Business Data Networks and Telecommunications
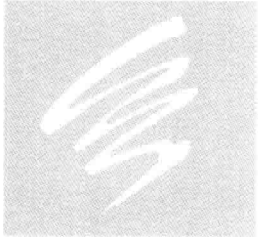
fourth edition

www.prenhall.com/panko

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Business Data Networks and Telecommunications

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To Julia, whose insights and diligence made this edition possible.

Preface

OUTLINE

- Why a Modular Design?
- Considerations for Potential Adopters
- For Adopters of the Previous Edition
- For New Adopters
- For Students
- Sample Syllabi

WHY A MODULAR DESIGN?

This book has a modular design with 11 core chapters plus additional material, including mini-chapters for hands-on material and case studies, advanced modules, and material at the website (new information, mini-case studies, hands-on exercises).

Tailor the Book to Your Class

This modular design allows you tailor the class to undergraduate MIS majors (using primarily the 11 core chapters), MS/IS graduate students (using selected information from the advanced modules), or MBAs (using case study mini-chapters and mini-case studies at the book's website, www.prenhall.com/panko). Sample syllabi at the end of this preface suggest the type of coverage you might wish in each class.

Select the Emphasis You Want

The modular design was also created to allow you to teach the course your way, covering core material but focusing on a few extra areas you consider to be important without having to create new material yourself.

As the outline before this paragraph indicates, the rest of this Preface is addressed to potential adopters, adopters of the previous (third) edition, new adopters, and students.

CONSIDERATIONS FOR POTENTIAL ADOPTERS

Four things are likely to be of interest to you in evaluating this textbook.

- ➤ The book's core chapters are short enough to be mastered by students, and the book's modular design allows you to enrich the course as appropriate to your students.
- ➤ The content is highly current and reflects what network administrators really do.
- ➤ There is superb teacher support, including full PowerPoint lectures.
- ➤ There is very good student support.

Core Chapters of Reasonable Length

Most teachers hate textbook chapters that are so long that they have to assign only some sections in each chapter. It drives students crazy. So the 11 core chapters in the book are all short enough to assign completely.

What about the other material? With 11 core chapters, most teachers have a week free. The other material in the book allows you to enrich the course in almost any direction you wish without having to prepare a lot of new material yourself. At the end of this Preface there are sample syllabi to indicate typical coverage for different types of courses.

For example, I usually also assign case study mini-chapters (such as Chapters 1a and 5a) as homework and go over them in class, along with the chapter review questions I choose to assign. For hands-on mini-chapters (such as 3a and 4a), I have a wire cutting day in class and give assignments on one or two others. Frankly, most students will read the hands-on mini-chapters on their own because they are so relevant to their lives.

Many teachers cover one of the advanced modules (Module A on TCP/IP and Module D on telephony are the most popular) or parts of a few modules. Or, you can use the freed time to do whatever you like, including spending more time on the most challenging chapters.

How to Use the Modular Design for Emphasis

When I first talked to networking teachers, I was most impressed by how different they were in terms of what they wanted to cover. All wanted to cover some core material, but beyond that, they had very different ideas about what to emphasize.

So I decided to create a modular design that would offer a set of core chapters covering essential information but would also offer other material that teachers could cover selectively in order to do things their way without having to create a lot of new material. Specifically, the book offers the following material beyond the core chapters:

➤ Mini-chapters after many core chapters. These mini-chapters offer either substantial case studies that emphasize the chapter's material or a hands-on lab that students can read or (preferably) do.

➤ Advanced modules keyed to the core chapters. These advanced modules offer material beyond that in the basic chapter. If you think I missed a key concept in a main chapter, there is a good chance I cover it in an advanced module. You can use an advanced module to add emphasis in your class, for instance TCP/IP.

➤ Website material provides new information, photos, mini-case studies that show what real companies are doing, and hands-on exercises (usually dealing with the Internet). If new things become important in the field, mini-chapters dealing with them will be added to the website to keep your course up to date.

Up-to-Date Content

I really hate "core dump" textbooks that tell you about every standard ever created in about equal (lack of) depth. As I did in earlier editions, I spent time with network managers finding out what they really do. This allowed me to cut out never-were products and obsolete products that students will rarely see in the field. Being market

focused also allowed me to spend time on topics that really matter even within the constraint of reasonably sized chapters.

➤ For instance, Ethernet is the main LAN focus (Chapters 4 and 5), as it is in life. Students learn Ethernet well.

➤ TCP/IP is the core internetworking focus. It is introduced in the first chapter that deals with standards (Chapter 2) and is discussed in depth in Chapter 8, where students even learn to think like a router. For a really strong TCP/IP focus, there is Module A.

