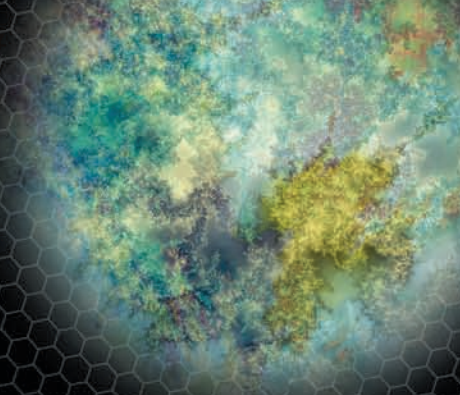
THE EXPERT'S VOICE® IN .NET



Pro .NET 2.0 XML

Master the .NET Framework's XML features to build powerful, data-driven applications

Bipin Joshi

Apress®

Pro .NET 2.0 XML

Bipin Joshi

Apress®

Pro .NET 2.0 XML

Copyright © 2007 by Bipin Joshi

All rights reserved. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage or retrieval system, without the prior written permission of the copyright owner and the publisher.

ISBN-13 (pbk): 978-1-59059-825-2

ISBN-10 (pbk): 1-59059-825-3

Printed and bound in the United States of America 9 8 7 6 5 4 3 2 1

Trademarked names may appear in this book. Rather than use a trademark symbol with every occurrence of a trademarked name, we use the names only in an editorial fashion and to the benefit of the trademark owner, with no intention of infringement of the trademark.

Lead Editors: Ewan Buckingham and Matthew Moodie
Technical Reviewer: Fabio Claudio Ferracchiati
Editorial Board: Steve Anglin, Ewan Buckingham, Gary Cornell, Jason Gilmore, Jonathan Gennick, Jonathan Hassell, James Huddleston, Chris Mills, Matthew Moodie, Jeff Pepper, Paul Sarknas, Dominic Shakeshaft, Jim Sumser, Matt Wade
Project Manager: Laura Esterman
Copy Edit Manager: Nicole Flores
Copy Editor: Sharon Wilkey
Assistant Production Director: Kari Brooks-Copony
Production Editor: Ellie Fountain
Compositor: Pat Christenson
Proofreader: April Eddy
Indexer: Brenda Miller
Artist: Kinetic Publishing Services, LLC
Cover Designer: Kurt Krames
Manufacturing Director: Tom Debolski

Distributed to the book trade worldwide by Springer-Verlag New York, Inc., 233 Spring Street, 6th Floor, New York, NY 10013. Phone 1-800-SPRINGER, fax 201-348-4505, e-mail orders-ny@springer-sbm.com, or visit http://www.springeronline.com.

For information on translations, please contact Apress directly at 2560 Ninth Street, Suite 219, Berkeley, CA 94710. Phone 510-549-5930, fax 510-549-5939, e-mail info@apress.com, or visit http://www.apress.com.

The information in this book is distributed on an "as is" basis, without warranty. Although every precaution has been taken in the preparation of this work, neither the author(s) nor Apress shall have any liability to any person or entity with respect to any loss or damage caused or alleged to be caused directly or indirectly by the information contained in this work.

The source code for this book is available to readers at http://www.apress.com in the Source Code/Download section.

This work is dedicated to Lord Shiva,
who, I believe, resides in each one of us as
pure consciousness

Contents at a Glance

About the Author xvii
About the Technical Reviewer xix
Acknowledgments xxi
Introduction xxiii

CHAPTER 1 Introducing XML and the .NET Framework 1
CHAPTER 2 Manipulating XML Documents by Using the Document Object Model 31
CHAPTER 3 Reading and Writing XML Documents 65
CHAPTER 4 Accessing XML Documents by Using the XPath Data Model 95
CHAPTER 5 Validating XML Documents 123
CHAPTER 6 Transforming XML with XSLT 165
CHAPTER 7 XML in ADO.NET 193
CHAPTER 8 XML Serialization 237
CHAPTER 9 XML Web Services 271
CHAPTER 10 XML in SQL Server 2005 303
CHAPTER 11 Use of XML in the .NET Framework 343
CHAPTER 12 Creating Services by Using Windows Communication Foundation 413
APPENDIX A Creating Custom XmlReader and XmlWriter Classes 433
APPENDIX B Case Study: A Web Service–Driven Shopping Cart 457
APPENDIX C Resources 479

