

Contents

Introduction	xxvii
---------------------	--------------

Part I: The C# Language	1
--------------------------------	----------

Chapter 1: .NET Architecture	3
-------------------------------------	----------

The Relationship of C# to .NET	4
The Common Language Runtime	4
Advantages of Managed Code	4
A Closer Look at Intermediate Language	7
Support for Object Orientation and Interfaces	8
Distinct Value and Reference Types	9
Strong Data Typing	9
Error Handling with Exceptions	16
Use of Attributes	17
Assemblies	17
Private Assemblies	18
Shared Assemblies	19
Reflection	19
.NET Framework Classes	19
Namespaces	21
Creating .NET Applications Using C#	21
Creating ASP.NET Applications	21
Creating Windows Forms	24
Windows Services	24
The Role of C# in the .NET Enterprise Architecture	24
Summary	26

Chapter 2: C# Basics	29
-----------------------------	-----------

Before We Start	30
Our First C# Program	30
The Code	30
Compiling and Running the Program	31

Contents

A Closer Look	31
Variables	34
Initialization of Variables	34
Variable Scope	35
Constants	38
Predefined Data Types	39
Value Types and Reference Types	39
CTS Types	40
Predefined Value Types	41
Predefined Reference Types	44
Flow Control	47
Conditional Statements	47
Loops	51
Jump Statements	54
Enumerations	55
Arrays	57
Namespaces	58
The using Statement	59
Namespace Aliases	60
The Main() Method	61
Multiple Main() Methods	61
Passing Arguments to Main()	62
More on Compiling C# Files	63
Console I/O	65
Using Comments	67
Internal Comments Within the Source Files	67
XML Documentation	68
The C# Preprocessor Directives	70
#define and #undef	70
#if, #elif, #else, and #endif	71
#warning and #error	72
#region and #endregion	72
#line	72
C# Programming Guidelines	73
Rules for Identifiers	73
Usage Conventions	74
Summary	81
Chapter 3: Objects and Types	83
Classes and Structs	84
Class Members	85
Data Members	85
Function Members	85

readonly Fields	99
Structs	101
Structs Are Value Types	102
Structs and Inheritance	103
Constructors for Structs	103
The Object Class	104
System.Object Methods	104
The ToString() Method	105
Summary	107
Chapter 4: Inheritance	109
<hr/>	
Types of Inheritance	109
Implementation Versus Interface Inheritance	109
Multiple Inheritance	110
Structs and Classes	110
Implementation Inheritance	111
Virtual Methods	112
Hiding Methods	113
Calling Base Versions of Functions	114
Abstract Classes and Functions	115
Sealed Classes and Methods	115
Constructors of Derived Classes	116
Modifiers	122
Visibility Modifiers	122
Other Modifiers	123
Interfaces	123
Defining and Implementing Interfaces	125
Derived Interfaces	128
Summary	130
Chapter 5: Operators and Casts	131
<hr/>	
Operators	131
Operator Shortcuts	133
The Ternary Operator	134
The checked and unchecked Operators	134
The is Operator	135
The as Operator	136
The sizeof Operator	136
The typeof Operator	136

Contents

Operator Precedence	137
Type Safety	137
Type Conversions	138
Boxing and Unboxing	141
Comparing Objects for Equality	142
Comparing Reference Types for Equality	142
The ReferenceEquals() Method	142
The virtual Equals() Method	143
The static Equals() Method	143
Comparison Operator (==)	143
Comparing Value Types for Equality	143
Operator Overloading	144
How Operators Work	145
Operator Overloading Example: The Vector Struct	146
Which Operators Can You Overload?	153
User-Defined Casts	154
Implementing User-Defined Casts	155
Multiple Casting	161
Summary	165
Chapter 6: Delegates and Events	167
Delegates	167
Using Delegates in C#	169
SimpleDelegate Example	172
BubbleSorter Example	174
Multicast Delegates	177
Events	179
The Receiver's View of Events	180
Generating Events	182
Summary	186
Chapter 7: Memory Management and Pointers	187
Memory Management under the Hood	187
Value Data Types	188
Reference Data Types	190
Garbage Collection	192
Freeing Unmanaged Resources	193
Destructors	193
The IDisposable Interface	195

Implementing IDisposable and a Destructor	196
Unsafe Code	197
Pointers	198
Pointer Example: PointerPlayaround	207
Using Pointers to Optimize Performance	212
Summary	216
Chapter 8: Strings and Regular Expressions	217
<hr/>	
System.String	218
Building Strings	219
Format Strings	223
Regular Expressions	229
Introduction to Regular Expressions	229
The RegularExpressionsPlayaround Example	230
Displaying Results	233
Matches, Groups, and Captures	234
Summary	237
Chapter 9: Collections	239
<hr/>	
Examining Groups of Objects	239
Array Lists	240
Collections	241
Dictionaries	245
Summary	256
Chapter 10: Reflection	257
<hr/>	
Custom Attributes	258
Writing Custom Attributes	258
Custom Attribute Example: WhatsNewAttributes	262
Reflection	265
The System.Type Class	266
The TypeView Example	268
The Assembly Class	271
Completing the WhatsNewAttributes Sample	272
Summary	276

