowStockPrice` function, the following statement creates a variable named *`StockQuote`* that corresponds to the object the code will use to interact with the StockQuote object:

```
Dim StockQuote As New _
➥   net.xmethods.services.netxmethodsservices_
➥   stockquoteStockQuoteService()
```

To call the `getQuote` method, the code uses the *`StockQuote`* variable as follows:

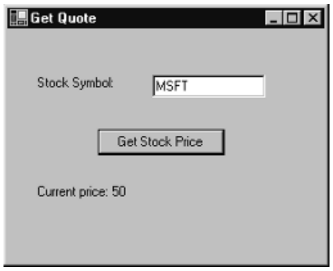
```
Price = StockQuote.getQuote(Symbol)
```

Retrieving Stock Prices within a C# Program

The following C# program, GetQuote.cs, displays a form that prompts the user for a company stock symbol. After the user enters the symbol and clicks the Get Stock Price button, the program will display the stock price, as shown in Figure 1.8.

FIGURE 1.8:

Using the StockQuote web service within a C# program



To create the GetQuote.cs program, perform these steps:

1. Within Visual Studio .NET, select the File menu New Project option. Visual Studio .NET will display the New Project dialog box.
2. Within the New Project dialog box Project Types list, click Visual C# Projects. Then, within the Templates field, click Windows Application. Finally, within the Location field, specify the folder within which you want to store the program and the program name **GetQuote**. Select OK. Visual Studio .NET will display a form onto which you can drag and drop the program's controls (label, buttons, and text box).
3. Using the Toolbox, drag and drop the label, buttons, and text box previously shown in Figure 1.8 onto the form.
4. To assign a Web Reference that corresponds to the object, select the Project menu Add Web Reference option. Visual Studio .NET will display the Add Web Reference dialog box.
5. Within the Address field, type the URL of the service's WSDL file. In this case, type **http://services.xmethods.net/soap/urn:xmethods-delayed-quotes.wsdl** and press Enter. The dialog box will load the file's contents. Click the Add Reference button.
6. Select the View menu Code option. Visual Studio .NET will display the program's source code. Within the source code (near the bottom of the class definition), add the following program statements:

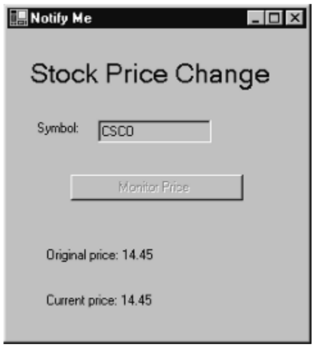
```
private void button1_Click(object sender, System.EventArgs e)
{
 float Price;
net.xmethods.services.netxmethodsservicesstockquote
➥     StockQuoteService Quote;
```

```
      Quote = new
➥    net.xmethods.services.netxmethodsservicesstockquoteStockQuoteService();

    if (textBox1.Text.Length == 0)
      label2.Text = "Must specify stock symbol";
    else
    {
      try
      {
        Price = Quote.getQuote(textBox1.Text);
        if (Price == -1)
          label2.Text = "Invalid symbol";
        else
                label2.Text = "Current price: " + Price.ToString();
      }
   catch(Exception ex)
      {
        label2.Text = "Web service exception" + ex.Message;
      }
        }
      }
```

The previous program used the StockQuote web service to retrieve a stock price for display. The following C# program, NotifyMe.cs, again prompts the user to enter a stock symbol. After the user enters the stock information, the user can minimize the program. The program, behind the scenes, will "wake up" every 15 seconds and compare the stock's current price to the original price. If the stock's price has changed by one dollar (either up or down), the program will bring the form to the top of any active programs. If the user has minimized the program, the program will highlight the program's icon within the Taskbar. See Figure 1.9.

FIGURE 1.9:
Using a web service within a program that performs background processing



Original price: 14.45
Current price: 14.45

To create the NotifyMe.cs program, perform these steps:

1. Within Visual Studio .NET, select the File menu New Project option. Visual Studio .NET will display the New Project dialog box.
2. Within the New Project dialog box Project Types list, click Visual C# Projects. Then, within the Templates field, click Windows Application. Finally, within the Location field, specify the folder within which you want to store the program and the program name **NotifyMe**. Select OK. Visual Studio .NET will display a form onto which you can drag and drop the program's controls (label, buttons, and text box).
3. Using the Toolbox, drag and drop the label, buttons, and text box previously shown in Figure 1.9 onto the form. Then, drag a Timer control onto the form.
4. Select the Project menu Add Web Reference option. Visual Studio .NET will display the Add Web Reference dialog box.
5. Within the Address field, type the URL **http://services.xmethods.net/soap/urn:xmethods-delayed-quotes.wsdl** and press Enter. The dialog box will load the file's contents. Click the Add Reference button.
6. Select the View menu Code option. Visual Studio .NET will display the program's source code. Within the source code (near the bottom of the class definition), add the following program statements:

```
float OriginalPrice;
float DollarChange;

net.xmethods.services.netxmethodsservicesstockquote
➥     StockQuoteService Quote;

private void button1_Click(object sender, System.EventArgs e)
{
  float Price;
  Quote = new
➥ net.xmethods.services.netxmethodsservicesstockquoteStockQuoteService();

  if (textBox1.Text.Length == 0)
    label4.Text = "Must specify stock symbol";
  else
  {
    textBox1.ReadOnly = true;
      button1.Enabled = false;

    try
    {
      Price = Quote.getQuote(textBox1.Text);
      OriginalPrice = Price;
```

```
        if (Price == -1)
          label4.Text = "Invalid symbol";
        else
        {
          label4.Text = "Original price: " + OriginalPrice.ToString();
          timer1.Interval = 15000;
          timer1.Enabled = true;
          DollarChange = 0;
        }
      }
      catch(Exception ex)
      {
        label4.Text = "Web service exception" + ex.Message;
      }
    }
  }

  private void timer1_Tick(object sender, System.EventArgs e)
  {
    float Price;

    try
    {
      Price = Quote.getQuote(textBox1.Text);

      if (Price == -1)
      {
        label5.Text = "Invalid symbol";
        this.Activate();
      }
      else
      {
        label5.Text = "Current price: " + Price.ToString();

        if (((Price - OriginalPrice) > DollarChange) ||
           ((OriginalPrice - Price) > DollarChange))
        {
          this.Activate();
          this.BringToFront();
        }
      }
    }

    catch(Exception ex)
    {
      label5.Text = "Web service exception" + ex.Message;
    }
  }
```

