





DATA COMMUNICATIONS AND

NETWORKING

Second Edition







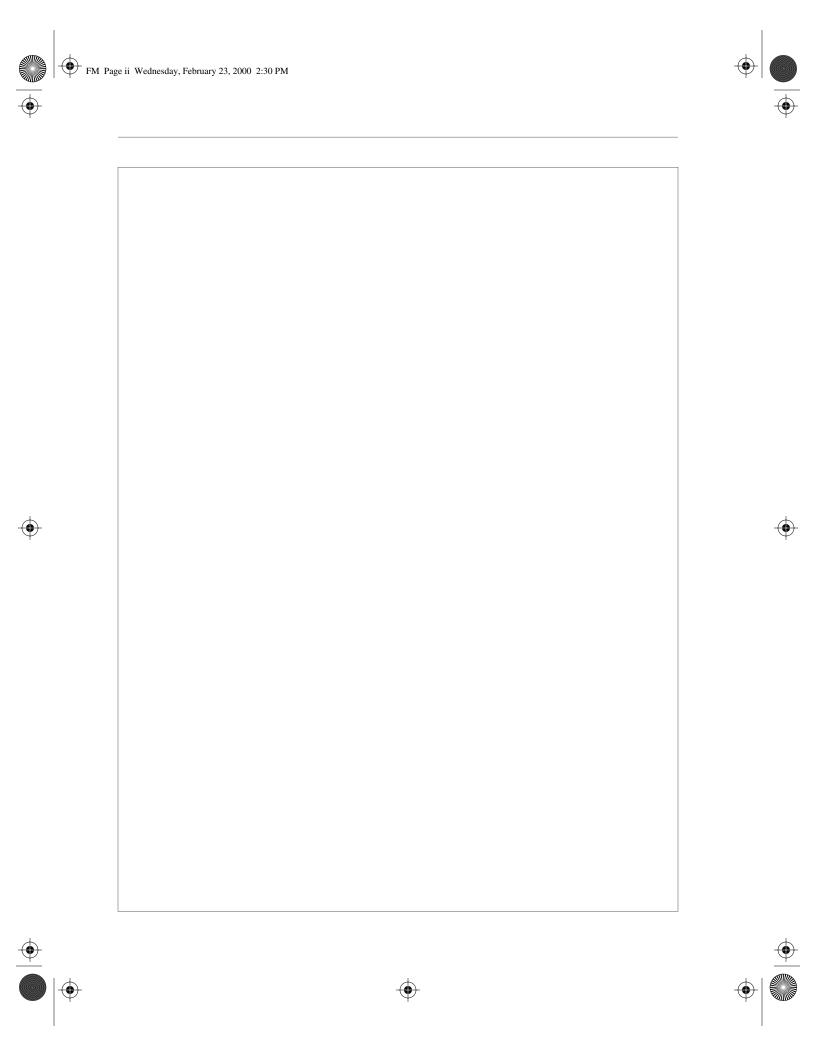


















DATA COMMUNICATIONS AND NETWORKING

Second Edition

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with

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DATA COMMUNICATIONS AND NETWORKING