INDEX 481

Contents

About the Author xvii
About the Technical Reviewer xix
Acknowledgments xxi
Introduction xxiii

CHAPTER 1 Introducing XML and the .NET Framework 1

What Is XML? 1
Benefits of XML 2
XML Is an Industry Standard 2
XML Is Self-Describing 2
XML Is Extensible 3
XML Can Be Processed Easily 3
XML Can Be Used to Easily Exchange Data 3
XML Can Be Used to Easily Share Data 3
XML Can Be Used to Create Specialized Vocabularies 3
XML-Driven Applications 3
Rules of XML Grammar 5
XML Markup Is Case Sensitive 7
The XML Document Must Have One and Only One Root Element 7
The Start Tag Must Have an End Tag 7
The Start and End Tags Must Be Properly Nested 7
The Attribute Values Must Be Enclosed in Quotes 8
DTDs and XML Schemas 8
Parsing XML Documents 8
XSLT 10
XPath 10
The .NET Framework 11

.NET and XML 12
Assemblies and Namespaces 13
The XML Parsing Model in the .NET Framework 14
.NET Configuration Files 14
ADO.NET 17
ASP.NET Server Controls 17
XML Serialization 18
Remoting 19
Web Services 19
XML Documentation 20
SQL Server XML Features 21
Working with Visual Studio 21
Creating Windows Applications 22
Creating Class Libraries 26
Summary 29

CHAPTER 2 Manipulating XML Documents by Using the Document Object Model 31

Using the DOM Parser 31
Knowing When to Use DOM 34
A Sample XML Document 34
Opening an Existing XML Document for Parsing 35
Navigating Through an XML Document 37
Looking for Specific Elements and Nodes 39
Retrieving Specific Elements by Using the GetElementByTagName() Method 40
Retrieving Specific Elements by Using the GetElementById() Method 41
Selecting Specific Nodes by Using the SelectNodes() Method 45
Selecting a Single Specific Node by Using the SelectSingleNode() Method 47
Modifying XML Documents 48
Navigating Between Various Nodes 49
Modifying Existing Content 51
Deleting Existing Content 52
Adding New Content 53
Using Helper Methods 55

Dealing with White Space 56
Dealing with Namespaces 59
Understanding Events of the XmlDocument Class 61
Summary 64

CHAPTER 3 Reading and Writing XML Documents 65

What Are XML Readers and Writers? 65
When to Use Readers and Writers 66
Reader Classes 66
The XmlTextReader Class 66
The XmlValidatingReader Class 66
The XmlNodeReader Class 67
Reading Documents by Using XmlTextReader 67
Opening XML Documents 67
Reading Attributes, Elements, and Values 69
Improving Performance by Using Name Tables 72
Dealing with Namespaces 73
Moving Between Elements 73
The ReadSubTree() Method 73
The ReadToDescendant() Method 74
The ReadToFollowing() Method 74
The ReadToNextSibling() Method 75
The Skip() Method 75
Moving Between Attributes 76
Reading Content 77
The ReadInnerXml() Method 77
The ReadOuterXml() Method 78
The ReadString() Method 78
Writing XML Documents 78
Exporting Columns As Elements 82
Exporting Columns As Attributes 83
Specifying Character Encoding 83
Formatting the Output 84
Including Namespace Support 87
Dealing with Nontextual Data 89
Serializing Data 90
Unserializing Data 91
Summary 93

CHAPTER 4 Accessing XML Documents by Using the XPath Data Model 95

Overview of XPath 95
Location Path 96
Axis 96
Node Tests 97
Predicates 97
Putting It All Together 97
XPath Functions 98
The XPath Data Model 99
Creating XPathNavigator 99
Navigating an XML Document by Using XPathNavigator 101
Selecting Nodes 104
Navigating Between Attributes 108
Retrieving Inner and Outer XML 109
Getting an XmlReader from XPathNavigator 111
Getting an XmlWriter from XPathNavigator 114
Editing XML Documents with the XPathNavigator Class 116
Summary 122

