



PATTERNS-BASED ENGINEERING

SUCCESSFULLY DELIVERING
SOLUTIONS VIA PATTERNS

FOREWORD BY GRADY BOOCH, IBM FELLOW

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Patterns-Based Engineering

*Successfully Delivering Solutions
via Patterns*

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Library of Congress Cataloging-in-Publication Data

Ackerman, Lee, 1971–

Patterns-based engineering : successfully delivering solutions via patterns / Lee Ackerman, Celso Gonzalez.
p. cm.

Includes bibliographical references and index.

ISBN 978-0-321-57428-2 (hardcover : alk. paper) 1. Computer software—Development. 2. Software patterns. I. Gonzalez, Celso, 1969– II. Title.

QA76.76.D47A255, 2010
005.1—dc22

2010013630

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501 Boylston Street, Suite 900
Boston, MA 02116
Fax: (617) 671-3447

ISBN-13: 978-0-321-57428-2

ISBN-10: 0-321-57428-1

Text printed in the United States on recycled paper at Courier in Westford, Massachusetts.

First printing, June 2010

Praise for *Patterns-Based Engineering*

“This book introduces a new and important idea, providing a rigorous approach to Patterns-Based Engineering. As the number of published patterns has increased, understanding how to apply them across all parts of the software development life-cycle has become critically important.”

—Kyle Brown, Distinguished Engineer, IBM Software Group,
Author of *Persistence in the Enterprise*

“To misquote Confucius, ‘Give a man a solution and you solve his problem for a day. Teach a man a pattern and you’ve solved his problems for a lifetime.’ The guidance provided by Lee and Celso in this book should help solve many lifetimes’ worth of software development problems. The book’s combination of solid theory coupled with practical implementation makes for an essential reference if you ever plan on trying the benefits of Patterns-Based Engineering. Well done guys!”

—Gregory Hodgkinson, Practice Director for the
Lifecycle Tools and Methodology Practice at Prolifics

“Ever since the GOF patterns book, software design patterns have been a great way to codify best practices to solve specific problems. *Patterns-Based Engineering* gives practical advice on how to manage design patterns for your organization and codify your best practices.”

—Dave Hendricksen, Software Architect, Thomson-Reuters

“Ackerman and Gonzalez have provided a well-written book, which describes a process that at a minimum can be used by any software development organization. The authors provide valuable case studies, detailed analysis, and the required governance to define new patterns or fully utilize the patterns already existing within an organization. As software professionals, we recognize the necessity and advantages for the usage of patterns; PBE provides a framework to dramatically enhance the productivity and reusability of those patterns within our projects.”

—Davie Sweis, IT Manager, North America and
Worldwide Solutions Architect, Robert Bosch LLC

Patterns-Based Engineering

*To Shawna, Katie, Hannah, and Aidan
No matter the distance, no matter the destination,
I cherish our journey.
—Lee Ackerman*

*A Chantal, Jordan, Duncan, Gwendolyn, et Gabriel
Vous avoir dans ma vie me rend meilleur.
—Celso Gonzalez*

Foreword

Developing, deploying, operating, and evolving software-intensive systems are problems of engineering: One must devise a solution that reasonably balances the forces upon that system. Every individual system faces its own unique set of forces, and thus every system presents a unique engineering problem. Nonetheless, these are not all problems of singularity: Over time, common solutions to common problems emerge, and these become part of the institutional memory of that system space. Insofar as we can make those patterns manifest, we can improve the manner in which we develop, deploy, operate, and evolve systems. Indeed, this too is the nature of engineering: For every new system, we look back on things that didn't work (and try alternatives) as well as things that did (and improve them).

Lee and Celso have considerable industrial experience in delivering software-intensive systems, and in this book they bring the best practices they have learned to the problem of engineering software-intensive systems. If you are unfamiliar with the nature of patterns, this book will help you understand how to discover, design, create, package, and consume these common solutions to common problems. Their extended case study demonstrates how to pragmatically apply these ideas; their guidelines offer patterns and antipatterns for engineering systems using patterns. Finally, Lee and Celso attend to the softer issues of Patterns-Based Engineering: its value, its risks, and its economic return.

As software-intensive systems continue to grow in complexity and in their importance to the world, it is our responsibility as software engineers to deliver systems of quality. Lee and Celso's work will help you along that path.

—*Grady Booch*
IBM Fellow
February 1, 2010

Preface

Increasing and unending pressure exists in software development to finish more quickly, to produce higher-quality solutions, and to do so with fewer resources. We can use patterns, proven best-practice solutions to known problems, as a powerful tool to help address these challenges. However, if the answer were as simple as “Just use patterns,” we would already have dealt with these challenges.