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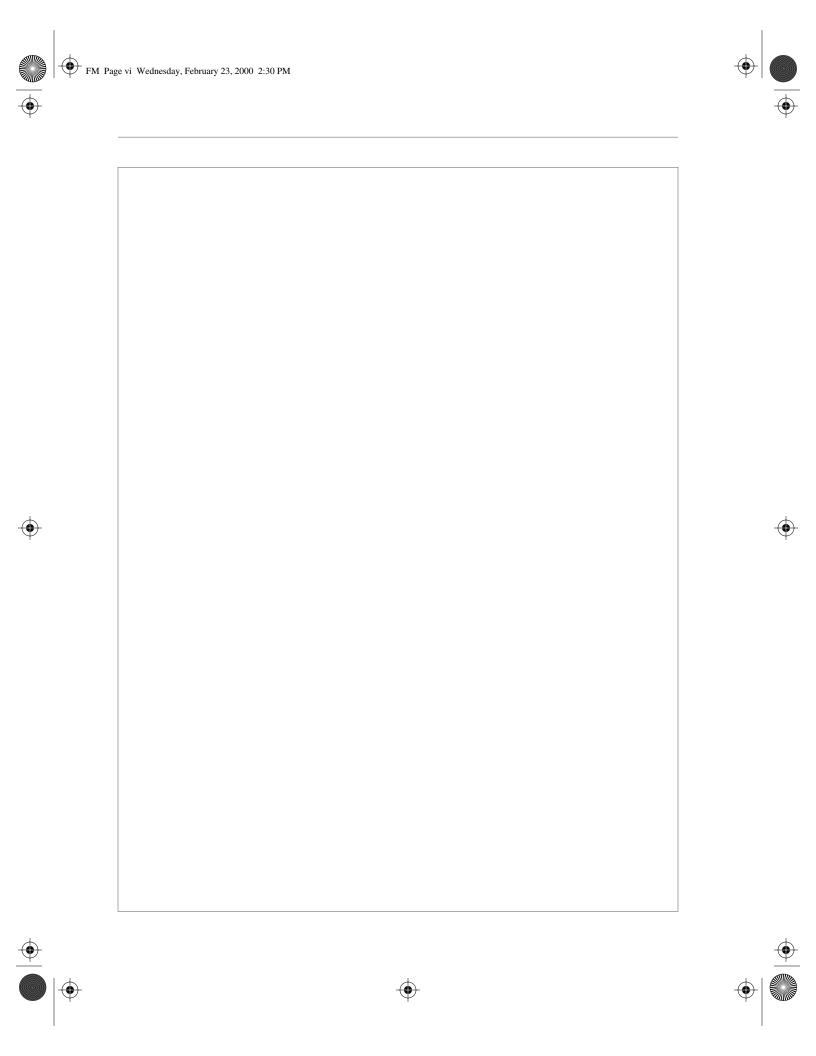


















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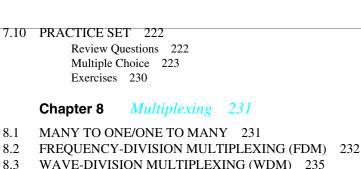












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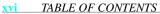












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Preface

Data communications and networking may be the fastest growing technologies in our culture today. One of the ramifications of that growth is a dramatic increase in the number of professions where an understanding of these technologies is essential for success—and a proportionate increase in the number and types of students taking courses to learn about them. Today, students wanting to understand the concepts and mechanisms underlying telecommunications and networking come from a variety of academic and professional backgrounds. To be useful, a textbook on data communications and networking must be accessible to students without technical backgrounds while still providing substance comprehensive enough to challenge more experienced readers. This text is written with this new mix of students in mind.

Features of the Book

Several features of this text are designed to make it particularly easy for students to understand data communications and networking.

Structure

We have used the seven-layer OSI model as the framework for the text not only because a thorough understanding of the model is essential to understanding most current networking theory but also because it is based on a structure of interdependencies: Each layer builds upon the layer beneath it and supports the layer above it. In the same way, each concept introduced in our text builds upon the concepts examined in the previous sections.

The OSI model was chosen because it is a model, not a protocol. The model is independent of any protocol such as TCP/IP, IPX/SPX (Novell), or AppleTalk. We believe that in an introductory course, the model should be understood before the actual protocols are discussed. The OSI model shows the layered architecture necessary for the design of network systems.

This text is designed for students with little or no background in telecommunication or data communication. For this reason, we use a bottom-up approach. In this approach, students can learn first about telecommunications (lower layers) before learning about data communications (upper layers). For example, students can learn



















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about signalling, encoding, modulating, and error detection before learning about data transfer across the Internet. This eliminates the need for two courses: One for telecommunications and one for data communications.

The first nine chapters emphasize the physical layer, which is essential for understanding the rest of the layers. These chapters are particularly needed for students with no background in networking and telecommunications.

Chapters 10 through 12 describe all issues related to local area networks. Chapter 13 discusses metropolitan area networks. Chapter 14 describes switching techniques as background preparation for wide area networks.

Chapters 15 to 20 discuss topics associated with wide area networks. Chapter 21 discusses the network layer function and the topic of internetworking local and wide area networks together. Chapters 22 and 23 focus on upper layer protocols (transport, session, presentation, and application layers).

Chapters 24 and 25 are dedicated to the TCP/IP protocol suite. These two chapters give a brief introduction and prepare the students for a course on the TCP/IP protocol suite.

