国外优秀信息科学与技术系列教学用书

基于项目的软件工程

——面向对象方法

（影印版）

PROJECT-BASED SOFTWARE ENGINEERING

An Object-Oriented Approach

■ Evelyn Stiller
Cathie LeBlanc

高等教育出版社
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出 版 说 明

20 世纪末，以计算机和通信技术为代表的信息科学和技术对世界经济、科技、军事、教育和文化等产生了深刻影响。信息科学技术的迅速普及和应用，带动了世界范围信息产业的蓬勃发展，为许多国家带来了丰厚的回报。

进入 21 世纪，尤其随着我国加入 WTO，信息产业的国际竞争将更加激烈。我国信息产业虽然在 20 世纪末取得了迅猛发展，但与发达国家相比，甚至与印度、爱尔兰等国家相比，还有很大差距。国家信息化的发展速度和信息产业的国际竞争能力，最终都将取决于信息科学技术人才的质量和数量。引进国外信息科学和技术优秀教材，在有条件的学校推动开展英语授课或双语教学，是教育部为加快培养大批高质量的信息技术人才采取的一项重要举措。

为此，教育部要求由高等教育出版社首先开展信息科学和技术教材的引进试点工作。同时提出了两点要求，一是要高水平，二是要低价格。在高等教育出版社和信息科学技术引进教材专家组的努力下，经过比较短的时间，第一批由教育部高等教育司推荐的 20 多种引进教材已经陆续出版。这套教材出版后受到了广泛的好评，其中有不少是世界信息科学技术领域著名专家、教授的经典之作和反映信息科学技术最新进展的优秀作品，代表了目前世界信息科学技术教育的一流水平，而且价格也是最优惠的，与国内同类自编教材相当。这套教材基本覆盖了计算机科学与技术专业的课程体系，体现了权威性、系统性、先进性和经济性等特点。

目前，教育部正在全国 35 所高校推动示范性软件学院的建设，这也是加快培养信息科学技术人才的重要举措之一。为配合软件学院的教学工作，结合各软件学院的教学计划和课程设置，高等教育出版社近期聘请有关专家和软件学院的教师遴选推荐了一批相应的原版教学用书，正陆续组织出版，以方便各软件学院开展双语教学。

我们希望这些教学用书的引进出版，对于提高我国高等学校信息科学技术的教学水平，缩小与国际先进水平的差距，加快培养一大批具有国际竞争力的高质量信息技术人才，起到积极的推动作用。同时我们也欢迎广大教师和专家们对我们的教材引进工作提出宝贵的意见和建议。联系方式：hep.cs@263.net。

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二〇〇二年九月

Preface

In teaching software engineering, experience has shown us that students are not convinced of the benefits of using software engineering techniques until they experience the benefits themselves. Completing a semester-long project is the most effective way of convincing students that software engineering is critical to their professional development. The software engineering course offered at Plymouth State College is therefore a very practical, hands-on course focused on the development of object-oriented software. Through the years, however, we became frustrated with the lack of textbooks appropriate for such a course. The majority of the available texts focus on the theoretical aspects of software engineering at the expense of its practical aspects. The texts that are project-based do not focus on the object-oriented paradigm. We wrote this textbook to fill this market gap.

This textbook focuses on actually performing software engineering. Theoretical concepts and terminology are introduced when they are necessary for successful software development. Although we recognize that there are a very large number of ways to develop software, we focus on a particular object-oriented software development methodology applied to a class project.

Having students engage in this semester-long team project also allows them to experience professional collaboration, which they seem to enjoy. Selecting an appropriate project is the most critical and most difficult aspect of teaching a project-based software engineering course. The project must be complex enough to engage a software development team of three to five students and yet be readily completed in fifteen weeks. More challenging than achieving proper scope is finding a project that interests and excites the students. To this end, we have provided a class project in the text. This project has been tested by Plymouth State College students and was successfully and enthusiastically implemented by a team of four students with varying programming and analytical skills.

This text is targeted to undergraduate computer science majors with little or no theoretical computer science in their background. The text is also written in a manner that is as programming language independent as possible. When language details are unavoidable, we have chosen Java as the programming language. We do not mean this text to be a reference manual of software engineering techniques and procedures. Instead, we provide a particular development methodology that will allow the completion of a significant software project over the course of a fifteen-week semester.

Since we assume the students will complete a project over the course of the semester, we have included the semester schedule for our course in Chapter 2. This schedule allows the project to begin swiftly at the start of the semester. Because we want students to experience as much of the software development methodology as possible, certain topics receive a less than comprehensive treatment. In particular, eliciting functional requirements from discussions with nontechnical users is a difficult task that requires much experience to accomplish successfully. Thus, we have presumed that the requirements will have been nearly completed by the instructor prior to the beginning of the semester.

To reinforce the practicality of the text, we also provide two running case studies. These are presented in a manner that models the development of the semester-long project. Sample deliverables are presented as part of the case studies to give students examples of the types of materials they are expected to deliver during the life cycle of their project.

