

CONTENTS IN DETAIL

FOREWORD FOR THE FIRST EDITION by Ralf Wildenhues	xix
FOREWORD FOR THE SECOND EDITION by Eric Blake	xxi
PREFACE	xxiii
Why Use the Autotools?	xxiv
Acknowledgments for the First Edition	xxvi
Acknowledgments for the Second Edition	xxvi
I Wish You the Very Best.	xxvi
INTRODUCTION	xxvii
Who Should Read This Book	xxviii
How This Book Is Organized	xxviii
Conventions Used in This Book	xxx
Autotools Versions Used in This Book	xxxi
1 AN END USER'S PERSPECTIVE ON THE GNU AUTOTOOLS	1
Software Source Archives	2
Unpacking a Source Archive	3
Building the Software	4
Testing the Build.	7
Installing the Built Software	9
Summary	11
2 A BRIEF INTRODUCTION TO THE GNU AUTOTOOLS	13
Who Should Use the Autotools?	14
When Should You Not Use the Autotools?	14
Apple Platforms and Mac OS X	15
The Choice of Language	16
Generating Your Package Build System	17
Configuration	18
Autoconf	18
autoreconf	19
autoheader	20
autoscan	20
autoupdate	20
ifnames	21
autom4te	21
Working Together	21

Automake	22
automake	23
aclocal	23
Libtool	24
libtool	25
libtoolize	25
ltdl, the Libtool C API	25
Building Your Package	26
Running configure	26
Running make	29
Installing the Most Up-to-Date Autotools	30
Summary	33

3 UNDERSTANDING THE GNU CODING STANDARDS 35

Creating a New Project Directory Structure	36
Project Structure	37
Makefile Basics	39
Rules	39
Variables	41
A Separate Shell for Each Command	42
Variable Binding	43
Rules in Detail	44
Resources for Makefile Authors	50
Creating a Source Distribution Archive	50
Forcing a Rule to Run	52
Leading Control Characters	53
Automatically Testing a Distribution	54
Unit Testing, Anyone?	55
Installing Products	56
Installation Choices	58
Uninstalling a Package	60
Testing Install and Uninstall	61
The Filesystem Hierarchy Standard	63
Supporting Standard Targets and Variables	64
Standard Targets	64
Standard Variables	65
Adding Location Variables to Jupiter	66
Getting Your Project into a Linux Distro	67
Build vs. Installation Prefix Overrides	69
User Variables	71
Nonrecursive Build Systems	73
Configuring Your Package	77
Summary	78

4 CONFIGURING YOUR PROJECT WITH AUTOCONF 79

Autoconf Configuration Scripts	80
The Shortest <code>configure.ac</code> File	82
Comparing M4 to the C Preprocessor	82

The Nature of M4 Macros	83
Executing autoconf	84
Executing configure	85
Executing config.status	86
Adding Some Real Functionality	87
Generating Files from Templates	90
Adding VPATH Build Functionality	91
Let's Take a Breather	94
An Even Quicker Start with autoscan	95
The Proverbial bootstrap.sh Script	97
Updating Makefile.in	99
Initialization and Package Information	100
AC_PREREQ	100
AC_INIT	100
AC_CONFIG_SRCDIR	101
The Instantiating Macros	102
Generating Header Files from Templates	107
Using autoheader to Generate an Include File Template	108
Back to Remote Builds for a Moment	111
Summary	112

5 MORE FUN WITH AUTOCONF: CONFIGURING USER OPTIONS 113

Substitutions and Definitions	114
AC_SUBST	114
AC_DEFINE	115
Checking for Compilers	116
Checking for Other Programs	117
A Common Problem with Autoconf	119
Checks for Libraries and Header Files	123
Is It Right or Just Good Enough?	126
Printing Messages	131
Supporting Optional Features and Packages	132
Coding Up the Feature Option	134
Formatting Help Strings	137
Checks for Type and Structure Definitions	138
The AC_OUTPUT Macro	141
Summary	143

6 AUTOMATIC MAKEFILES WITH AUTOMAKE 145

Getting Down to Business	146
Enabling Automake in configure.ac	147
A Hidden Benefit: Automatic Dependency Tracking	151
What's Actually in a Makefile.am File?	153
Analyzing Our New Build System	154
Product List Variables	155
Product Source Variables	160
PLV and PSV Modifiers	161

Unit Tests: Supporting make check	162
Reducing Complexity with Convenience Libraries	164
Product Option Variables	167
Per-Makefile Option Variables	169
Building the New Library	169
What Goes into a Distribution?	171
Maintainer Mode	172
Cutting Through the Noise	173
Nonrecursive Automake	175
Summary	177

7 BUILDING LIBRARIES WITH LIBTOOL 179

The Benefits of Shared Libraries	180
How Shared Libraries Work	181
Dynamic Linking at Load Time	181
Using Libtool	185
Abstracting the Build Process	185
Abstraction at Runtime	186
Installing Libtool	187
Adding Shared Libraries to Jupiter	188
Using the LTLIBRARIES Primary	188
Public Include Directories	189
Customizing Libtool with LT_INIT Options	192
Reconfigure and Build	197
So What Is PIC, Anyway?	200
Fixing the Jupiter PIC Problem	203
Summary	207