There is complexity, depth, and nuance to using patterns, and succeeding with them requires knowledge, expertise, and guidance. And not only do we want to succeed with patterns, we want to do so in a fashion that is scalable, repeatable, and predictable. This book introduces an approach known as Patterns-Based Engineering (PBE) that provides guidance on how to successfully incorporate and leverage patterns in software development. We don’t just use patterns; we think, evaluate, create, innovate, collaborate, abstract, simplify, justify, automate, and reuse.

Patterns-Based Engineering

PBE is a specialized approach to asset-based development that focuses on patterns, a specific type of reusable asset. PBE provides guidance and support for using patterns in a systematic, disciplined, and quantifiable way. With PBE an organization uses patterns in multiple forms, for numerous purposes, and in a number of ways. More specifically, we look at two specific types of patterns: pattern specifications and pattern implementations. We use these types of patterns to support design, testing, deployment, and other aspects of the software development lifecycle. In performing these tasks, we use patterns in many ways such as documenting, generating, refactoring, and harvesting. As a result, we are able to use patterns to boost productivity, improve quality, leverage expertise, simplify, and improve communication within an organization. The goal is to ensure that as we use and create patterns, we are doing so in a way that adds value and boosts the agility of our projects and organization.

An important aspect of PBE is that it goes beyond just the technology. Success on a project has never been and will never be just about the technology. We need to ensure that the team is able to work together; that we all know the roles we are to play, the tasks to be done, the work products to create along the way; and that we can communicate with one another.

How to Read This Book

This section starts with an overview of the book's structure. We then provide a guide to reading the book based on role, and we finish with suggestions for the background needed to get the most out of the book and a list of learning objectives.

Book Structure

This book is divided into four parts. Part I provides an introduction to PBE. Within this part, Chapter 1 starts by defining PBE and Chapter 2 follows by providing some examples of pattern implementations, as this is a new concept for most and is an important aspect of PBE. Chapters 3 through 7 then show an example of PBE in action through a case study. Chapter 8 concludes Part I with a discussion of the process aspects of PBE and how it could fit into existing software development processes, including coverage of Extreme Programming, Scrum, and OpenUP.

Part II describes some of the best practices related to PBE in the form of patterns and guidelines. Chapter 9 explains the organization and summarizes each of the patterns and guidelines. Chapters 10 through 16 detail the patterns and guidelines, each chapter focusing on a specific category.

Part III covers additional topics that provide a deeper examination of PBE, particularly the nontechnical aspects. We detail some of the PBE benefits in Chapter 17, move to the economic aspects of PBE in Chapter 18, and finish Part III with Chapter 19, which takes a look at some of the PBE misconceptions that may be faced in rolling out PBE within an organization.

Part IV wraps up the book with a set of appendices that provide supporting materials and references. Appendix A summarizes the main PBE definitions to provide quick access to some of the terms and concepts used throughout the book. Appendix B takes a look at PBE in comparison to other software development approaches. Appendix C provides a nonexhaustive list of tools available to help in applying PBE within an organization. Appendix D provides a set of PBE Patterns and Guidelines overview diagrams. Appendix E provides the pattern specification for the Subsystem Façade pattern created and used in the case study. Appendix F serves as a companion to Chapter 8, adding more details to support our understanding of the PBE Practice.

To get a high-level understanding of PBE, read all of Part I and Chapter 9 from Part II, which provides a high-level summary of the PBE Patterns and Guidelines.

For a deeper understanding of PBE you should go at least once through the PBE Patterns and Guidelines to get a better idea of what problems they address and the associated solutions. And if you are interested in some of the nontechnical aspects of PBE, Part III is a must read.

Who Should Read This Book

Patterns surface and are applicable throughout the development lifecycle and for multiple purposes. Thus, there is a wide audience for this book, including

- Software architects, designers, and developers: Read all parts.
- Project managers: Read Part I, at least Chapter 1, and Part III.
- Process engineers: Read all parts with a focus on Chapter 8 and Appendix F.
- Analysts, including those responsible for testing, requirements, and business: Read Part I, at least Chapter 1.

Suggested Background

To get the most from this book, we suggest that you have basic familiarity with the following topics:

- Object-oriented programming with a language such as Java or C#
- Patterns
- Unified Modeling Language (UML)
- XML

Learning Objectives

Upon completion of the book, you will be able to

- Describe ways in which patterns can be leveraged in delivering software
- Describe the roles, tasks, work products, and best practices defined within PBE
- Describe the factors that help decision making about investments driven by PBE as well as the expected implications of such decisions
- Describe the value and purpose of using patterns (implementations and specifications)
- Successfully identify, specify, and implement patterns
- Understand that patterns are for all roles and projects

Why This Book?

