

Preface

Technologies related to networks and internetworking may be the fastest growing in our culture today. The appearance of some new social networking applications every year is a testimony to this claim. People use the Internet more and more every day. They use the Internet for research, shopping, airline reservations, checking the latest news, weather, and so on.

In this Internet-oriented society, specialists need be trained to run and manage the Internet, part of the Internet, or an organization's network that is connected to the Internet. This book is designed to help students understand the basics of networking in general and the protocols used in the Internet in particular.

Features

Although the main goal of the book is to teach the principles of networking, it is designed to teach these principles using the following goals:

Protocol Layering

The book is designed to teach the principles of networking by using the protocol layering of the Internet and the TCP/IP protocol suite. Some of the networking principles may have been duplicated in some of these layers, but with their own special details. Teaching these principles using protocol layering is beneficial because these principles are repeated and better understood in relation to each layer. For example, although *addressing* is an issue that is applied to four layers of the TCP/IP suite, each layer uses a different addressing format for different purposes. In addition, addressing has a different domain in each layer. Another example is *framing and packetizing*, which is repeated in several layers, but each layer treats the principle differently.

Top-Down Approach

Although one of the authors of this book has written several books about networking and the Internet (*Data Communication and Networking*, *TCP/IP Protocol Suite*, *Cryptography and Network Security*, and *Local Area Networks*), the approach to networking in this book is different. It is a top-down approach.

Although each layer in the TCP/IP protocol suite is built on the services provided by the layer below, there are two approaches to learn about the principles in each layer. In the bottom-up approach, we learn about how bits and signals are moving at the physical layer before learning how applications use these bits to send messages. In the top-down approach, we first learn about how application-layer protocols exchange messages before learning how these messages are actually broken into bits and signals and physically carried through the Internet. In this book, we use the top-down approach.

Audience

This book is written for both academic and professional audiences. The book can be used as a self-study guide for interested professionals. As a textbook, it can be used for a one-semester or one-quarter course. It is designed for the last year of undergraduate study or the first year of graduate study. Although some problems at the end of the chapters require some knowledge of probability, the study of the text needs only general mathematical knowledge taught in the first year of college.

Organization

The book is made of eleven chapters and five appendices.

- **Chapter 1.** Introduction
- **Chapter 2.** Application Layer
- **Chapter 3.** Transport Layer
- **Chapter 4.** Network Layer
- **Chapter 5.** Data-Link Layer: Wired Networks
- **Chapter 6.** Wireless Networks and Mobile IP
- **Chapter 7.** Physical Layer and Transmission Media
- **Chapter 8.** Multimedia and Quality of Service
- **Chapter 9.** Network Management
- **Chapter 10.** Network Security
- **Chapter 11.** Socket Programming In Java
- **Appendices.** Appendices A to E

Pedagogy

Several pedagogical features of this text are designed to make it particularly easy for students to understand computer networking in general and the Internet in particular.

Visual Approach

The book presents highly technical subject matter without complex formulas by using a balance of text and figures. More than 670 figures accompanying the text provide a visual and intuitive opportunity for understanding the material. Figures are particularly important in explaining networking concepts. For many students, these concepts are more easily grasped visually than verbally.

Highlighted Points

We have repeated important concepts in boxes for quick reference and immediate attention.

Examples and Applications

Whenever appropriate, we have included examples that illustrate the concepts introduced in the text. Also, we have added some real-life applications throughout each chapter to motivate students.

End-of-Chapter Materials

Each chapter ends with a set of materials that includes the following:

Key Terms

The new terms used in each chapter are listed at the end of the chapter and their definitions are included in the glossary.

Summary

Each chapter ends with a summary of the material covered by that chapter. The summary glues the important materials together to be seen in one shot.

Further Reading

This section gives a brief list of references relative to the chapter. The references can be used to quickly find the corresponding literature in the reference section at the end of the book.

Practice Set

Each chapter includes a practice set designed to reinforce salient concepts and encourage students to apply them. It consists of three parts: quizzes, questions, and problems.

Quizzes

Quizzes, which are posted on the book website, provide quick concept checking. Students can take these quizzes to check their understanding of the materials. The feedback to the students' responses is given immediately.