The program uses a timer set to 15-second intervals. Each time the timer occurs, the code uses the web service to retrieve the stock's current price. If the stock price has increased or decreased by a dollar or more since the user first requested the price, the code will bring the form to the top of any open applications:

```
if (((Price - OriginalPrice) > DollarChange) ||
   ((OriginalPrice - Price) > DollarChange))
{
  this.Activate();
  this.BringToFront();
}
```

Retrieving Book Information

On the Web, Amazon (`amazon.com`) and Barnes & Noble (`barnesandnoble.com`) are two of the largest online booksellers. Both sites let users shop for books electronically. To integrate the capabilities of these two online sites into your own programs and web pages, you can take advantage of web services.

To start, Amazon offers a software development kit (SDK) programmers can use to search for books, videos, and music, and by keyword, author, artist, and more. Further, programmers can integrate support for the Amazon shopping cart into their own applications and websites.

You can download the Amazon web services SDK from the Amazon website at `www.amazon.com/webservices`. After you download the software development kit, you must apply for a developer's token (a key) that you must include as a parameter within your function calls to the services.

Second, the BNQuote web service returns the price of a book at Barnes & Noble for a given ISBN.

The ASP.NET page AmazonDemo.aspx on this book's companion website uses the Amazon web services to list the titles and prices of various Sybex books at Amazon. When you display the page and click on the Get Amazon.com Pricing button, the page will use the Amazon web service to perform a keyword search on "Sybex." The page will place the search results for the first 50 books within the text box, as shown in Figure 1.10.

Likewise, the ASP.NET page BarnesAndNoble.aspx at this book's companion website displays buttons for several different book titles. If you click one of the buttons, the page will display the book's current price at the online Barnes & Noble store, as shown in Figure 1.11.

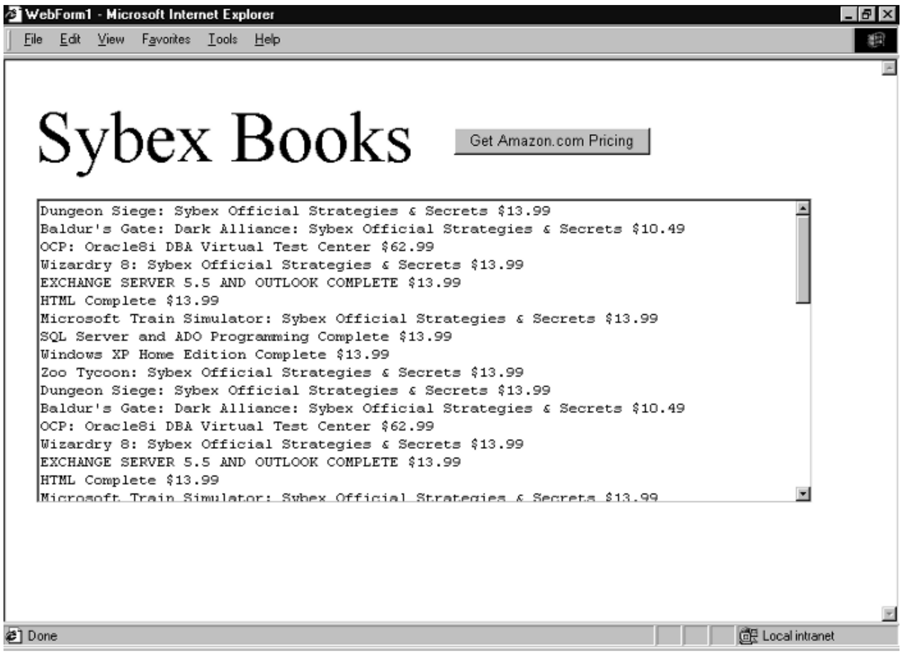


FIGURE 1.10: Using the Amazon web services SDK within an ASP.NET page

WebForm1 - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Sybex Books
Get Amazon.com Pricing
Done
Local intranet

```
Dungeon Siege: Sybex Official Strategies & Secrets $13.99
Baldur's Gate: Dark Alliance: Sybex Official Strategies & Secrets $10.49
OCP: Oracle8i DBA Virtual Test Center $62.99
Wizardry 8: Sybex Official Strategies & Secrets $13.99
EXCHANGE SERVER 5.5 AND OUTLOOK COMPLETE $13.99
HTML Complete $13.99
Microsoft Train Simulator: Sybex Official Strategies & Secrets $13.99
SQL Server and ADO Programming Complete $13.99
Windows XP Home Edition Complete $13.99
Zoo Tycoon: Sybex Official Strategies & Secrets $13.99
Dungeon Siege: Sybex Official Strategies & Secrets $13.99
Baldur's Gate: Dark Alliance: Sybex Official Strategies & Secrets $10.49
OCP: Oracle8i DBA Virtual Test Center $62.99
Wizardry 8: Sybex Official Strategies & Secrets $13.99
EXCHANGE SERVER 5.5 AND OUTLOOK COMPLETE $13.99
HTML Complete $13.99
Microsoft Train Simulator: Sybex Official Strategies & Secrets $13.99
```