Contents

Chapter 11: Errors and Exceptions	277
Looking into Errors and Exception Handling	277
Exception Classes	278
Catching Exceptions	280
User-Defined Exception Classes	290
Summary	297
Part II: The .NET Environment	299
Chapter 12: Visual Studio .NET	301
Working with Visual Studio .NET 2003	301
Creating a Project	304
Solutions and Projects	311
Windows Application Code	314
Reading in Visual Studio 6 Projects	314
Exploring and Coding a Project	315
Building a Project	326
Debugging	331
Other .NET Tools	334
The ASP.NET Web Matrix Project	335
WinCV	335
Summary	337
Chapter 13: Assemblies	339
What Are Assemblies?	339
The Answer to DLL Hell	340
Features of Assemblies	341
Application Domains and Assemblies	341
Assembly Structure	344
Assembly Manifests	346
Namespaces, Assemblies, and Components	346
Private and Shared Assemblies	347
Viewing Assemblies	347
Building Assemblies	348
Cross-Language Support	353
The CTS and the CLS	353
Language Independence in Action	354
CLS Requirements	364

Global Assembly Cache	366
Native Image Generator	366
Global Assembly Cache Viewer	367
Global Assembly Cache Utility (gacutil.exe)	368
Creating Shared Assemblies	369
Shared Assembly Names	369
Creating a Shared Assembly	371
Configuration	376
Configuration Categories	376
Versioning	377
Configuring Directories	387
Summary	390
Chapter 14: .NET Security	391
Code Access Security	392
Code Groups	393
Code Access Permissions and Permissions Sets	399
Policy Levels: Machine, User, and Enterprise	403
Support for Security in the Framework	405
Demanding Permissions	406
Requesting Permissions	407
Implicit Permission	410
Denying Permissions	411
Asserting Permissions	412
Creating Code Access Permissions	414
Declarative Security	414
Role-Based Security	415
The Principal	415
Windows Principal	416
Roles	417
Declarative Role-Based Security	418
Managing Security Policy	419
The Security Configuration File	419
Managing Code Groups and Permissions	423
Turning Security On and Off	423
Resetting Security Policy	423
Creating a Code Group	423
Deleting a Code Group	424
Changing a Code Group's Permissions	424
Creating and Applying Permissions Sets	425
Distributing Code Using a Strong Name	427

Contents

Distributing Code Using Certificates	429
Managing Zones	435
Summary	437
Chapter 15: Threading	439
Threading	439
Applications with Multiple Threads	441
Manipulating Threads	441
The ThreadPlayaround Sample	444
Thread Priorities	448
Synchronization	449
Summary	453
Chapter 16: Distributed Applications with .NET Remoting	455
What Is .NET Remoting?	456
Application Types and Protocols	456
CLR Object Remoting	457
.NET Remoting Overview	457
Contexts	460
Activation	461
Attributes and Properties	461
Communication between Contexts	462
Remote Objects, Clients, and Servers	462
Remote Objects	462
A Simple Server	464
A Simple Client	465
.NET Remoting Architecture	466
Channels	466
Formatters	470
ChannelServices and RemotingConfiguration	471
Object Activation	472
Message Sinks	476
Passing Objects in Remote Methods	476
Lifetime Management	481
Miscellaneous .NET Remoting Features	484
Configuration Files	484
Hosting Applications	494
Classes, Interfaces, and SoapSuds	495
Asynchronous Remoting	498
Remoting and Events	499
Call Contexts	505
Summary	507

Chapter 17: Localization	509
Namespace System.Globalization	510
Unicode Issues	510
Cultures and Regions	511
Cultures in Action	516
Sorting	520
Resources	522
Creating Resource Files	522
ResGen	523
ResourceWriter	523
Using Resource Files	524
The System.Resources Namespace	527
Localization Example Using Visual Studio .NET	527
Outsourcing Translations	533
Changing the Culture Programmatically	534
Using Binary Resource Files	536
Using XML Resource Files	537
Automatic Fallback for Resources	539
Globalization and Localization with ASP.NET	539
A Custom Resource Reader	540
Creating a DatabaseResourceReader	541
Creating a DatabaseResourceSet	542
Creating a DatabaseResourceManager	543
Client Application for DatabaseResourceReader	544
Summary	544
Chapter 18: Deployment	545
Designing for Deployment	545
Deployment Options	546
Xcopy	546
Copy Project	546
Deployment Projects	546
Deployment Requirements	546
Simple Deployment	547
Xcopy	548
Xcopy and Web Applications	548
Copy Project	550
Installer Projects	551
What Is Windows Installer?	551
Creating Installers	552
Advanced Options	562
Summary	569