➤ Wireless networking? Sure. And it is integrated throughout the chapters because wireless networking, while new, is no longer a missionary technology. Wireless propagation problems are treated in Chapter 3. Chapter 5 covers 802.11 and Bluetooth. Chapter 6 covers cellular telephony (including 3G). If you prefer to treat wireless in one place, however, there is an online wireless chapter that students can download from the book's website.

➤ Security has become a major IT concern in recent years, and the September 11, 2001, tragedy has intensified concerns about security. The security chapter (Chapter 9) is very rich, and Chapter 7 covers VPNs while Chapter 10 covers server access permissions.

Teacher Support

This is a tough course to teach. To help, I've provided strong support tools.

Full PowerPoint Lectures

There are detailed PowerPoint lectures for each chapter. Not just the "few selected figures" that most books provide but full lectures that I put together (and use) personally. For my students, I print handouts six per page and have students buy them from the copy center to reduce the need for note taking.

By the way, feel free to post these PowerPoint lectures to your local server if you adopt the book. Also, feel free to make changes. However, please don't reuse the clip art (we aren't licensed for that), and please do not remove the copyright notice.

Website Maintained by the Author

The book has a website, www.prenhall.com/panko. I maintain it myself and update it frequently. The website has a number of features for students and teachers.

➤ Photos of equipment. A lot of them. Students really like these things. When I do the PowerPoint presentations, I also bring up the website. I often switch to the browser to show photos of equipment I am discussing.

➤ New information since the book went to press. Assign this material to keep the material completely up to date.

➤ PowerPoint lecture presentation files for downloading.

➤ Word for Windows homework files that have the chapter questions in Word for Windows format. You can assign some or all questions, and students can do their homework on their word processors. (Besides being nice for students, it's a lot easier to grade.)

➤ Small case studies, most of which are articles in the trade press. This material changes too rapidly to print in the book.

➤ Hands-on exercises that typically use the Internet. For instance, students can practice getting a domain name, see how fast their Internet connection really is, and check their home computer for vulnerabilities.

➤ An online glossary organized both by chapter and alphabetically.

Password-Protected Instructor's Part of the Website

There is a password-protected part of the website for adopters. This contains information from the Instructor's Resource CD-ROM (discussed next), but not the sensitive test bank. It has other resources, such as teaching tips and new market data that you can use in class to help students understand the importance of various topics.

Instructor's Resource CD-ROM

The book has an Instructor's Resource CD-ROM that contains material the instructor will wish to have.

➤ A computerized test bank and exam generator, of course.

➤ Answer keys for chapter review questions: test-your-understanding questions in the chapter body and end-of-chapter questions.

➤ PowerPoint presentations. (However, newer ones will be posted to the website to keep the material up to date about every eight months.)

➤ Transparency masters. Some teachers like the freedom of using transparencies compared to PowerPoint presentations. The Instructor's Resource CD-ROM contains transparency masters for *all* figures and tables in the book. They are in Acrobat format.

Chapter Review Questions

Within the chapter's text, there are "test-your-understanding" questions frequently to let students check that they understand the material. These questions cover almost all key points. Quite a few professors assign them selectively for homework and then base their exams on the questions they assigned.

At the ends of chapters, there are enrichment questions, such as troubleshooting questions to help students see how to apply the material to the real world, thought questions that stimulate deeper thinking about the material, and design questions that have them design things (such as a PC network for a small firm in Chapter 4).

Adopters' Mailing List

If you adopt the book, please send me an e-mail (Ray@Panko.com) telling me to put you on the adopters' mailing list. First, this gives me a quick way to communicate with you if there is a major update at the website and (rarely) if there is a really critical piece of networking news you should know about. Second, the list is a great way for me to get feedback from adopters. A number of key design decisions for the current edition were made with input from dozens of adopters of the previous edition.

Student Support

The previous section looked at a number of support tools for students: PowerPoint presentations, downloadable homework questions, and the website with photos, new information, short case studies, hands-on exercises, and an online glossary. In addi-

tion, there are a number of mini-chapters (such as Chapter 1a) that are case studies of meaningful length or hands-on activities.

I've also tried to make the book very easy to study. Nearly all important points are covered in the figures. The book has a lot of special "study figures" that outline key points in major sections of chapters (for example, consider Figures 1-1, 1-9, 1-10, 1-14, and 1-17). The test-your-understanding questions cover almost all key points. Chapters begin with objectives. They usually end with a "Market Realities" section that shows students how businesses really use the technologies and standards they learned about in the chapter.

Contact Me

If you have any questions, please send me an e-mail. Again, I'm Ray@Panko.com.

FOR ADOPTERS OF THE PREVIOUS EDITION

Thank you for having used the third edition of the book. I think you will like the fourth even better, although there were quite a few changes.