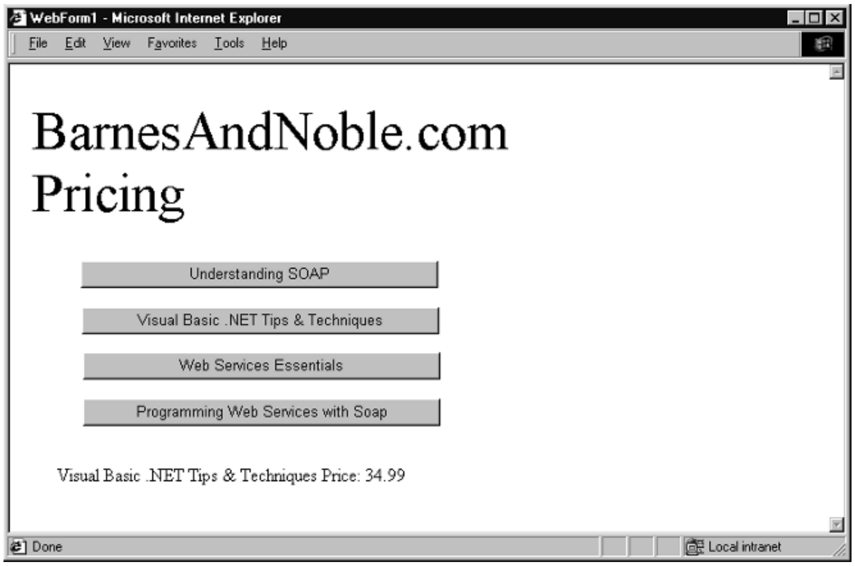


FIGURE 1.11: Using the BNQuote Web service to display book prices at Barnes & Noble online

WebForm1 - Microsoft Internet Explorer
File Edit View Favorites Tools Help
BarnesAndNoble.com Pricing
Understanding SOAP
Visual Basic .NET Tips & Techniques
Web Services Essentials
Programming Web Services with Soap
Done
Local intranet

Visual Basic .NET Tips & Techniques Price: 34.99

Behind the Scenes of the Amazon Web Service

The Amazon web SDK provides several different web services. To search Amazon products, you use the AmazonSearchService, passing to the service a parameter that specifies whether you want to perform a keyword search or search by author, artist, and so on. To interact with the Amazon shopping cart, you would use a different web service. Listing 1.3 implements the ASP.NET page AmazonDemo.aspx.

Listing 1.3 **AmazonDemo.aspx**

```
Public Class WebForm1
    Inherits System.Web.UI.Page
    Protected WithEvents TextBox1 As System.Web.UI.WebControls.TextBox
    Protected WithEvents Label1 As System.Web.UI.WebControls.Label
    Protected WithEvents Button1 As System.Web.UI.WebControls.Button

#Region " Web Form Designer Generated Code "
    ' Code not shown.
#End Region

Private Sub Button1_Click(ByVal sender As System.Object, _
    ByVal e As System.EventArgs) Handles Button1.Click
  Dim AmazonQuery As New com.amazon.soap.AmazonSearchService()
  Dim KeywordRequest As New com.amazon.soap.KeywordRequest()
  Dim WebError As Boolean = False

  Dim ProductInfo As com.amazon.soap.ProductInfo

  KeywordRequest.devtag = "XXXXXXXXXXXXXX"  'Replace X's with your key.

  KeywordRequest.keyword = "Sybex"
  KeywordRequest.mode = "books"
  KeywordRequest.type = "heavy"
  KeywordRequest.tag = "webservices-20"
  KeywordRequest.version = "1.0"

  Dim Page As Integer

  For Page = 0 To 4
    KeywordRequest.page = Page.ToString()
    Try
      ProductInfo = AmazonQuery.KeywordSearchRequest(KeywordRequest)
    Catch Ex As Exception
      WebError = True
      TextBox1.Text = "Error in Web service " & Ex.Message
    End Try

    If (Not WebError) Then
      Dim Info As com.amazon.soap.Details
      For Each Info In ProductInfo.Details
       TextBox1.Text &= Info.ProductName & " " & Info.OurPrice & vbCrLf
      Next
    End If
   Next

End Sub
End Class
```

As discussed, before a program can use a web service, the program must create an object that corresponds to the web service. The following statement creates a variable named *AmazonQuery* that corresponds to the AmazonSearchService:

```
Dim AmazonQuery As New com.amazon.soap.AmazonSearchService()
```

To perform a keyword search, the code must create a variable that specifies the search criteria. The following statement creates a variable to hold the search fields:

```
Dim KeywordRequest As New com.amazon.soap.KeywordRequest()
```

Then, the following statements specify the search criteria. The Amazon web services software development kit briefly describes the various fields. You must change the statement that assigns X's to the *devtag* field to contain the developer tag you download from the Amazon web service site:

```
KeywordRequest.devtag = "XXXXXXXXXXXXXX"  'Replace X's with your key.

KeywordRequest.keyword = "Sybex"
KeywordRequest.mode = "books"
KeywordRequest.type = "heavy"
KeywordRequest.tag = "webservices-20"
KeywordRequest.version = "1.0"
```

By default, the Amazon web service search operation will return 10 matching products. To display 50 Sybex books, the code repeatedly performs the search operation within a `For Each` loop. Note that the code calls the service's KeywordSearchRequest method within a `Try-Catch` block to detect any exceptions the service may generate.