8 LIBRARY INTERFACE VERSIONING AND RUNTIME DYNAMIC LINKING 209

System-Specific Versioning	210
Linux and Solaris Library Versioning	210
IBM AIX Library Versioning	212
Microsoft DLL Versioning	214
HP-UX/AT&T SVR4 Library Versioning	215
The Libtool Library Versioning Scheme	216
Library Versioning Is Interface Versioning	216
When Library Versioning Just Isn't Enough	220
Using libltdl	221
Necessary Infrastructure	221
Adding a Plug-In Interface	222
Doing It the Old-Fashioned Way	223
Converting to Libtool's ItdL Library	228
Preloading Multiple Modules	232
Checking It All Out	233
Summary	234

UNIT AND INTEGRATION TESTING WITH AUTOTEST

235

Autotest Overview	238
Wiring Up Autotest	241
Adding a Test	248
Defining Tests with AT_CHECK	250
Defining Test Groups with AT_SETUP and AT_CLEANUP	251
So What Happened?	255
Unit Testing vs. Integration Testing	257
Administrative Details	261
Distributing Test Files	261
Checking Installed Products	262
Cleaning Up	266
Niceties	267
A Minimal Approach	268
Summary	268

FINDING BUILD DEPENDENCIES WITH PKG-CONFIG

271

A pkg-config Overview	272
Diving In	274
Writing pkg-config Metadata Files	276
Informational Fields	278
Functional Fields	279
Generating .pc Files with Autoconf	282
Generating pc Files from pc.in Templates	282
Generating .pc Files with make	283
Uninstalled .pc Files	285
Using pkg-config in configure.ac	287
pkg-config Autoconf Macros	290
Summary	292

INTERNATIONALIZATION

293

Obligatory Disclaimer	294
Internationalization (I18n)	295
Instrumenting Source Code for Dynamic Messages	296
Instrumenting Source Code for Static Messages	325
Summary	329

LOCALIZATION

331

Getting Started	331
Language Selection	332
Building Message Catalogs	334

Integrating gettext with the Autotools	339
What Should Be Committed?	348
Adding a Language	349
Installing Language Files	350
Manual make Targets	351
Summary	352

13 MAXIMUM PORTABILITY WITH GNULIB 353

License Caveat	354
Getting Started	354
Adding Gnulib Modules to a Project	355
Summary	365

14 FLAIM: AN AUTOTOOLS EXAMPLE 367

What Is FLAIM?	368
Why FLAIM?	368
Logistics	369
An Initial Look	370
Getting Started	372
Adding the configure.ac Files	372
The Top-Level Makefile.am File	376
The FLAIM Subprojects	378
The FLAIM Toolkit configure.ac File	379
The FLAIM Toolkit Makefile.am File	388
Designing the ftk/src/Makefile.am File	391
Moving On to the ftk/util Directory	393
Designing the XFLAIM Build System	394
The XFLAIM configure.ac File	394
Creating the xflaim/src/Makefile.am File	398
Turning to the xflaim/util Directory	399
Summary	405

15 FLAIM PART II: PUSHING THE ENVELOPE 407

Building Java Sources Using the Autotools	408
Autotools Java Support	408
Using ac-archive Macros	411
Canonical System Information	412
The xflaim/java Directory Structure	413
The xflaim/src/Makefile.am File	414
Building the JNI C++ Sources	415
The Java Wrapper Classes and JNI Headers	416
A Caveat About Using the JAVA Primary	418

Building the C# Sources	418
Manual Installation	421
Cleaning Up Again	422
Configuring Compiler Options	422
Hooking Doxygen into the Build Process	424
Adding Nonstandard Targets	426
Summary	429

16 USING THE M4 MACRO PROCESSOR WITH AUTOCONF 431

M4 Text Processing	432
Defining Macros	433
Macros with Arguments	435
The Recursive Nature of M4	436
Infinite Recursion	438
Quoting Rules	438
Autoconf and M4	439
Writing Autoconf Macros	441
Simple Text Replacement	441
Documenting Your Macros	444
M4 Conditionals	445
Diagnosing Problems	449
Summary	450

17 USING THE AUTOTOOLS WITH WINDOWS 451

Environment Options	452
Tool Chain Options	452
Getting Started	453
Cross-Compiling for Windows on Linux	454
Installing a Windows Cross Tool Chain	454
Testing the Build	455
Windows Subsystem for Linux	460
Cygwin	462
Installing Cygwin	464
Opening the Cygwin Terminal	470
Testing the Build	471
Building True Native Windows Software	474
Analyzing the Software	476
MinGW: Minimalist GNU for Windows	477
Installing MinGW	478
Testing the Build	485
Msys2	487
What's Msys?	488
Installing Msys2	488
Installing Tools	493
Testing the Build	495
Summary	497

**A CATALOG OF TIPS AND REUSABLE SOLUTIONS
FOR CREATING GREAT PROJECTS****499**

Item 1: Keeping Private Details out of Public Interfaces	499
Solutions in C	501
Solutions in C++	502
Item 2: Implementing Recursive Extension Targets	505
Item 3: Using a Repository Revision Number in a Package Version	508
Item 4: Ensuring Your Distribution Packages Are Clean	510
Item 5: Hacking Autoconf Macros	511
Providing Library-Specific Autoconf Macros	516
Item 6: Cross-Compiling	517
Item 7: Emulating Autoconf Text Replacement Techniques	523
Item 8: Using the Autoconf Archive Project	528
Item 9: Using Incremental Installation Techniques	529
Item 10: Using Generated Source Code	529
Using the BUILT_SOURCES Variable	529
Dependency Management	530
Built Sources Done Right	533
Item 11: Disabling Undesirable Targets	536
Item 12: Watch Those Tab Characters!	537
Item 13: Packaging Choices	539
Wrapping Up	540

INDEX**541**