

# Contents

<i>About the Author</i> .....	<i>xiii</i>
<i>About the Technical Reviewer</i> .....	<i>xiv</i>
<i>Acknowledgments</i> .....	<i>xv</i>
<i>Introduction</i> .....	<i>xvii</i>
 <b>Chapter 1 Language Interoperability</b> .....	<b>1</b>
<i>Language Interoperability in Action</i> .....	<i>1</i>
<i>Language Interoperability in Theory</i> .....	<i>8</i>
<i>Language Interoperability in Practice</i> .....	<i>12</i>
<i>Conclusion</i> .....	<i>21</i>
 <b>Chapter 2 ilasm Directives and Attributes</b> .....	<b>23</b>
<i>General Assembly ilasm</i> .....	<i>23</i>
Defining the Assembly .....	<i>23</i>
Defining the Modules .....	<i>30</i>
Defining the UI .....	<i>30</i>
Concurrent Assembly Execution .....	<i>31</i>
Defining Data Segments .....	<i>31</i>
<i>Type-Specific Directives</i> .....	<i>32</i>
Defining the Type .....	<i>32</i>
<i>Adding Fields to a Type</i> .....	<i>41</i>
Field Scope .....	<i>42</i>
Field Initialization .....	<i>43</i>
serializable Redux .....	<i>44</i>
<i>Adding Methods to Types</i> .....	<i>45</i>
Type and Instance Methods .....	<i>45</i>
Method Implementation Details .....	<i>46</i>
Calling Conventions .....	<i>46</i>
Passing Arguments .....	<i>48</i>
Unmanaged Calls .....	<i>48</i>
Type and Instance Initializers .....	<i>49</i>
beforefieldinit Redux .....	<i>50</i>
Exporting Methods .....	<i>51</i>
Method Body Directives .....	<i>53</i>
<i>Defining Properties in Types</i> .....	<i>62</i>
<i>Adding Events to Types</i> .....	<i>64</i>
<i>Conclusion</i> .....	<i>67</i>

<b>Chapter 3 CIL Opcodes</b>	69
<i>Basic Stack Information</i>	69
<i>Opcode Essentials</i>	70
<i>Basic Opcodes</i>	71
Using Local Variables	71
Conversions	74
Using Method Arguments	77
Using Type Fields	79
<i>Basic Operations</i>	80
Arithmetic Operations	80
Binary Operations	83
Comparison Operations	85
<i>Object Instructions</i>	86
Creating Type Instances	86
Calling Methods	88
Constructors	91
Unmanaged Method Calls	91
Method Pointers	93
Boxing, Unboxing, and Value Type Indirection	94
Type Casting	96
Array Manipulation	97
Memory Manipulation	99
String Manipulation	101
<i>Controlling Code Flow</i>	102
<i>Handling Exceptions</i>	106
<i>Opcode Miscellanea</i>	114
Variable Argument Lists	114
.maxstack Calculations	116
Pointer Prefixes	117
Method Jumps	117
<i>Conclusion</i>	119
 <b>Chapter 4 ilasm and CIL in Practice</b>	 121
<i>Generating Random Numbers</i>	121
<i>Designing the Essentials</i>	122
<i>Implementing the Essentials</i>	123
Stubbing Out the Delegate	123
Field Definitions	125
Event Methods	125

Constructors .....	127
Creating the Properties .....	128
Implementing Generate() .....	129
Implementing GenerateViaDelegate() .....	131
Implementing GenerateViaEvent() .....	132
Generating the RIG Assembly .....	133
<i>Designing the Test Harness</i> .....	133
<i>Implementing the Test Harness</i> .....	134
Referencing Assemblies for UI Design .....	134
Defining UI Components .....	135
Initializing the Form .....	136
Calling Generate() .....	138
Calling GenerateViaDelegate() .....	141
Calling GenerateViaEvent() .....	143
Generating the RIGTestClient Assembly .....	144
<i>Conclusion</i> .....	147
 <b>Chapter 5 Debugging CIL</b> .....	149
<i>Debug Builds</i> .....	149
<i>The Command-Line Tool: cordbg.exe</i> .....	151
cordbg Basics .....	151
Watching Register Values and Native Instructions .....	156
Setting Breakpoints .....	159
Modes .....	160
Recording and Using cordbg Scripts .....	161
<i>The GUI Tool: dbgclr.exe</i> .....	163
Debugging Windows .....	165
Saving the Solution .....	170
Debugger Differences .....	171
<i>Debugging In-Process Assemblies</i> .....	171
DLLs in dbgclr .....	171
DLLs in cordbg .....	176
<i>Registry Control</i> .....	176
<i>Verifying Assemblies</i> .....	178
<i>Debugging Compiled Programs</i> .....	182
Preventing Recompilation .....	186
<i>Conclusion</i> .....	192