Part III: Windows Forms **571**

Chapter 19: Windows Forms **573**

Creating a Windows Form Application	574
Control Class	579
Size and Location	580
Appearance	580
User Interaction	580
Windows Functionality	582
Miscellaneous Functionality	582
Class Hierarchy	582
Standard Controls and Components	584
Forms	598
Form Class	599
Multiple Document Interface (MDI)	607
Custom Controls	610
Summary	622

Chapter 20: Graphics with GDI+ **623**

Understanding Drawing Principles	624
GDI and GDI+	624
Drawing Shapes	626
Painting Shapes Using OnPaint()	629
Using the Clipping Region	630
Measuring Coordinates and Areas	632
Point and PointF	632
Size and SizeF	634
Rectangle and RectangleF	635
Region	636
A Note about Debugging	637
Drawing Scrollable Windows	638
World, Page, and Device Coordinates	644
Colors	645
Red-Green-Blue (RGB) Values	645
The Named Colors	646
Graphics Display Modes and the Safety Palette	646
The Safety Palette	647
Pens and Brushes	648
Brushes	648
Pens	649

Drawing Shapes and Lines	650
Displaying Images	652
Issues When Manipulating Images	655
Drawing Text	655
Simple Text Example	656
Fonts and Font Families	657
Example: Enumerating Font Families	659
Editing a Text Document: The CapsEditor Sample	661
The Invalidate() Method	666
Calculating Item Sizes and Document Size	667
OnPaint()	668
Coordinate Transforms	670
Responding to User Input	671
Printing	675
Implementing Print and Print Preview	676
Summary	680
Part IV: Data	683
Chapter 21: Data Access with .NET	685
ADO.NET Overview	685
Namespaces	686
Shared Classes	686
Database-Specific Classes	687
Using Database Connections	688
Using Connections Efficiently	689
Transactions	692
Commands	693
Executing Commands	694
Calling Stored Procedures	698
Fast Data Access: The Data Reader	701
Managing Data and Relationships: The DataSet Class	704
Data Tables	704
Data Columns	705
Data Relationships	711
Data Constraints	713
XML Schemas	715
Generating Code with XSD	716
Populating a DataSet	721
Populating a DataSet Class with a Data Adapter	722
Populating a DataSet from XML	723

Contents

Persisting DataSet Changes	723
Updating with Data Adapters	724
Writing XML Output	726
Working with ADO.NET	728
Tiered Development	728
Key Generation with SQL Server	730
Naming Conventions	732
Summary	734
Chapter 22: Viewing .NET Data	735
The DataGrid Control	735
Displaying Tabular Data	735
Data Sources	738
DataGrid Class Hierarchy	746
Data Binding	750
Simple Binding	750
Data-Binding Objects	751
Visual Studio.NET and Data Access	757
Creating a Connection	758
Selecting Data	759
Generating a DataSet	762
Updating the Data Source	763
Building a Schema	764
Other Common Requirements	770
Summary	778
Chapter 23: Manipulating XML	781
XML Standards Support in .NET	782
Introducing the System.Xml Namespace	782
Using MSXML in .NET	783
Using System.Xml Classes	786
Reading and Writing Streamed XML	786
Using the XmlTextReader Class	787
Using the XmlValidatingReader Class	791
Using the XmlTextWriter Class	794
Using the DOM in .NET	795
Using the XmlDocument Class	797
Using XPath and XSLT in .NET	802
The System.Xml.XPath Namespace	803
The System.Xml.Xsl Namespace	807

XML and ADO.NET	812
Converting ADO.NET Data to XML	812
Converting XML to ADO.NET Data	820
Reading and Writing a DiffGram	822
Serializing Objects in XML	825
Serialization without Source Code Access	833
Summary	836
Chapter 24: Working with Active Directory	837
The Architecture of Active Directory	838
Features	838
Active Directory Concepts	839
Characteristics of Active Directory Data	843
Schema	843
Administration Tools for Active Directory	845
Active Directory Users and Computers	845
ADSI Edit	846
Active Directory Service Interfaces (ADSI)	847
Programming Active Directory	848
Classes in System.DirectoryServices	849
Binding	849
Getting Directory Entries	854
Object Collections	855
Cache	857
Creating New Objects	857
Updating Directory Entries	858
Accessing Native ADSI Objects	859
Searching in Active Directory	860
Searching for User Objects	864
User Interface	864
Get the Schema Naming Context	864
Get the Property Names of the User Class	866
Search for User Objects	867
Summary	869
Part V: Web Programming	871
Chapter 25: ASP.NET Pages	873
ASP.NET Introduction	874
State Management in ASP.NET	875

