

Contents

Acknowledgments	iv
Introduction	1
A Brief Description of Our Journey	1
From Old Problematic Monoliths to Innovative, Lightweight, Efficient Programs	3
“Why ILE? OPM Has Served Me Fine So Far”	4
The Virtues of ILE, by IBM Itself (with a Little Help from Me)	4
<i>Modularity, or Playing with Legos</i>	5
<i>Reusable Components—Don’t Rewrite; Reuse!</i>	5
<i>Common Runtime Services—Don’t Reinvent the Wheel</i>	6
<i>Source Debugger—No Longer the ISDB Nightmare</i>	6
Summary	6
 PART 1: ILE BASICS	 7
 Chapter 1: Modules, Programs, and Service Programs	 9
A Typical OPM Scenario	10
A Basic ILE Approach to This Problem	11
Why Some Detractors Say ILE Means “It’s a Link Editor”	13
Anatomy of a Module Object	14

An Even Better Way: In Comes the Service Program	15
Summary	16
Chapter 2: Binding It All Together.....	19
Before We Begin, Let’s Review the Journey	19
Start Here: Compiling Your First Module	21
Next Stop: Service Programs (with a Detour to Explain Binding)	21
Our Final Destination: Compiling a Program Object	24
No Trip Is Perfect Without a Couple of Unexpected Situations	25
... And a Few Shortcuts	26
Summary	26
Chapter 3: Procedures: How, When, and Why to Build Them	29
How to Build Your First Procedure, Using Your OPM Knowledge.....	30
When and Why You Should Build a Procedure.....	35
A Side Note: /COPY or /INCLUDE?	37
Summary	39
Chapter 4: Improve Your Code’s Readability with Functions	41
Reshaping the “Check If Item Exists in Inventory” Procedure into a Function	42
The Importance of Being a Function, or the Return Value Concept.....	45
Functions Within Functions Made Simple	47
Nested Functions: A Different Approach to Functions Within Functions.....	51
Summary	53
Chapter 5: All About Parameters	55
Adding VALUE to Your Parameters.....	56
Keeping It CONSTant.....	57
Value Versus CONST	58
So, What Keyword Should I Use for My Input Parameters?.....	59
You Need to Know Your OPTIONS.....	60
Allowing (and Handling) Missing-in-Action Parameters with *NOPASS	60
A Different Approach to the MIA Parameter Problem	64
*NOPASS Versus *OMIT	67

The Morphing Parameter (Wait, What?!)	67
C-like Strings	69
(Sort of) Self-Formatting Parameters	69
Summary	70
PART 2: TAKING ADVANTAGE OF ILE	73
Chapter 6: BIF Up Your Code!	75
Get Rid of Those Annoying File-Related Indicators	75
<i>Let's Start at the End—End of File, Actually</i>	76
<i>Still CHAINED to Indicators?</i>	77
<i>When %Equal Means More Efficient Code</i>	78
Start Moving MOVE and MOVEL Out of Your Code	79
<i>Removing MOVE from Your Numeric Conversion Operations</i>	80
<i>Need to Convert Something to Integer? Here's a (H)%int</i>	81
<i>Whatever %FLOATs Your Boat</i>	82
<i>A Word About Fixed-Format Code</i>	84
Keep Moving MOVE Out of Your Code	84
<i>Converting Numeric Data to Character with %CHAR</i>	84
<i>Using Edit Codes and Edit Words to “Beautify” Numeric Data</i>	85
<i>Yet Another Use of MOVE You Can Do Without</i>	87
Simplifying String Operations with BIFs	88
<i>“Ancient” Versus “Modern” Ways</i>	89
<i>Out with the Old, In with the New</i>	90
<i>Do You %TRIM?</i>	91
Easily Find and Replace Text in Strings with BIFs	92
<i>Making the “Modern” Approach More Dynamic with %SCAN</i>	93
<i>Improving It with %REPLACE</i>	94
<i>The Good and Bad News About %SCANRPL</i>	96
Time to Build a Few BIFed Up Functions!	98
<i>My Method for Building Procedures and Functions</i>	98
<i>Demonstrating the Methodology with a Few Functions</i>	99
<i>Building Excel-like String-Handling Functions</i>	106
<i>The LEFT Function</i>	107

