国外优秀信息科学与技术系列教学用书

Web 程序设计

（影印版）

PROGRAMMING THE WORLD WIDE WEB

■ Robert W. Sebesta

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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。

高等教育出版社

二〇〇二年九月

Preface

Overview

It is difficult to overestimate the effects the World Wide Web has had on the day-to-day lives of people, at least those in the developed countries. In just a few years, we have learned to use the Web for a myriad of disparate tasks, ranging from the mundane task of shopping for airline tickets to the crucial early morning gathering of business news for a high-stakes day trader.

The speed at which the hundreds of thousands of Web sites have appeared would seem to indicate that the technologies used to build them were sitting on the shelf, fully developed and ready to use, even before the Web was developed. Also, one might guess that the tens of thousands of people who built those sites were sitting around unemployed, waiting for an opportunity and already possessing the knowledge and abilities required to carry out this mammoth construction task when it appeared. Neither of these was true. The need for new technologies was quickly filled by a large number of entrepreneurs, some at existing companies and some who started new companies. A large part of the programmer need was filled, at least to the extent to which it has been filled, by new programmers, some straight from high school. Many, however, were previously employed by other sectors of the software development industry. All of them had to learn to use new languages and new software systems.

Until recently, programmers learned Web software technologies through company in-house training, a scattering of courses focused on one or the other Web technology at colleges and universities, or on their own. A trip to a local bookstore will turn up a large supply of books on these technologies aimed at the practicing professional. In the last couple of years college courses have begun to appear that attempt to cover a broad spectrum of Web programming technologies. One difficulty suffered by those teaching these courses is the lack

of a textbook that is targeted to their needs. Most of the books that discuss Web programming were written for professionals, rather than college students. Such books are typically written to fulfill the needs of professionals, which are quite different from those of college students. One major difference between an academic book and a professional book lies in the assumptions made by the author about the prior knowledge and experience of the audience. The backgrounds of professionals vary widely, making it difficult to assume much of anything. On the other hand, a book written for junior computer science majors can make some definite assumptions about the background of the reader. This book is written for those students.

The goal of this book is to provide the reader with a comprehensive introduction to the programming tools and skills required to build and maintain the server sites on the Web. A wide variety of technologies are used in the construction of a Web site. There are now many books, nearly all for professionals, available that focus on each of these technologies. For example, there are dozens of books that address only HTML. The same is true for a half-dozen other technologies. This book provides an overview of how the Web works, as well as descriptions of many of the most widely used Web technologies.

The manuscript of this book has been used to teach a junior-level Web programming course at the University of Colorado at Colorado Springs. In this course, Chapters 11 and 12 were covered only lightly and there was not time for students to use either in programming exercises. It takes a significant amount of time for students to learn Perl and JavaScript and their uses in Web programming, which turn out to be the meat of the course. Many students know some HTML before taking the course, so Chapter 2 can be covered quickly.

The most important prerequisite to the material of this book is a solid background in programming in some language that supports object-oriented programming. It is helpful to have some knowledge of a second programming language and a bit of UNIX, which helps with the Perl part of the course. Also, UNIX is still a popular platform choice for Web servers. Familiarity with a second language makes learning the new languages easier.

Table of Contents

We provide solid introductions to HTML, Perl, and JavaScript. In the cases of Perl and JavaScript, we first introduce the language and then discuss its use in Web programming. Java is now being used in the introductory programming sequence at many colleges and universities. This allows us to discuss Java applets without first introducing Java. For those institutions that do not use Java as the language vehicle for their introductory programming courses, we provide a quick introduction to Java in an appendix.

XML has now become an important addition to the collection of Web technologies. In recognition of this, we include an entire chapter on XML. Servlets are becoming widely used, justifying a chapter on them. Knowledge of databases and the ability to interact with them through the Web have become essential to the Web programmer. This book includes a chapter on database use through a Web server, focusing on the Java JDBC system.