CHAPTER 5 Validating XML Documents 123

Providing Structure for XML Documents 123
Document Type Definitions (DTDs) 124
XML Data Reduced Schemas (XDR Schemas) 124
XML Schema Definition Language Schemas (XSD Schemas) 124
Creating Structure for an XML Document 124
The Structure of Employees.xml 125
Creating the DTD 125
Creating the XSD Schema 127
Creating Schemas by Using the Schema Object Model (SOM) 142
The Core SOM Classes 142
Creating an XSD Schema by Using the SOM 144

Validating XML Documents Against DTDs and XSD Schemas 152
Inline DTD 153
External DTD 153
Inline Schema 154
External Schema 154
Using the XmlReader Class to Validate XML Documents 156
Using XmlDocument to Validate XML Documents Being Loaded 159
Using XPath Navigator to Validate XML Documents 162
Summary 162

CHAPTER 6 Transforming XML with XSLT 165

Overview of XSLT 165
Applying Templates by Using <xsl:apply-templates> 169
Branching by Using <xsl:if> 171
Branching by Using <xsl:choose> and <xsl:when> 173
Transforming Elements and Attributes 175
The XslCompiledTransform Class 178
Performing Transformations by Using XslCompiledTransform 179
Passing Arguments to a Transformation 182
Using Script Blocks in an XSLT Style Sheet 186
Using Extension Objects 190
Summary 191

CHAPTER 7 XML in ADO.NET 193

Overview of ADO.NET Architecture 193
Connected Data Access 193
Disconnected Data Access 194
ADO.NET Data Providers 195
Basic ADO.NET Classes 197
XML and Connected Data Access 198
Using the ExecuteXmlReader() Method 198

XML and Disconnected Data Access 201
Understanding DataSet 201
Understanding DataAdapter 203
Working with DataSet and DataAdapter 205
Saving DataSet Contents As XML 212
Reading XML Data into DataSet 218
Generating Menus Dynamically Based On an XML File 221
Reading Only the Schema Information 224
Creating a Typed DataSet 226
Using Visual Studio to Create a Typed DataSet 227
Using the xsd.exe Tool to Create a Typed DataSet 231
The XmlDataDocument Class 232
Using the XmlDataDocument Class 232
Converting Between DataRow and XmlElement 234
Summary 236

CHAPTER 8 XML Serialization 237

Understanding the Flavors of Serialization 238
Classes Involved in the Serialization Process 238
Serializing and Deserializing Objects by Using XML Format 239
Handling Events Raised During Deserialization 243
Serializing and Deserializing Complex Types 245
Serialization and Inheritance 254
Customizing the Serialized XML 257
Serializing Data in SOAP Format 263
Customizing SOAP Serialization 267
Summary 270

CHAPTER 9 XML Web Services 271

What Are Web Services? 271
Creating and Consuming Web Services 272
Creating a Web Service 273
Creating a Proxy for a Web Service 285
Creating a Form That Consumes a Web Method 287
Calling a Web Method Asynchronously 289
Understanding SOAP 291
Using SOAP Headers 292

Understanding the WSDL Document 297
The Messages 300
The Type Definitions 300
The Port Types 301
The Binding 301
The Service 301
A Summary of WSDL 301
Summary 302

CHAPTER 10 XML in SQL Server 2005 303

Using XML Extensions to the SELECT Statement 303
The FOR XML Clause 303
Using OPENXML 313
Using SQLXML Features 315
The SQLXML Managed Classes 316
The XML Data Type 331
Creating a Table with an XML Column 332
Inserting, Modifying, and Deleting XML Data 332
Methods of the XML Data Type 334
XML Data Modification Language (XML DML) 336
XQuery Support in the XML Data Type 337
Native Web Services 337
Creating a Stored Procedure 338
Creating an HTTP Endpoint 338
Creating a Proxy for the Endpoint 340
Consuming the Native Web Service 341
Summary 342