<i>RIGHT Is Next</i>	109
<i>Building the Chg_Case Function</i>	111
<i>The Tricky Case of Proper Case</i>	115
Using BIFs to Perform Date Operations	118
<i>A Simple Problem: Calculating the Last Day of the Month</i>	119
<i>Introducing the %DATE BIF</i>	119
<i>The LastDayOfMonth Function</i>	121
<i>The %DIFF BIF: A Swiss Army Knife of Date Calculations</i>	123
<i>The Clc_DayOfWeek Function</i>	124
<i>The Rtv_DayOfWeek Function</i>	126
<i>Testing the Date-Related Functions</i>	128
Using BIFs to Perform Time Operations.....	129
<i>Do You Know How Long You Have to Work Until the Weekend?</i>	130
This Chapter Doesn't Have a Summary	135
Chapter 7: Code Organization Strategies	137
When the Name Says It All: the Importance of Naming Conventions	137
<i>Naming Variables, Part 1: Prefixes</i>	138
<i>Naming Variables, Part 2: Proper Names</i>	143
<i>Naming Procedures and Functions</i>	144
<i>Naming Modules</i>	145
<i>Naming Conventions for Physical and Logical Files</i>	146
<i>Using Prefixes as a Workaround for Duplicated Field Names in Multiple Files</i>	147
Commenting and Documenting Strategies for Better Code.....	149
<i>Documenting Procedures and Functions</i>	149
<i>Comment First, Code Later!</i>	150
<i>Documenting for the Lazy, I Mean Busy, Programmer</i>	151
<i>Defining Your Documentation Strategy</i>	152
Code Organization	152
<i>How to Organize Your Service Programs</i>	153
<i>Binding Directory Organization</i>	154
Summary	156
Chapter 8: /FREE Your Code!	157
Free-Format Pros and Cons.....	157

It's /FREE, But It Has Rules	159
What the Most-Used Operation Codes Look Like in Free Format	160
Converting Fixed-Format Code to Free-Format	166
The Operation Codes Free Format Left Behind	167
<i>The Quick Wins</i>	167
<i>Moving Toward a More Structured Programming Syntax</i>	168
<i>Operation Codes That Became BIFs</i>	169
<i>Other Operation Codes (Kind of) Replaced by BIFs</i>	169
<i>Replacing COMP and CASXX</i>	170
<i>Goodbye Spaghetti Code: No More CABXX, TAG, and GOTOs</i>	171
<i>Array-Related Operation Codes</i>	172
Summary	176
Chapter 9: No More ISDB Nightmares: Meet the New ILE Debugger	181
The Interactive Source Debugger Versus the ILE Debugger	181
Getting to Know the Different Debugging Views	182
Choosing the Right View for You	188
Encrypting Your Debugging Views	189
Starting a Debug Session	190
Navigating in the Debug Session	193
The Actual Debug Process: Working with Breakpoints	196
The Actual Debug Process: Working with Watch Conditions	198
A Step-by-Step Debug Session	201
Debugging Service Programs	206
Using the ILE Debugger on OPM RPG and CL Programs	207
Debugging Batch Jobs	207
Summary	209
Chapter 10: The Latest and Greatest News for RPG	211
Free Your Code, from the First Line: the New H-specs	211
Free-Format File Definitions	213
Finally, Data Definitions in RPG Look “Modern”!	216
<i>Make Your Variable Definitions Crystal-Clear</i>	216
<i>A New Way to Define Constants—and New Uses for Them</i>	220
<i>Simplifying the Data Structure Definition</i>	222