To build the ASP.NET page perform these steps:

1. Within Visual Studio .NET, select the File menu New Project option. Visual Studio .NET will display the New Project dialog box.
2. Within the New Project dialog box Project Types list, click Visual Basic Projects. Then, within the Templates field, click ASP.NET Web Application. Finally, within the Location field, specify the name **AmazonDemo**. Select OK. Visual Studio .NET will display a page onto which you can drag and drop the program's controls (label, buttons, and text box).

3. Using the Toolbox, drag and drop the label, buttons, and text box previously shown in Figure 1.10 onto the page. Using the Properties window, set the text box to support multiline operations.
4. Select the Project menu Add Web Reference option. Visual Studio .NET will display the Add Web Reference dialog box.
5. Within the Address field, type the URL **http://soap.amazon.com/schemas/AmazonWebServices.wsdl** and press Enter. The dialog box will load the file's contents. Click the Add Reference button.
6. Select the View menu Code option. Visual Studio .NET will display the program's source code. Enter the program statements previously shown.

Behind the Scenes of the Barnes & Noble Web Service

The BNQuote web service supports one method, `getPrice`, which returns the price for a book based on an ISBN number:

```
single getPrice(string ISBN)
```

Listing 1.4 implements the ASP.NET page BarnesAndNoble.aspx.

Listing 1.4 BarnesAndNoble.aspx

```
Public Class WebForm1
    Inherits System.Web.UI.Page
    Protected WithEvents Label1 As System.Web.UI.WebControls.Label
    Protected WithEvents Button1 As System.Web.UI.WebControls.Button
    Protected WithEvents Button2 As System.Web.UI.WebControls.Button
    Protected WithEvents Button3 As System.Web.UI.WebControls.Button
    Protected WithEvents Button4 As System.Web.UI.WebControls.Button
    Protected WithEvents Label2 As System.Web.UI.WebControls.Label

#Region " Web Form Designer Generated Code "
    ' Code not shown.
#End Region

    Private Sub Page_Load(ByVal sender As System.Object, ByVal e_
➥As System.EventArgs) Handles MyBase.Load
        'Put user code to initialize the page here
    End Sub

    Private Sub ShowPrice(ByVal Title As String, ByVal ISBN As String)
        Dim BNQuery As New net.xmethods.www.BNQuoteService()
        Dim Price As Single
        Dim WebError As Boolean = False
        Try
            Price = BNQuery.getPrice(ISBN)
        Catch Ex As Exception
            WebError = True
            Label2.Text = "Web service error: " & Ex.Message
        End Try

        If (Not WebError) Then
            If (Price = -1) Then
                Label2.Text = Title & " not found"
            Else
                Label2.Text = Title & " Price: " & Price.ToString()
            End If
        End If

    End Sub

    Private Sub Button1_Click(ByVal sender As System.Object, _
➥       ByVal e As System.EventArgs) Handles Button1.Click
        ShowPrice(Button1.Text, "0672319225")
    End Sub

    Private Sub Button2_Click(ByVal sender As System.Object, _
➥       ByVal e As System.EventArgs) Handles Button2.Click
        ShowPrice(Button2.Text, "0072223189")
    End Sub

    Private Sub Button3_Click(ByVal sender As System.Object, _
➥       ByVal e As System.EventArgs) Handles Button3.Click
        ShowPrice(Button3.Text, "0596002246")
    End Sub

    Private Sub Button4_Click(ByVal sender As System.Object, _
➥       ByVal e As System.EventArgs) Handles Button4.Click
        ShowPrice(Button4.Text, "0596000952")
    End Sub
End Class
```

As you can see, the program defines handlers that correspond to each of the form's buttons. Within each handler, the code calls the `ShowPrice` function, passing to the function the name of the corresponding book and the book's ISBN. Within the `ShowPrice` function, to interact with the BNQuote web service, the code first creates an object that corresponds to the service:

```
Dim BNQuery As New net.xmethods.www.BNQuoteService()
```

Then, within a `Try-Catch` block, the code calls the service's `getPrice` method. If the service cannot find the book based on the specified ISBN, the `getPrice` method will return the value *-1*.

To build the BarnesAndNoble.aspx ASP.NET page, perform these steps:

1. Within Visual Studio .NET, select the File menu New Project option. Visual Studio .NET will display the New Project dialog box.
2. Within the New Project dialog box Project Types list, click Visual Basic Projects. Then, within the Templates field, click ASP.NET Web Application. Finally, within the Location field, specify the name **BarnesAndNobleDemo**. Select OK. Visual Studio .NET will display a page onto which you can drag and drop the program's controls (label, buttons, and text box).
3. Using the Toolbox, drag and drop the label, buttons, and text box previously shown in Figure 1.11 onto the page.
4. Select the Project menu Add Web Reference option. Visual Studio .NET will display the Add Web Reference dialog box.
5. Within the Address field, type the URL **http://www.xmethods.net/sd/2001/BNQuoteService.wsdl** and press Enter. The dialog box will load the file's contents. Click the Add Reference button.
6. Select the View menu Code option. Visual Studio .NET will display the program's source code. Enter the program statements previously shown.

Retrieving Caller-ID Information

Most telephones and phone lines now support caller-ID, which displays an incoming caller's name. Sometimes your phone displays only the caller's phone number.

The GeoPhone web service offered by ServiceObjects lets you determine the person or business that corresponds to a specific phone number. For example, if you enter the phone number 510-523-8233, the service will return the owner, "Sybex Computer Books."