So, why this book? Why does the world need another patterns book? Aren't there enough already? One way to answer these questions is to say that we do not like solving the same problems over and over again. As a matter of fact, we struggle a bit dealing with the mechanical and mundane aspects of writing software. We are big fans of trying to be creative and solving new and unique problems. And we like to leverage automation to help us minimize and avoid having to work on those mechanical and mundane tasks.

Another way to answer these questions is that it's not enough to be passionate. It's not enough to be creative. It's not enough to use tooling and automation. There's already content in many forms—books, courses, and articles—that touches upon these topics. However, we were not able to find content that brings these ideas together. A holistic approach is needed to discuss how we can use patterns more strategically, more systematically. We need to be able to scale the use of patterns across the organization and ensure predictability and repeatability in our pattern-infused projects.

Downloadable Content

There are three downloads associated with this book, available from www.PatternsBasedEngineering.net. These downloads include

- Source artifacts for the pattern implementation that is discussed in the case study
- The source plug-in for a PBE Practice to be used with Eclipse Process Framework Composer
- A published configuration of the PBE Practice composed of a set of HTML pages that can be viewed with a standard web browser

Writing Style

Software development is a team sport; we present the rest of the book as a team effort. We are in this together, having a chat about how we can better leverage patterns in our projects.

Acknowledgments

There is no way that this book would have been completed without contributions from many people. With immense gratitude we would like to offer our appreciation to those who have supported us in this journey and provided suggestions, discussions, and questions that have helped to shape our efforts:

- Our reviewers via Addison-Wesley: Brian Foote, Dave Hendricksen, Peter Kovari, Davie Sweis, and Rebecca Wirfs-Brock
- The many folks from within IBM who have taken the time to help us: Jonathan Adams, Dan Berg, Andy Berner, Craig Branham, Alan Brown, Kyle Brown, Peter Coldicott, Jim Conallen, Dino D'Agostino, Dwayne Dreakford, Todd Dunning, Peter Eeles, Paul Elder, Jeff Fischer, Chris Gerken, Geoffrey Hambrick, Michael Hartmann, Michael Holmes, Derek Holt, James Jamison, Claus Jensen, Eoin Lane, Grant Larsen, Jean-Michel Lemieux, Dan Leroux, Bertrand Portier, Valerio Rosati, Jim Ruehlin, Guenter Sauter, Scott Schneider, Ralph Schoon, Darrell Schrag, James Siddle, Bill Smith, Jason Smith, Doug Stewart, Nansi Stretcher, Cindy VanEpps, Paul Verschueren, Janette Wong
- Our colleagues from across the industry who have shared their experiences and expertise: Regis Coqueret, Johan den Haan, David Dossot, Jonathan Harclerlode, Greg Hodgkinson, Darcy Jouan, Peter Kovari, Randy Lexvold, Mark Lines, Michael Sikorsky, Michael Wahler
- Our team at Addison-Wesley who have helped to guide this project from proposal through to completion: Raina Chrobak, Chris Guzikowski, Laurie McGuire, Anna Popick, and Barbara Wood
- And a special thank you to Grady Booch for his input, comments, and, of course, the Foreword

About the Authors

Combined, Lee and Celso have been working in the software industry for close to 30 years. During that time they have worked in development, services, and enablement organizations. Along the way they have used patterns in their projects and resulting solutions.

More recently, they've been building out PBE within IBM. During this time they have delivered enablement sessions, built courses, delivered conference presentations and workshops, written articles and Redbooks, participated in pattern-related studies, supported governance efforts, and contributed to IBM software products. In these efforts they have created patterns, used patterns, and helped others to use and build patterns.

Most of their PBE efforts have involved the use of IBM products such as IBM Rational Software Architect, Rational Application Developer, Rational Method Composer, and Rational Asset Manager. Because patterns are based on experience, the examples discussed use IBM Rational tools. However, the majority of the concepts, ideas, and guidance presented are applicable to tools provided by multiple vendors and the open-source community. Appendix B and Appendix C relate PBE to other approaches and provide tooling options.



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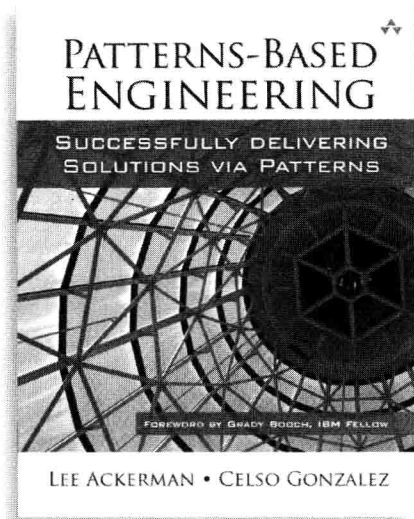
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