Chapter 1 lays the groundwork for the rest of the book. A few fundamentals are introduced, including the history and nature of the Internet, the World Wide Web, browsers, servers, URLs, MIME types, and HTTP. Also included in Chapter 1 are brief overviews of the most important topics of the rest of the book.

Chapter 2 provides an introduction to HTML, including links, lists, tables, and forms. Small examples are used to illustrate the many HTML elements that are discussed in this chapter.

The topic of Chapter 3 is Cascading Style Sheets, which have quickly become the standard way of imposing style on the content specified in HTML tags. Because of the size and complexity of the topic, we do not cover all of the aspects of style sheets. The topics discussed are levels of style sheets, style specification formats, style classes, properties and property values, and color. Small examples are used to illustrate the subjects being discussed.

Chapter 4 introduces the characteristics and capabilities of Perl as a general-purpose programming language. Both before and since the arrival of the Web, the power and flexibility of Perl have been used on a variety of non-Web applications, including UNIX system administration and as the language for many of the small to medium size programming tasks formally done in C. For the most part, we limit our focus on Perl to those parts of the language that are needed for CGI programming. Control statements, arrays, hashes, references, functions, pattern matching, and file input and output are discussed.

Chapter 5 introduces the use of Perl for Common Gateway Interface (CGI) programming. Although there are now alternatives to CGI, it is still widely used, and when it is, it is most often done in Perl. CGI and CGI linkage are introduced first. Then the form of query strings for form data is described, along with the Perl approaches to decoding query strings. Then the CGI.pm module is introduced, which greatly simplifies CGI programming in Perl. Finally, the process of creating animation with CGI is briefly discussed. Several examples are used to show how common CGI tasks are designed and programmed in Perl, both with and without CGI.pm.

Chapter 6 introduces the core of JavaScript, which has become a powerful language that could be used for a variety of different applications. Our interest, of course, is its use in Web programming. Although JavaScript has become a large and complex language, we use the student's experience with Java and Perl

to leverage our discussion, thereby providing a useful introduction to the language in a manageably small number of pages. Topics covered are the object model of JavaScript, its control statements, objects, arrays, functions, constructors, and pattern matching.

In Chapter 7, we discuss some of the features of JavaScript that are related to HTML documents. Included is the use of the JavaScript event and event-handling model, which can be used in conjunction with some of the elements of HTML documents.

Perhaps the most exciting and interesting application of JavaScript is for building dynamic HTML documents using the Document Object Model (DOM). Chapter 8 provides descriptions of a collection of some of the document changes that can be made using JavaScript and the DOM. Included are element positioning, moving elements, changing the visibility of elements, changing the color, style, and size of text, changing the content of tags, and changing the stacking order of overlapped elements.

Java applets are described in Chapter 9. First, the fundamentals of applet activities and the paint method are introduced. Then, the <object> tag and applet parameters are discussed. Next, the chapter introduces the AWT graphics that can be created by applets. Applets that can interact with the user through widgets are then covered. Finally, the chapter provides discussions of Java concurrency and the use of threads and applets to create animation in Web documents.

Chapter 10 presents an introduction to XML, which provides the means to design topic-specific markup languages that can be shared among users with common interests. Included are the syntax and document structure used by XML, data type definitions, namespaces, and the display of XML documents with both Cascading Style Sheets and XML Transformations.

Web servers and Java servlets are discussed in Chapter 11. The general characteristics of Web servers are introduced, followed by a brief discussion of the Apache server under UNIX, including descriptions of the most commonly used Apache directives. Next, the chapter introduces the mechanisms for building Java servlets and presents several examples of how servlets can be used to present interactive Web documents. Finally, two approaches to storing information on clients, cookies and session tracking, are introduced and illustrated with examples.

The last chapter of the book provides an introduction to database access through the Web, using Java JDBC. This chapter includes a brief look at the nature of relational databases, architectures for database access, and the structured query language. Then, the approaches to using JDBC are introduced. Next, JDBC applications are discussed and illustrated with a significant example. Metadata and the use of JDBC and servlets are also introduced.