CHAPTER 11 Use of XML in the .NET Framework 343

Understanding Remoting 343
Remoting Architecture 344
Object Activation 345
Channels and Formatters 345
Flavors of Marshalling 346
Remoting Assemblies and Namespaces 346
Creating a Remoting-Enabled Application 347

Using XML in ASP.NET 356
Web Form Code Models 357
XML and ASP.NET 357
The XML Data Source Control 367
Working with Site Maps 375
Using a SiteMapPath Control 378
Using a SiteMapDataSource Control 379
Using the XML Control 379
Using the .NET Framework Configuration System 382
Structure of the web.config File 383
Inheritance and web.config 384
Common Configuration Tasks 384
The ASP.NET Provider Model 388
Displaying Custom Error Pages 401
Documenting XML Code 404
Creating a Class Library 404
Generating Documentation 408
Summary 412

CHAPTER 12 Creating Services by Using Windows Communication Foundation 413

Understanding WCF Vocabulary 414
Creating and Consuming a WCF Service 415
Creating the Service 415
Hosting the Service 421
Consuming the Service 424
Testing the Host and Client 426
Hosting a WCF Service in IIS 428
Understanding the Role of XML in WCF Services 430
Using the XmlFormatter and XmlSerializer Classes 431
Using XmlSerializer Instead of XmlFormatter 431
Summary 431

APPENDIX A Creating Custom XmlReader and XmlWriter Classes 433

Creating a Custom Implementation of XmlReader 433
Inheriting from XmlReader 434
Creating a TableReader Class 435
Using the TableReader Class 444

Creating a Custom XmlWriter 446
Inheriting from XmlWriter 447
Consuming the RssWriter Class 455
Summary 456

APPENDIX B Case Study: A Web Service–Driven Shopping Cart 457

Creating the Database 457
Creating the Web Service 459
Creating the SqlHelper Class 459
Specifying the Connection String in web.config 461
Creating the Web Methods 462
Creating the Shopping Cart 467
Adding the Web Reference 467
Displaying the Product Catalog 468
Creating the Shopping Cart Page 471
Testing the Website 476

APPENDIX C Resources 479

INDEX 481

About the Author

BIPIN JOSHI is a trainer and consultant by profession and runs his own firm, BinaryIntellect Consulting. Bipin has been programming since 1995 and has worked with .NET ever since its beta release. Founder and web master of two community websites—DotNetBips.com and BinaryIntellect.net—he also contributes to printed magazines and other websites. He is the author or coauthor of half a dozen books, including his *Developer's Guide to ASP.NET 2.0*. Bipin is a Microsoft MVP and a member of ASPInsiders. His deep interest in yoga prompted him to start YogaVision.in, a website dedicated to yoga and spirituality. Having adopted a yoga way of life, he remains absorbed in practicing and studying yoga when not engaged with computers. His blog at bipinjoshi.com is his place to jot down thoughts about technology and life. He can also be reached there.

About the Technical Reviewer

FABIO CLAUDIO FERRACCHIATI is a senior developer for Brain Force (`http://www.brainforce.com`). A prolific writer on leading-edge technologies, he has contributed to more than a dozen books on .NET, C#, Visual Basic, and ASP.NET. His most recent books are *LINQ for Visual C# 2005* and *LINQ for VB 2005*. He's a .NET MCSD and lives in Milan, Italy. He can be reached at `http://www.ferracchiati.com`.

Acknowledgments

Though my name alone appears as the author, many have contributed directly or indirectly to this book. When I got a nod from Apress to begin this book, I was a bit worried because I had only five months in hand and there were many activities going on at my end, including training programs, writing for my websites, and development work. Today I feel satisfied to see the task accomplished on time.

First of all, I must express my feeling of devotion toward Lord Shiva. His yogic teachings have made me understand the real meaning of life. Without His blessings, this would not have been possible. I am also thankful to my parents and brother for their help and support in my activities at all levels.