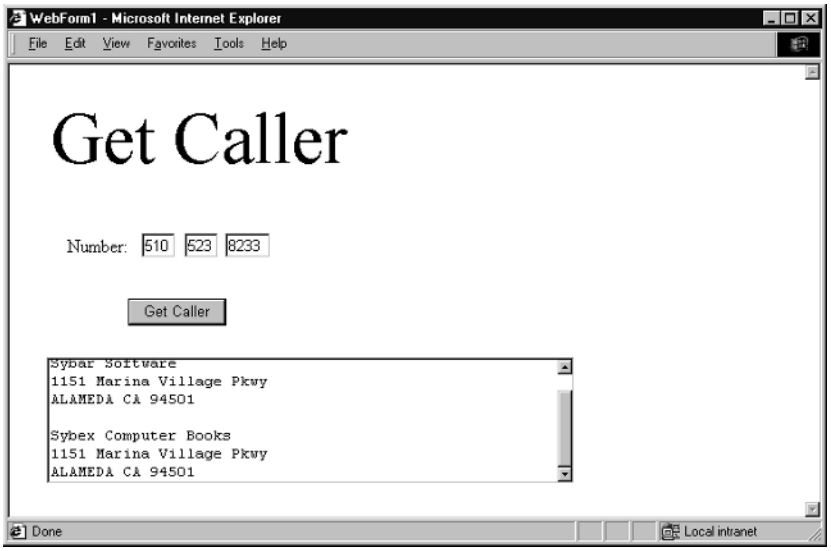
The ASP.NET page GetCaller.aspx, which you can run from this book's companion website, displays a form that prompts you to enter a phone number. After you enter the number and click the Get Caller button, the page will use the GeoPhone web service to retrieve the caller information, which the page will then display as shown in Figure 1.12. If the service cannot determine a number's owner, the page will display a message so stating.

Behind the Scenes of the GeoPhone Web Service

The GeoPhone web service supports the following method:

```
PhoneInfo GetPhoneInfo(string PhoneNumber, string LicenseKey)
```

FIGURE 1.12: Using the GeoPhone web service to retrieve caller information


WebForm1 - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Get Caller
Number: 510 523 8233
Get Caller
Done
Local intranet

```
Sybar Software
1151 Marina Village Pkwy
ALAMEDA CA 94501

Sybex Computer Books
1151 Marina Village Pkwy
ALAMEDA CA 94501
```

The `GetPhoneInfo` method returns a value of type `PhoneInfo`, which, depending on the phone listing the service discovers, may contain an array of contacts and an array of providers (the telephone companies that manage the numbers). Each entry within the contacts array contains name and address information.

The `PhoneNumber` parameter that you pass to the `GetPhoneInfo` method should not contain hyphens. To look up the number 800-555-1212, you would use the string *8005551212*.

The `GetPhoneInfo` method requires that you pass a parameter that specifies your license key. If you visit the ServiceObjects website, you can download a trial key that lets you use the service for a specific period of time. If you need unlimited use of the service, you must purchase a license for service from ServiceObjects. The GetCaller.aspx ASP.NET page uses the license key *0*, which provides a limited use of the service. The source code in Listing 1.5 implements the ASP.NET page GetCaller.aspx.

Listing 1.5 **GetCaller.aspx**

```
Public Class WebForm1
    Inherits System.Web.UI.Page
    Protected WithEvents Label1 As System.Web.UI.WebControls.Label
    Protected WithEvents Label2 As System.Web.UI.WebControls.Label
    Protected WithEvents TextBox1 As System.Web.UI.WebControls.TextBox
    Protected WithEvents TextBox2 As System.Web.UI.WebControls.TextBox
    Protected WithEvents TextBox4 As System.Web.UI.WebControls.TextBox
    Protected WithEvents Button1 As System.Web.UI.WebControls.Button
    Protected WithEvents TextBox3 As System.Web.UI.WebControls.TextBox
```

```
#Region " Web Form Designer Generated Code "
    ' Code not shown
#End Region

    Private Sub Page_Load(ByVal sender As System.Object, ByVal e
➥As System.EventArgs) Handles MyBase.Load
        'Put user code to initialize the page here
    End Sub

    Private Sub Button1_Click(ByVal sender As System.Object,
➥ByVal e As System.EventArgs) Handles Button1.Click
        Dim Phone As New net.serviceobjects.ws.GeoPhone()
        Dim PhoneInfo As net.serviceobjects.ws.PhoneInfo
        Dim Contact As net.serviceobjects.ws.Contact
        Dim Provider As net.serviceobjects.ws.Provider
        Dim PhoneNumber As String
        Dim ProcessingError As Boolean = False

        PhoneNumber = TextBox1.Text & TextBox2.Text & TextBox3.Text

        If (PhoneNumber.Length <> 10) Then
            TextBox4.Text = "Invalid phone number" & PhoneNumber
        Else
            Try
                PhoneInfo = Phone.GetPhoneInfo(PhoneNumber, 0)
            Catch Ex As Exception
                TextBox4.Text = "Error processing number " & Ex.Message
                ProcessingError = True
            End Try

            If (ProcessingError) Or (PhoneInfo Is Nothing) Then
                TextBox4.Text = "Error processing number"
            Else
                TextBox4.Text = "Contact: "
                If (PhoneInfo.Contacts.Length = 0) Then
                    TextBox4.Text &= "Unknown"
                Else
                    For Each Contact In PhoneInfo.Contacts
                        TextBox4.Text &= vbCrLf & Contact.Name
                        TextBox4.Text &= vbCrLf & Contact.Address
                        TextBox4.Text &= vbCrLf & Contact.City
                        TextBox4.Text &= " " & Contact.State
                        TextBox4.Text &= " " & Contact.Zip & vbCrLf
                    Next
                End If

            End If
        End If

    End Sub
End Class
```

Within the button-click event handler, the following statement creates an object the program will use to interact with the GeoPhone web service:

```
Dim Phone As New net.serviceobjects.ws.GeoPhone()
```

After the user enters a phone number and clicks the Get Caller button, the code calls the `GetPhoneInfo` method within a `Try-Catch` block. If the web service is successful, the code will use a `ForEach` loop to display each element within the Contacts array.