Chapter Reorganization

Based on comments from adopters of the third edition, I've rearranged some of the material in a way that I think will fit most adopters better.

➤ TCP/IP still begins early, in Chapter 2. However, many teachers asked for a flow of material in the book that would start from bottom layers and then move up the layer hierarchy. So after three introductory chapters, the book focuses first on LANs (Chapters 4 and 5), telephony (Chapter 6), and WANs (Chapter 7), all of which involve the lowest two layers. Then comes internetworking at the internet and transport layers (Chapter 8). Applications come last (in Chapter 11), which is good because applications can be a lot of fun to cover. Security (Chapter 9) and network management (Chapter 10) come just before applications because they involve all layers.

➤ Cheating a little, Chapter 4 covers more than LANs; it discusses the whole task of setting up a small PC network. Perhaps you should think of it as a fourth introductory chapter.

➤ The order of the final two chapters (network management in Chapter 10 and applications in Chapter 11) was selected because many adopters do not cover applications, usually because they are covered in other courses. Putting applications last makes it easiest to drop applications. Network management comes next-to-last because it is the next-most-frequently skipped material.

➤ A good deal of telephony (Chapter 6) is now integrated into the core chapters because Module D was so widely used in the third edition.

➤ There is one fewer core chapter (11 instead of 12), giving you a bit more flexibility. Some teachers will devote extra time to the most difficult chapters. Others will use the reduced number of chapters to add enrichment to their classes.

New and Expanded Material

The book covers several new or expanded topics.

Wireless

Chapter 3 introduces wireless propagation and transmission problems. Chapter 5 presents 802.11 and Bluetooth wireless LANs. Chapter 6 introduces metropolitan wireless networking in the context of cellular telephony (including 3G systems). If you prefer to cover wireless networking all at once, there is an online wireless chapter at the website that students can download.

Security

The security chapter (Chapter 9) is much better than it was in the third edition. In addition, VPNs are covered in Chapter 7, and server access permissions are covered in Chapter 10.

Applications

Chapter 11 covers peer-to-peer (P2P) networking, Web services and .NET, and an integrative section on e-commerce.

PowerPoint Lectures

You'll again get full PowerPoint lectures. They will be a little shorter than the early ones for the third edition. For those who want it, there are notes pages (only available to teachers) containing a script you can use to present each slide.

Adopters-Only Material

The website has an adopters-only section protected by a password. I'll put answer keys there as well as the notes pages for the PowerPoint presentations. I'll also put new market information with facts that you can toss out in class and impress your students. Let me know if there is anything else you would like there.

The Website

Otherwise, the website will look a lot like the current website. It will still have photos, downloadable PowerPoint presentations, downloadable homework, mini-cases, hands-on exercises, and errors pages.

Online Glossary

One major change to the website. The website now has an online glossary organized both by topic and alphabetically. Students can search online or print out the glossary for reading.

Contact Me

If you have any questions, please send me an e-mail. I'm Ray@Panko.com.

FOR NEW ADOPTERS

Thank you for adopting my textbook. If you have any questions or comments, please contact me at Ray@Panko.com. Also, please send me your e-mail address and have me put you on the adopters' mailing list. I'll occasionally send you news of really important new developments in the field (I won't do it often), let you know about major updates to the website, and occasionally send out questions that will help me design the next edition. (Many design choices in this edition are based on adopter feedback.)

If you didn't select the book yourself, you might look at the part of this Preface addressed to potential adopters. It will help you work with this book and its resources. By the way, if you didn't get the Instructor's Resource CD-ROM, you can request a copy from your Prentice Hall sales representative. If you aren't sure who that is, contact Prentice Hall's Faculty and Field Services department by calling 800-526-0485, if you are in the United States.

Selecting Coverage

This book has a modular design to provide teachers with flexibility rather than to present material to be covered in its entirety. At the end of this Preface, there are some sample syllabi indicating typical coverage.

The 11 core chapters provide a complete course in networking, usually with about a week to spare. The rest of the book is for selective enrichment rather than for complete coverage. The modules in particular are designed to let teachers cover extra material selectively without having to produce their own material.

If you have a two-term course, you can cover the entire book, but in a one-term course, most teachers cover the core chapters and a little more. For instance, in the last edition, about half of all adopters covered only the 12 core chapters (one more chapter than this time), and those that went beyond the core chapters usually covered only one or two modules' worth of material. (There were no mini-chapters after the main chapters in the last edition.) Module A (TCP/IP) and Module D (telephony) were the most frequently covered modules, but every module was covered by some adopters. The goal is to let you do things your way.