Writing a book is about teamwork. Input from the technical reviewer, Fabio Claudio Ferracchiati, was very useful in rendering the book accurate. The whole team at Apress was very helpful. Ewan Buckingham provided very good coordination and input at the conceptualization and initial stage. Matthew Moodie kept an eagle's eye on the language consistency and overall format. Laura Esterman was always there to ensure that everything went as per the schedule. Thank you, team, for playing your part so wonderfully.

Finally, thanks to Sona (my dog). Each time I show her my book, she feels so proud! Thank you, Sona, for providing fun at the end of tiring work schedules.

Introduction

The Internet has brought a huge difference in the way we develop and use software applications. Applications are becoming more and more distributed, connecting heterogeneous systems. With such a radical change, the role of XML is highly significant. XML has already established itself as a standard way of data encoding and transfer. No wonder that Microsoft's .NET Framework provides such a strong support for XML. Data access, raw parsing, configuration, code documentation, and web services are some of the examples where .NET harnesses the power and flexibility of XML.

The .NET Framework comes with a plethora of classes that allow you to work with XML data. This book demystifies XML and allied technologies. Reading and writing XML data, using DOM, ADO.NET integration with XML, SQL Server XML features, applying XSLT style sheets, SOAP, web services, and configuration systems are some of the topics that this book explores in detail. Real-world examples scattered throughout the book will help you understand the practical use of the topic under consideration. The book will also act as a handy reference when developers go on the job.

Who Is This Book For?

This book is for developers who are familiar with the .NET Framework and want to dive deep into the XML features of .NET. This book will not teach you XML manipulation using non-Microsoft tools. All the examples in this book are presented in C#, and hence working knowledge of C# is also assumed. In some chapters, familiarity with ADO.NET and SQL Server is necessary, though I have provided a brief overview along with the respective topics.

Software Required

I have used Visual Studio 2005 as the IDE for developing various applications. However, for most of the examples you can use Visual C# Express Edition. In some samples you also need Visual Web Developer Express Edition, SQL Server 2005, and the Sandcastle help file generation tool.

Structure of the Book

The book is divided into twelve chapters and three appendixes. Chapters 1 to 4 talk about navigating, reading, and writing XML documents by using classes from the `System.Xml` namespace. In these chapters, you will learn to use classes such as `XmlDocument`, `XmlReader`, `XmlWriter`, and `XPathNavigator`.

Manipulating XML data is just one part of the story. Often you need to validate and transform it so that it becomes acceptable to your system. Chapters 5 and 6 deal with the issues of validating XML documents and applying XSLT transformations to them, respectively.

The .NET Framework itself uses XML in many places. This is often under the hood, but for any XML developer it is essential to know where this occurs. To that end, Chapters 7 to 9 cover topics such as ADO.NET integration with XML, XML serialization, and XML web services.

Microsoft has not limited the use of XML only to areas such as ADO.NET and web services. SQL Server 2005 incorporates many XML-related enhancements. These features are discussed in Chapter 10. Though this topic isn't strictly one of the XML features of .NET, many developers will find it useful. This is because many real-world projects developed by using the .NET Framework make use of SQL Server 2005 as a data store. Chapter 11 covers many other areas where the .NET Framework uses XML. Some of them include configuration files, ASP.NET server controls, and C# XML comments.

In the .NET Framework 3.0, Microsoft added a new component-development framework called Windows Communication Foundation (WCF). WCF allows you to develop service-oriented applications by using a unified programming model. It also uses XML heavily as a format of communication. Thus it is worthwhile to peek into this new framework, and Chapter 12 does exactly that.

Finally, the three appendixes supplement what you learned throughout the book by providing real-world case studies and resources.

Downloading the Source Code

The complete source of the book is available for download at the book's companion website. Just visit `http://www.apress.com` and download the zip file containing the code from the Source Code/Download area.

Contacting the Author

You can reach me via the DotNetBips.com discussion forums (`http://www.dotnetbips.com/forums`) or via my blog at `http://www.bipinjoshi.com`.