This book includes an appendix that introduces Java to those who have experience with C++ and object-oriented programming. Students who do not know Java can learn enough of the language from this appendix to allow them to understand the Java applets, servlets, and JDBC that appear in this book.

Supplements

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

- Solutions to some of the exercises
- A set of lecture notes in the form of Powerpoint files. The notes were developed to be the basis for class lectures on the book material.
- Code for example programs
- Powerpoint slides of all the figures

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

Software Availability

Most of the software systems described in this book are available, free to students. These include browsers, which provide an interpreter for JavaScript and the Java Virtual Machine. Also, Perl and Java language processors, as well as Java class libraries to support servlets and Java JDBC, are available and free.

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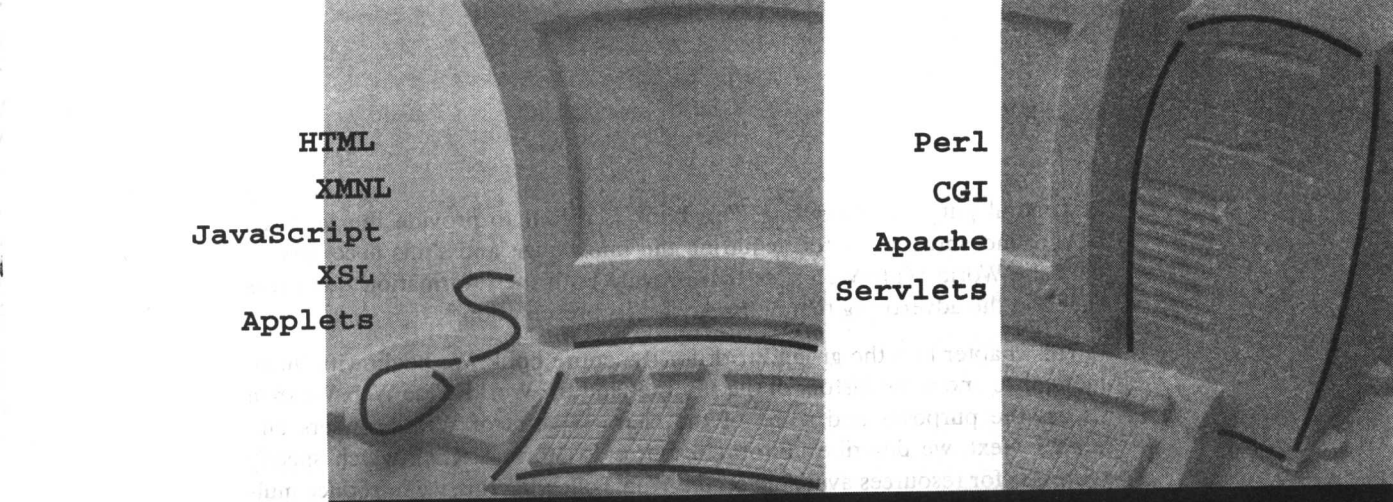

1 Fundamentals

The lives of most of inhabitants of industrialized countries, as well as some in unindustrialized countries, have been changed forever by the advent of the World Wide Web. Although this has had some downsides, for example, easier access to pornography and the ease with which those with destructive ideas can propagate those ideas to others, on balance the changes have been enormously positive. Many of us use the Internet and the World Wide Web on a daily basis, communicating with friends, relatives, and business associates through electronic mail, shopping for virtually anything that can be purchased anywhere, and digging up a limitless variety of information, from movie theater schedules to hotel room prices in cities halfway around the world to the history and characteristics of the culture of some small and obscure society of humans. Constructing the software that provides all of this information requires knowledge of several different technologies, such as markup languages and metamarkup languages, as well as programming skills in a myriad of different programming languages, some specific to the World Wide Web and some designed