<i>What You Need to Know About the New Procedure Definitions</i>	222
<i>One Additional Example: Converting a Function Header to Full Free Format</i>	224
Fully Free-Format Code	226
Summary	227
Chapter 11: SQL in a Nutshell	229
What Is SQL?	229
A Concise Introduction to Data Manipulation Language	232
<i>The Simplicity and Flexibility of the SELECT Statement</i>	232
<i>Adding New Rows with INSERT</i>	240
<i>“Massaging” Data with UPDATE</i>	242
<i>Try Not to Do (Too Much) Damage with DELETE</i>	244
SQL’s Column Functions: Adding Flexibility and Awesome Power to Your SQL Statements	245
<i>Aggregate Functions</i>	245
<i>Scalar Functions</i>	248
Tools at Your Disposal to Execute SQL Statements	270
Embedding SQL in Your RPG Code	279
<i>How to Embed SQL Code in Fixed-Format RPG</i>	280
<i>How to Embed SQL Code in Free-Format RPG</i>	281
<i>How to Get RPG and SQL to Talk to One Another in Your Programs</i>	281
<i>How to Compile SQL-Infused RPG Code</i>	285
<i>Your First Embedded SQL Function</i>	286
<i>Using SQL Cursors to Replace Record-Level Data Access</i>	289
<i>Replacing the Dreaded OPNQRYF with an SQL Cursor</i>	292
<i>Ultra-Flexible Cursors: the Beauty of PREPARE</i>	294
<i>Other Embedded SQL Statements</i>	296
Flipping It: Using RPG Code in SQL	299
<i>Using ILE RPG Programs and Procedures as SQL SPs</i>	300
<i>Using ILE RPG Functions as SQL UDFs</i>	303
A DDL Hands-on Tour	307
<i>Providing a Parent for Your SQL Objects: Creating a Schema</i>	308
<i>Tables: Luxury Yachts for Your Data</i>	310
<i>Taking in the View</i>	318

<i>Using an Index to Improve Database Performance</i>	320
<i>OVRDBF Made Simple, Practical, and Permanent: the ALIAS SQL Instruction</i>	322
<i>SQL's Way to Delete Things: Drop Them</i>	322
<i>Simplifying Application Development with SQL Triggers</i>	323
Summary	330

**PART 3: BEYOND ILE—
START MODERNIZING YOUR APPLICATIONS 335**

Chapter 12: Modernizing Your Applications: Why, What, Where, and How ... 337

A Fuzzy Buzzword.....	337
Why You Should Give Modernization a Shot	338
Modernization Eye Candy.....	338
Restructuring the Database	339
The Big Question You Should Ask Yourself Before Starting a Modernization Process.....	341
The Benefits of Modernization for You, Your Boss, and Your Company	343
Tips to Avoid the Pains of Modernization	345
Setting Your Modernization Goals	347
Summary	354

Chapter 13: Database Modernization 357

A Bit of Database Theory.....	357
<i>Conceptual, Logical, and Physical Models</i>	358
<i>Database Normalization</i>	358
<i>Entity Relationship Diagram</i>	359
Tools to Help the Modernization Process.....	363
<i>IBM Data Studio</i>	363
<i>IBM InfoSphere Data Architect</i>	364
<i>Adsero Optima Foundation</i>	365
Database Modernization Methodology	365
Step One: Convert DDS Files to DDL Objects	366
<i>Discover and List Existing Files</i>	367

<i>Figure Out and Map Implicit Relationships Between Files</i>	367
<i>Start Preparing to Tidy Up Your Database</i>	368
<i>Converting DDS to DDL</i>	369
<i>Normalizing the Database</i>	371
Step Two: Move Business Rules to the Database	372
<i>Putting Database Validation in the Database</i>	372
Step Three: Take Advantage of DB2's Advanced Functionalities	386
Summary	391
Chapter 14: UI Modernization and the MVC Concept	393
Why Separate the UI Code from the Rest?	393
Building Your Programs the Modern Way	394
<i>A Simple Multi-Tier Architecture Implementation</i>	396
<i>A More Realistic Multi-Tier Architecture Implementation</i>	398
<i>Good, But Not Enough—Introducing MVC</i>	399
<i>The Model Layer</i>	401
<i>The Controller Layer</i>	403
<i>The View Layer</i>	404
<i>Reengineering an ILE Program Using the MVC Design Pattern</i>	404
RPG Open Access: UI Modernization Made Easy	405
<i>Tools to Modernize the UI Using RPG OA</i>	406
Summary	407
Where to Go from Here	408
Index	409