Contents

ASP.NET Web Forms	875
ASP.NET Server Controls	880
ADO.NET and Data Binding	892
Updating the Event-Booking Application	893
More on Data Binding	901
Application Configuration	906
Summary	907
Chapter 26: Web Services	909
<hr/>	
SOAP	910
WSDL	911
Web Services	913
Exposing Web Services	913
Consuming Web Services	916
Extending the Event-Booking Example	918
The Event-Booking Web Service	919
The Event-Booking Client	922
Exchanging Data Using SOAP Headers	924
Summary	929
Chapter 27: User Controls and Custom Controls	931
<hr/>	
User Controls	932
A Simple User Control	932
Custom Controls	939
Custom Control Project Configuration	940
Basic Custom Controls	944
Creating a Composite Custom Control	949
A Straw Poll Control	951
The Candidate Controls	953
The StrawPoll Control Builder	954
Straw Poll Style	955
The Straw Poll Control	956
Summary	962
Part VI: Interop	963
Chapter 28: COM Interoperability	965
<hr/>	
.NET and COM	966
Metadata	966
Freeing Memory	966

Interfaces	967
Method Binding	969
Data Types	969
Registration	969
Threading	969
Error Handling	971
Event Handling	972
Marshaling	972
Using a COM Component from a .NET Client	973
Creating a COM Component	973
Creating a Runtime Callable Wrapper	977
Threading Issues	980
Adding Connection Points	980
Using ActiveX Controls in Windows Forms	982
Using COM Objects from within ASP.NET	985
Using a .NET Component from a COM Client	985
COM Callable Wrapper	986
Creating a .NET Component	986
Creating a Type Library	987
COM Interop Attributes	989
COM Registration	992
Creating a COM Client	993
Adding Connection Points	995
Creating a Client with a Sink Object	996
Running Windows Forms Controls in Internet Explorer	997
Summary	998
Chapter 29: Enterprise Services	999
<hr/>	
Overview	999
History	999
Where to Use Enterprise Services?	1000
Contexts	1001
Automatic Transactions	1001
Distributed Transactions	1001
Object Pooling	1002
Role-based Security	1002
Queued Components	1002
Loosely Coupled Events	1002
Creating a Simple COM+ Application	1003
Class ServicedComponent	1003
Application Attributes	1003
Creating the Component	1004

Contents

Deployment	1005
Automatic Deployment	1005
Manual Deployment	1005
Component Services Admin Tool	1006
Client Application	1008
Transactions	1009
ACID Properties	1009
Transaction Attributes	1009
Transaction Results	1010
Sample Application	1011
Summary	1021
Part VII: Windows Base Services	1023
Chapter 30: File and Registry Operations	1025
<hr/>	
Managing the File System	1026
.NET Classes That Represent Files and Folders	1027
The Path Class	1029
Example: A File Browser	1030
Moving, Copying, and Deleting Files	1035
Example: FilePropertiesAndMovement	1035
Reading and Writing to Files	1039
Streams	1040
Reading and Writing to Binary Files	1042
Reading and Writing to Text Files	1047
Reading and Writing to the Registry	1054
The Registry	1055
The .NET Registry Classes	1057
Example: SelfPlacingWindow	1059
Summary	1066
Chapter 31: Accessing the Internet	1067
<hr/>	
The WebClient Class	1068
Downloading Files	1068
Basic Web Client Example	1068
Uploading Files	1070
WebRequest andWebResponse Classes	1070
Other WebRequest andWebResponse Features	1071
Displaying Output as an HTML Page	1074
The Web Request and Web Response Hierarchy	1075

Utility Classes	1077
URIs	1077
IP Addresses and DNS Names	1079
Lower-Level Protocols	1082
Lower-Level Classes	1083
Summary	1088
Chapter 32: Windows Services	1091
What Is a Windows Service?	1091
Windows Services Architecture	1093
Service Program	1093
Service Control Program	1095
Service Configuration Program	1095
System.ServiceProcess Namespace	1095
Creating a Windows Service	1096
A Class Library Using Sockets	1096
TcpClient Example	1100
Windows Service Project	1102
Threading and Services	1107
Service Installation	1107
Installation Program	1108
Monitoring and Controlling the Service	1113
MMC Computer Management	1114
net.exe	1114
sc.exe	1115
Visual Studio .NET Server Explorer	1116
ServiceController Class	1116
Troubleshooting	1122
Interactive Services	1123
Event Logging	1123
Performance Monitoring	1130
Power Events	1135
Summary	1135
At www.wrox.com	
Appendix A: Principles of Object-Oriented Programming	1137
Appendix B: C# for Visual Basic 6 Developers	1177
Appendix C: C# for Java Developers	1225
Appendix D: C# for C++ Developers	1253
Index	1307