To build the GetCaller.aspx ASP.NET page, perform these steps:

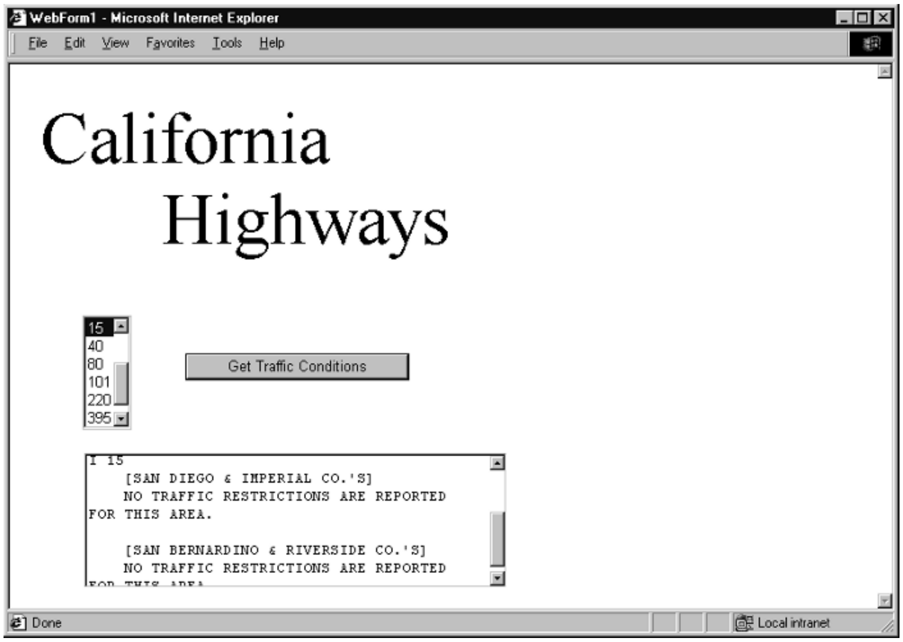
1. Within Visual Studio .NET, select the File menu New Project option. Visual Studio .NET will display the New Project dialog box.
2. Within the New Project dialog box Project Types list, click Visual Basic Projects. Then, within the Templates field, click ASP.NET Web Application. Finally, within the Location field, specify the name **GetCaller**. Select OK. Visual Studio .NET will display a page onto which you can drag and drop the program's controls (label, buttons, and text box).
3. Using the Toolbox, drag and drop the label, buttons, and text boxes previously shown in Figure 1.12 onto the page. Using the Properties window, set the text box to support multiline operations.
4. Select the Project menu Add Web Reference option. Visual Studio .NET will display the Add Web Reference dialog box.
5. Within the Address field, type the URL **http://ws.serviceobjects.net/gp/GeoPhone.asmx?WSDL** and press Enter. The dialog box will load the file's contents. Click the Add Reference button.
6. Select the View menu Code option. Visual Studio .NET will display the program's source code. Enter the program statements previously shown.

Retrieving Traffic Information

To help motorists select the best route to a destination, the California Department of Transportation provides a website at which users can look up current conditions for specific highways. The CATraffic web service offered by XMethods lets you integrate the traffic report into your own programs and web pages.

The ASP.NET page CalTraffic.aspx at this book's companion website lets you select a specific California highway. After you choose a highway and click the Get Traffic Conditions button, the page will display the highway's current traffic conditions, as shown in Figure 1.13.

FIGURE 1.13: Using the CATraffic web service to retrieve traffic information



```
I 15
    [SAN DIEGO & IMPERIAL CO.'S]
    NO TRAFFIC RESTRICTIONS ARE REPORTED
FOR THIS AREA.

    [SAN BERNARDINO & RIVERSIDE CO.'S]
    NO TRAFFIC RESTRICTIONS ARE REPORTED
FOR THIS AREA.
```

Behind the Scenes of the CATraffic Web Service

The CATraffic web service calls the `getTraffic` method that programs can use to look up traffic conditions on a specific highway:

```
string getTraffic(string highway)
```

The source code in Listing 1.6 implements the ASP.NET page CalTraffic.aspx.

Listing 1.6 **CalTraffic.aspx**

```
Public Class WebForm1
    Inherits System.Web.UI.Page
    Protected WithEvents Label1 As System.Web.UI.WebControls.Label
    Protected WithEvents Label2 As System.Web.UI.WebControls.Label
    Protected WithEvents ListBox1 As System.Web.UI.WebControls.ListBox
    Protected WithEvents Button1 As System.Web.UI.WebControls.Button
    Protected WithEvents TextBox1 As System.Web.UI.WebControls.TextBox

#Region " Web Form Designer Generated Code "
  ' Code not shown
#End Region

Private Sub Button1_Click(ByVal sender As System.Object, _
➥    ByVal e As System.EventArgs) Handles Button1.Click
```

```
    Dim Highway As New net.xmethods.www.CATrafficService()
    Dim WebError As Boolean = False

    Dim Conditions As String

    Try
      Conditions = Highway.getTraffic(ListBox1.SelectedItem.ToString())
    Catch Ex As Exception
      WebError = True
    End Try

    If (WebError) Then
      TextBox1.Text = "Error accessing Web service"
    Else
      TextBox1.Text = Conditions
    End If
  End Sub
  End Class
```