Visual Approach

The book presents highly technical subject matter without complex formulas by using a balance of text and figures. The approximately 700 figures accompanying the text provide a visual and intuitive opportunity for understanding the material. Figures are particularly important in explaining networking concepts, which are based on connections and transmission. These are both often more easily grasped visually than verbally.

For example, Figure 3.8 shows the encapsulation of a network-layer packet in a data-link-layer frame. The figure also shows how network-layer addresses are unchanged compared to the data-link-layer addresses that change from station to station. Another figure, Figure 5.36, shows how an 8-QAM signal can carry three bits in each baud. Figure 8.4 clearly shows how FDM combines three modulated signals into one composite signal. Figures 25.3, 25.4, 25.5, and 25.6 show how the domain name system is divided into three domains: country, generic, and inverse domains.

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 concept introduced in the text. They also help students do the exercises at the end of each chapter.

Also, we have added real-life applications throughout each chapter. For example, in Chapter 8, after a discussion of FDM, we give an application, the analog hierarchy of the telephone system. Similarly, after discussion of TDM, we give an application, the DS hierarchy of the telephone system.

Summary

Each chapter ends with a summary of the material covered in that chapter. The summary is a brief overview of all the important points in the chapter.

















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Key Terms

Each chapter includes a list of key terms used throughout the chapter for a quick reference.

Practice Set

Each chapter includes a practice set designed to reinforce salient concepts and encourage students to apply them. It consists of three parts: review questions, multiple-choice questions, and exercises. Review questions are intended to test students for their firstlevel understanding of the material presented in the chapter. Multiple-choice questions test students' grasp of basic concepts and terminology. Exercises require deeper understanding of the material.

Appendixes

The appendixes are intended to provide quick reference material or a 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.

Changes in the Second Edition

In this edition, material on the newer technologies has been added, the contents of the chapters have been revised, and the end materials have been augmented and improved.

New Material

We have added the following new material:

- 56K modems and cable modems (Chapter 6).
- Transmission impairment and transmission media performance (Chapter 7).
- Digital subscriber line (DSL) technology and fiber to the curb (FTTC) (Chapter 8).
- Switched and Gigabit Ethernet (Chapter 12).
- Point-to-Point Protocol (PPP) (Chapter 15).
- Traffic control (Chapter 18).
- Switching fabrics and ATM LANs (Chapter 19).
- Additional encryption methods (Chapter 23).
- Lempel-Ziv-Welch compression method (Appendix G).
- Spanning Tree algorithm (Appendix I).

All chapters have been revised, particularly Chapters 4, 9, 18, and 19 and Appendix H.

End Material Augmentation and Improvement

- Several examples are added to many chapters to clarify the materials.
- Key terms are added at the end of each chapter.









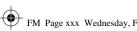
















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- Review questions are added at the end of each chapter.
- The quality and quantity of the multiple-choice questions have been improved.
- The quality and quantity of the exercises have been improved. Most of the old exercises have been revised and many exercises have been added.

Online Supplementary Material

Online Learning Center

The McGraw-Hill Online Learning Center is a "digital cartridge" that contains the book's pedagogy and supplements. As students read through *Data Communications* and Networking, they can go online to take self-grading quizzes. They also get appropriate access to lecture materials such as PowerPoint slides and animated figures from the book. Solutions are also available to instructors through this site.

Additionally, McGraw-Hill makes it easy to create a website for your networking course with an exclusive McGraw-Hill product called Pageout. It requires no prior knowledge of HTML, no long hours, and no design skills on your part. Instead, Pageout offers a series of templates. Simply fill them with your course information and click on one of 16 designs. The process takes under an hour and leaves you with a professionally designed website.

Although PageOut offers "instant" development, the finished website offers powerful features. An interactive course syllabus allows you to post content to coincide with your lectures, so when students visit your PageOut website, your syllabus will direct them to components of Forouzan's Online Learning Center, or specific material of your own.

How to Use the Book

This book is written for both an academic and a professional audience. 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. The chapters are organized to provide a great deal of flexibility. The following are some guidelines:

- Chapters 1 through 12 are fundamental.
- Chapter 13 is optional.
- Chapters 14 through 18 can be covered in detail for a semester course or briefly for a quarter course.
- Chapters 19 through 25 are fundamental.

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