Another important characteristic of this text is that it focuses on the object-oriented software development paradigm almost exclusively. Although we see the object-oriented approach as a logical extension of previous industry-adopted paradigms, this text is structured for an object-oriented project conceptualization, analysis, design, and implementation. A historical overview of software engineering techniques is presented to introduce students to the precursors to the object-oriented paradigm.

Although the long-enduring software crisis is not presented as the exclusive motivation for using software engineering techniques, a series of software development horror stories is included in the text so that students can see the results of ignoring various aspects of software engineering. Rather than addressing these stories as introductory material, they are included later in the text, so that there is less delay in getting to chapters needed to start the software engineering project.

In introducing the techniques that comprise the object-oriented paradigm, the Unified Modeling Language (UML) is used to model the software. Since UML is extremely large and intimidating, a subset of the notation is introduced on an "as-needed" basis. This book is not intended to serve as a comprehensive reference on UML. Many such references exist. Instead, UML is used as a tool in this text, much as it is used as a tool in the development of "real-world" software.

Pedagogical Features

- Each chapter begins with a list of important concepts that will be covered in the chapter.
- A class project that has been tested on our students runs throughout the text. The project is large enough for three to five students to complete over the course of a semester. Each chapter includes a set of activities that must be carried out in order to complete the class project. A specification of the deliverables for each part of the project is also included with the activities.
- Although the text includes a class project, the text is written so that an instructor can simply ignore the class project sections. If the instructor chooses to ignore the class project, a different project (or set of projects) can be substituted.
- Review questions are included at the end of each chapter. These exercises allow students additional practice with each of the topics covered in the book. They vary in complexity and difficulty.
- Exercises are included throughout each chapter. These exercises are most often presented as thought experiments and in most cases can be completed in class or out of class as deemed appropriate by the instructor.
- Unified Modeling Language is presented only when needed. When a particular modeling technique is needed for a particular step in the development methodology, the technique is described and examples are given. Through this approach, a subset of UML is presented.
- Two case studies run through the text. The first case study begins early in the text and is developed as the various steps in the methodology are presented. The second case study begins in Chapter 6, which acts as a review of the analysis and design phases of the development methodology. This second case study is then carried through the remainder of the text.
- Summary boxes are presented to allow a review of the development methodology at a quick glance.
- The chapters are organized so that students can realistically complete the class project in a single semester. For example, during the last four weeks of the class, while the students are engaged in coding and testing their projects and the topics of implementation and testing have already been covered, the text addresses topics such as project management, risk management, design patterns, and software development horror stories.
- Projects and schedules that have actually been tested in the classroom are included in the text.
- The last chapter of the text turns the tables on the students, requiring them to reflect on their experiences with the class project. It is entirely possible that the experience of some project development teams may be less successful than

others, so the discussion allows the students to review their course of action and suggest improvements. The final chapter guides students through a formal and professional presentation of their projects to the instructor and other classmates.

Supplements and Instructor Materials

Support materials are available to instructors adopting this textbook for classroom use and include the following:

- PowerPoint slides for each figure in the book
- PowerPoint lecture slides for each chapter
- Solutions for the *Questions for Review* sections
- Sample solutions or hints to spark discussion for the exercises embedded in each chapter
- A sample set of deliverables for the embedded class project
- Materials for two alternate class projects
- Source code for the Game2D case study.

Please check online information for this book at www.aw.com/cssupport for more information on obtaining these supplements.

In addition to these resources, we anticipate publishing a student supplement every two years that contains materials and exercises relevant for two different class projects.

Class Project

Instructors are encouraged to substitute their own projects, or an alternate project that has been provided as supplemental instructor material, for the specific class project included in the text. Each chapter that pertains to the development of the class project contains a section specifying class project-related goals and objectives. These sections have been written in a generic manner and should pertain to an alternate project as well as the project provided in the textbook.

There are a few sections of the book that address the included class project specifically. These sections have been included because the sample project serves as a particularly good example to illustrate a few of the design objectives discussed in the text. In order to understand these sections, students do not need to be familiar with the details of the included project, but rather simply need understand the idea of playing a multi-player game over the Internet. The examples address the sequence events comprising initiating such a multi-player game or making a board game-type move.

The following sections contain specific references to the class project:

- Section 1.10 contains the requirements specification. You may substitute an alternate project description here. This section should be skipped if an alternate project is being used.
- Section 2.2.2 illustrates a sample informal scenario, which can be easily understood by anyone familiar with common board games. We recommend using this example even if another class project is being used.
- Section 4.9 illustrates modeling the interprocess communication in the sample class project. This illustration can be easily understood by someone who is familiar with any multi-player, Internet-based game, so we recommend its use by those using an alternate class project.

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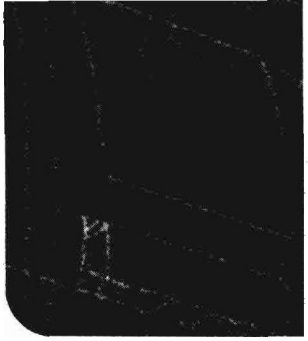

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