Within the button-click handler, the code first creates an object that the program will use to interact with the web service:

```
Dim Highway As New net.xmethods.www.CATrafficService()
```

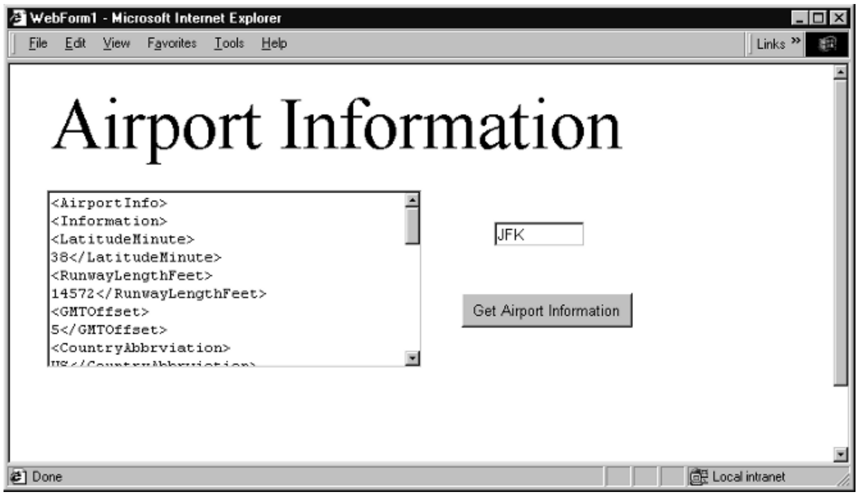
Then, within a `Try-Catch` block, the code will call the `getTraffic` method. If the method is successful, the code will assign the traffic conditions to the text box. To create the CalTraffic.aspx ASP.NET page, perform these steps:

1. Within Visual Studio .NET, select the File menu New Project option. Visual Studio .NET will display the New Project dialog box.
2. Within the New Project dialog box Project Types list, click Visual Basic Projects. Then, within the Templates field, click ASP.NET Web Application. Finally, within the Location field, specify the name **CalTraffic**. Select OK. Visual Studio .NET will display a page onto which you can drag and drop the program's controls (label, buttons, and text box).
3. Using the Toolbox, drag and drop the label, buttons, and text boxes previously shown in Figure 1.13 onto the page. Using the Properties window, set the text box to support multiline operations. Also, add entries similar to those shown within the list box.
4. Select the Project menu Add Web Reference option. Visual Studio .NET will display the Add Web Reference dialog box.
5. Within the Address field, type **http://www.xmethods.net/sd/2001/CATrafficService.wsdl** and press Enter. The dialog box will load the file's contents. Click the Add Reference button.
6. Select the View menu Code option. Visual Studio .NET will display the program's source code. Enter the program statements previously shown.

Retrieving Airport Information

Whether you are a frequent traveler or you are finally getting away for a much-needed vacation, you can use the AirportInfo web service offered by Web ServiceX.Net to determine specifics about an airport, such as airport's longitude and latitude, the length of the airport runway, and so on.

The ASP.NET page at AirportInfo.aspx at this book's companion website prompts a user to enter an airport code, such as JFK or LAX. After the user specifies the airport and clicks the Airport Information button, the page will display current conditions at the airport, as shown in Figure 1.14. Behind the scenes, web services make extensive use of XML-based data. Within the .NET environment, your programs normally do not have to work directly with the XML. The AirportInfo web service returns a string that contains its result in XML. For simplicity and to introduce you briefly to XML-based data, the AirportInfo.aspx ASP.NET page displays the service's result using an XML-based format. In later chapters, you will learn how to parse XML-based documents to extract the specific data you need.


WebForm1 - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Links
Airport Information
JFK
Get Airport Information
Done
Local intranet

```
<AirportInfo>
<Information>
<LatitudeMinute>
38</LatitudeMinute>
<RunwayLengthFeet>
14572</RunwayLengthFeet>
<GMTOffset>
5</GMTOffset>
<CountryAbbrviation>
```

FIGURE 1.14: Using the AirportInfo web service to retrieve XML-based airport information

Behind the Scenes of the AirportInfo Web Service

The AirportInfo web service supports myriad methods that your programs can call to get airport information by airport code, city, state, and more. The AirportInfo.aspx page uses the `getAirportInformationbyAirportCode` method:

```
string getAirportInformationbyAirportCode(string Code)
```

The source code in Listing 1.7 implements the ASP.NET page AirportInfo.aspx.

Listing 1.7 AirportInfo.aspx

```
Public Class WebForm1
    Inherits System.Web.UI.Page
    Protected WithEvents Label1 As System.Web.UI.WebControls.Label
    Protected WithEvents TextBox1 As System.Web.UI.WebControls.TextBox
    Protected WithEvents Button1 As System.Web.UI.WebControls.Button
    Protected WithEvents TextBox2 As System.Web.UI.WebControls.TextBox
    Protected WithEvents Image1 As System.Web.UI.WebControls.Image

#Region " Web Form Designer Generated Code "
    ' Code not shown.
#End Region

Private Sub Button1_Click(ByVal sender As System.Object, _
➥ByVal e As System.EventArgs) Handles Button1.Click
  Dim AirportInfo As New net.webservicex.www.AirportInfoWebservice()

  Dim Info As String
  Dim WebError As Boolean = False

  Try
   Info = AirportInfo.getAirportInformationByAirportCode(TextBox1.Text)
  Catch Ex As Exception
   WebError = True
   TextBox2.Text = "Web service error: " & Ex.Message
  End Try

  If (Not WebError) Then
    TextBox2.Text = ""

    Dim I As Integer
    Dim Letter As String

    For I = 0 To Info.Length - 1
      Letter = Info.Substring(I, 1)

      If (Letter = ">") Then
        TextBox2.Text &= Letter & vbCrLf
      Else
        TextBox2.Text &= Letter
      End If
    Next
  End If

End Sub
End Class
```