<b>Chapter 6 .NET Languages and CIL</b>	193
<i>Debug and Release Builds</i>	193
The C# Implementation	194
The VB .NET Implementation	198
The Component Pascal Implementation	202
Commentary	204
<i>Language Constructs</i>	205
VB .NET's With Statement	205
Implementing Interface Methods	208
On Error Resume Next, or How to Create a Lot of CIL	214
Active Objects	221
<i>Language Interoperability: The Real Story</i>	224
Inheritance with Oberon .NET Types	224
Overloaded and Overridden Methods	226
The Other Property	230
Overloading Methods in CIL	234
<i>Conclusion</i>	237
 <b>Chapter 7 Emitting Types</b>	239
<i>Applying CIL</i>	239
<i>Emitter Basics</i>	240
Defining the Essentials	240
Creating Assemblies	241
Building Types	243
Adding Fields	244
<i>Emitting Methods</i>	244
Adding Methods	244
Implementing Methods	246
Exception Handling	250
<i>Persisting the Results</i>	251
Baking Types	251
Transient-Only Assemblies	252
Persistent-Only Assemblies	252
Transient, Persistent Assemblies	254
<i>Beyond the Basics</i>	254
Setting Entry Points	254
Adding Attributes	255
Modifying Method Parameter Information	256

<i>Debugging Dynamic Assemblies</i> .....	258
Emitting Debug Information .....	258
Adding to the Symbol Writer .....	258
Reloading the Assembly .....	260
Where's the Target IL File? .....	262
Creating the DebugFile Class .....	263
Debugging Transient Modules .....	269
<i>Conclusion</i> .....	270

## **Chapter 8 Dynamic Proxies in .NET** .....271

<i>Separating Concerns</i> .....	271
<i>Functional Specifications</i> .....	274
<i>Class Design and Method Call Conditions</i> .....	275
Receiving a Notification before Method Invocation .....	276
Receiving a Notification after Method Invocation .....	277
When Method Invocations Go Bad .....	278
Proxy Call Flow .....	278
<i>Implementing Proxy Creation</i> .....	279
Preconditional Checks .....	279
Caching Types, Modules, and Assemblies .....	282
Defining the Constructors .....	285
Implementing the Interfaces .....	287
Invoking Target Methods .....	287
Setting Up the Method Hooks .....	294
<i>Testing the Solution</i> .....	301
Loading the Form .....	302
Creating Proxies .....	302
Type Inspection .....	305
<i>Contexts and .NET</i> .....	309
Dynamic Proxies and Contexts .....	314
<i>Conclusion</i> .....	315

## **Chapter 9 CIL Tips** .....317

<i>Be CLS-Compliant Aware</i> .....	317
<i>Use Verification Tools</i> .....	317
<i>Comments and Code Regions</i> .....	318
<i>Stay Location Savvy When Emitting Assemblies</i> .....	318
<i>Final Thoughts</i> .....	318

<i>Appendix A The Future of CIL</i> .....	319
<i>Generics in CIL</i> .....	319
<i>Extended IL</i> .....	322
<i>Inline CIL</i> .....	324
 <i>Appendix B .NET Languages</i> .....	 327
 <i>Index</i> .....	 329



<http://www.springer.com/978-1-59059-041-6>

CIL Programming

Under the Hood of .NET

Bock, J.

2002, XVIII, 360 p., Hardcover

ISBN: 978-1-59059-041-6

A product of Apress