Questions

This section contains simple questions about the concepts discussed in the book. Answers to the odd-numbered questions are posted on the book website to be checked by the student.

Problems

This section contains more difficult problems that need a deeper understanding of the materials discussed in the chapter. We strongly recommend that the student try to solve all of these problems. Answers to the odd-numbered problems are also posted on the book website to be checked by the student.

Simulation Experiments

Network concepts and the flow and contents of the packets can be better understood if they can be analyzed in action. Most chapters include a section to help students experiment with these. This section is divided into two parts:

Applets

Java applets are interactive experiments that are created by the authors and posted on the website. Some of these applets are used to better understand the solutions to some problems; others are used to better understand the network concepts in action.

Lab Assignments

Some chapters include lab assignments that use Wireshark simulation software. The instructions for downloading and using Wireshark are given in Chapter 1. In some other

chapters, there are a few lab assignments that can be used to practice sending and receiving packets and analyzing their contents.

Programming Assignments

Some chapters also include programming assignments. Writing a program about a process or procedure clarifies many subtleties and helps the student better understand the concept behind the process. Although the student can write and test programs in any computer language she or he is comfortable with, the solutions are given in Java language at the book website for the use of professors.

Appendices

The appendices are intended to provide a quick reference or review of materials needed to understand the concepts discussed in the book.

Glossary and Acronyms

The book contains an extensive glossary and a list of acronyms for finding the corresponding term quickly.

Instruction Resources

The book contains complete instruction resources that can be downloaded from the book site <http://www.mhhe.com/forouzan> (added by McGraw-Hill). They include:

Presentations

The site includes a set of colorful and animated PowerPoint presentations for teaching the course.

Solution to Practice Set

Solutions to all questions and problems are provided at the book website for the use of professors who teach the course.

Solution to Programming Assignments

Solutions to programming assignments are also provided at the book website. The programs are in C language for Chapter 2 and in Java language for other chapters.

How to Use the Book

The chapters in the book are organized to provide a great deal of flexibility. We suggest the following:

- ❑ Most of the material discussed in Chapter 1 is essential to understanding the rest of the book. The first two sections are critical to understanding the network layering upon which the whole book is designed. The last two sections, Internet History and Internet Standards and Administration, can be skipped or assigned as self-study materials.
- ❑ Chapters 2 to 6 are based on the four top layers of the TCP/IP protocol suite. We recommend these be covered in the same order as presented to preserve the top-down

approach of the book. However, there are some sections, such as Client-Server Socket Interface in Chapter 2, Next Generation IP in Chapter 4, or Other Wired Networks in Chapter 5, that can be skipped without loss of continuity.

- ❑ Chapter 7, Physical Layer, is added to the book to make the discussion of the TCP/IP protocol suite complete. It can be skipped if the professor feels that the students are already familiar with the materials or they have taken some other related courses.
- ❑ Chapters 8, 9, and 10 can be taught in any order after the first six chapters are discussed. These chapters can be taught fully, partially, or totally skipped at the professor's discretion.
- ❑ Chapter 11 is devoted to Java network programming. It has two purposes: First, it gives the idea of client-server programming to make the students better understand the whole purpose of the Internet. Second, it prepares the student for more advanced courses in network programming. A mini duplicate of this chapter was given in Chapter 2 in C language. The professor can either use that section or use Chapter 11 to teach the basics of network programming.

Web Site

The book website, <http://www.mhhe.com/forouzan>, contains the following:

Quizzes

The quizzes are posted on the website, but the results can be sent to the professor who teaches the course.

Students' Solutions

The answer to the odd-numbered questions and problems are posted for the students to check their work and get some feedback.

Applets

Applets designed for each chapter are available to the students to see some protocols and problems in action.

Professor's Solutions

The answers to all questions and problems are posted for the use of professors who teach the course.

Programming Assignments

The codes for programming assignments are posted for the use of the professors who teach the course.

PowerPoint Presentations

Full-colored and animated presentations are posted for the professors who teach the course. They are designed to allow the professors to tailor them for their own courses.

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