Within the button-click event handler, the following statement creates an object the code uses to interact with the web service:

```
Dim AirportInfo As New net.webservicex.www.AirportInfoWebservice()
```

Then, the program calls the service, passing to the method the airport code the user specifies. If the service is successful, the code then displays the result within the text box. To create the AirportInfo.aspx ASP.NET page, perform these steps:

1. Within Visual Studio .NET, select the File menu New Project option. Visual Studio .NET will display the New Project dialog box.
2. Within the New Project dialog box Project Types list, click Visual Basic Projects. Then, within the Templates field, click ASP.NET Web Application. Finally, within the Location field, specify the name **AirportInfo**. Select OK. Visual Studio .NET will display a page onto which you can drag and drop the program's controls (label, buttons, and text box).
3. Using the Toolbox, drag and drop the label, buttons, and text boxes previously shown in Figure 1.14 onto the page. Using the Properties window, set the text box to support multiline operations.
4. Select the Project menu Add Web Reference option. Visual Studio .NET will display the Add Web Reference dialog box.
5. Within the Address field, type the URL **http://www.webservicex.net/airport.asmx?wsdl** and press Enter. The dialog box will load the file's contents. Click the Add Reference button.
6. Select the View menu Code option. Visual Studio .NET will display the program's source code. Enter the program statements previously shown.

Where to Find Web Services on the Web

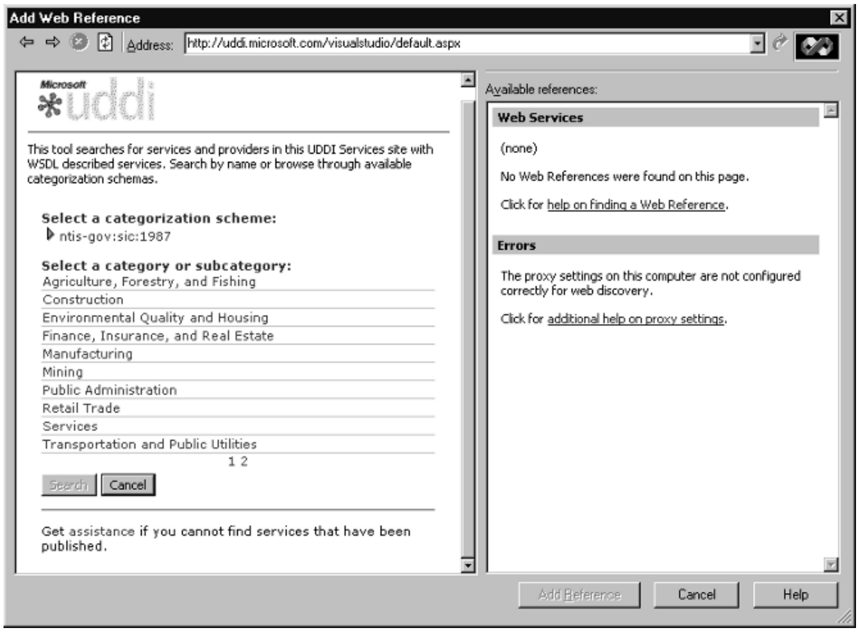
Across the Web, you can find web services from a variety of sources. This chapter took advantages of web services offered from the following websites:

```
www.XMethods.com
www.ServiceObjects.com
www.WebServiceX.net
www.Amazon.com\webservices
```

Later in this book, you will take advantage of web services available from Microsoft and other key software developers. In addition, you will learn how to locate web services using the UDDI directory within the Add Web References dialog box, as shown in Figure 1.15.

FIGURE 1.15:

Searching the UDDI directory for specific web services


Add Web Reference
Address: http://uddi.microsoft.com/visualstudio/default.aspx
Microsoft uddi

This tool searches for services and providers in this UDDI Services site with WSDL described services. Search by name or browse through available categorization schemas.

Select a categorization scheme:
ntis-gov:sic:1987

Select a category or subcategory:
Agriculture, Forestry, and Fishing
Construction
Environmental Quality and Housing
Finance, Insurance, and Real Estate
Manufacturing
Mining
Public Administration
Retail Trade
Services
Transportation and Public Utilities
1 2

Search Cancel

Get assistance if you cannot find services that have been published.

Available references:

Web Services

(none)

No Web References were found on this page.

Click for help on finding a Web Reference.

Errors

The proxy settings on this computer are not configured correctly for web discovery.

Click for additional help on proxy settings.

Summary

Web services let developers extend website capabilities to their applications. By integrating web services into an application, a programmer can integrate capabilities that correspond to e-commerce operations at Amazon, search operations at Google, airline reservations at an airline, and more. Web services provide a platform to extend a company's key capabilities beyond the company's website.

In this chapter you learned how to build Visual Basic .NET and C# programs as well as ASP.NET pages that consume Web services. Across the Web, many sites offer web services that your programs can use to interact with the services the site offers. In this way, you can create programs that offer the same operations a user would traditionally find only at a company's web page.

The Microsoft Visual Studio .NET environment makes it very easy for you to integrate a web service into your programs. To start, you add a Web Reference to the remote web service by specifying the WSDL (web service definition language) file that defines the service (the methods the service offers as well as the parameters each method uses). Then, you create an object that corresponds to the service. Finally, you use the object to call the web service methods.

This chapter taught you how to use existing web services. In Chapter 2, you will create your own web services.