I personally cover the 11 core chapters plus Module A and the mini-chapters. I merely assign mini-chapters that are case studies as homework, and we go over the students' answers in class. I demo most of the hands-on mini-chapters in class, but I do take one day to have a hands-on class in which my students cut wire and add connectors. Cutting wire is really neat, and students really love it, but it requires about $125 for one set of stripping, cutting, and connectorizing tools to be shared by 10 students, and each student uses about $1.25 in UTP wire and RJ-45 connectors. You'll also need a wiring tester for about $125. (You'll really need a tester because only about two-thirds of all students get it right the first time.)

Using Chapter Review Questions

The chapter review questions are designed to focus student learning. Often, teachers assign a list of chapter review questions for homework or study and then base their exams on those questions. Within the chapters, test-your-understanding questions appear frequently, allowing students to check how well they just learned a section. At

the end of each chapter, there are more challenging questions involving trouble-shooting, design, and advanced thinking about the material in the chapter. I also assign mini-chapter case study questions as homework.

Using Figures

To help students organize the material in their own heads, I've covered almost all key points in figures. Many of these figures are study figures (for example, Figures 1-1, 1-9, 1-10, 1-14, and 1-17), which outline key sections. My own students have found these very useful.

Contact Me

Again, if you have any questions, please send me an e-mail. I'm Ray@Panko.com.

FOR STUDENTS

Almost every information systems (IS) program today has a course in networking. Obviously this course is critical to students who will pursue networking as a career. However, programmers increasingly find themselves writing groups of programs on different machines; these programs communicate with each other over a network. Distributed databases are increasing in importance, and help desk personnel today deal as much with networking problems as with application software problems. For better or worse, networking will permeate your working life.

Some Tips on Using this Book

Doing the Review Questions

I've tried to make this book easy to study. First, focus on chapter review questions, which cover almost all key concepts and get you to think about what you have learned. As you go through the chapter, stop and do the test-your-understanding questions after each section before you go on to the next section. Also go back to these test-your-understanding questions when you study each section. In addition, do the end-of-chapter questions to get better insight into the material and how to apply it to real situations.

Study in a Group

I strongly suggest that after you have made up your own answers, you go have a study session with other students in the class and compare your answers. This is a great way to identify holes in your knowledge or at least see where you need to look at the material in more depth.

Study the Figures

In addition, the figures cover almost all important topics in the book, so go over the figures as well as the text itself. Especially important are "study figures" (for example, Figures 1-1, 1-9, 1-10, 1-14, and 1-17) which outline key points in whole sections.

Use the Book's Website

At the book's website (www.prenhall.com/panko), you can download PowerPoint lecture presentation, do hands-on exercises to do fun things (usually over the Internet), download the chapter review questions in Word for Windows format, and read study hints for each chapter. Before you start each chapter, you should check the website for reported errors and correct them in your textbook. Also, use the online glossary to check your understanding of terms. (You can also print out the glossary if you wish.)

Pursuing Networking as a Career

If you are considering networking as a career, you should know that job prospects are excellent, pay is good, and the work is challenging. You should also know that there are some things you should do besides your IS classes to help you land a good job and prepare for that career.

Systems Administration

For better or worse, networking professionals usually also have to manage servers and spend a majority of their time doing this. For historical reasons, this is called systems administration. It would be very good to take practical courses in managing Windows and LINUX servers. At a minimum, you should know how to give basic commands to move around the server's directory structure, how to add and drop users, and how to change user access permissions.

Certification

A major trend in the field is becoming certified to show that you possess a good level of knowledge. The easiest certification to get (note that I did not say easy) is the basic Cisco Systems certification, CCNA (Cisco Certified Network Administrator). With the material students learn in my textbook, you can learn what you need to pass the CCNA in about a normal course's worth of self study. I'd again strongly recommend group study. Todd Lammle has an excellent preparation book (*CCNA Cisco Certified Network Associate: Study Guide with CD-ROM, Deluxe Edition,* Sybex, November 2001). This book can be purchased with a router simulator that is not perfect but it is quite good. A fuller version of the simulator can be purchased from Routersim.com.

Internships

Classes and certification are good, but there is no substitute for experience. It is a very good idea to do at least one meaningful internship in networking while you are in school. Of course, a real job is even better.

SAMPLE SYLLABI

Here is a sampling of what teachers may wish to cover in their courses. Of course, coverage may deepen if students have had more networking background, and some schools cover material in other courses.

Community College or Technical Institute Course

Many community colleges with IT programs and technical institutes cover the 11 core chapters and some of the hands-on exercises (such as Chapters 3a and 4a). They usually cover the hands-on exercises using class demos or, if they have the equipment, using hands-on homework assignments. This gives a solid course in networking and telecommunications. Selective coverage of the hands-on exercises at the website is common.

Introductory Course for MIS Majors

In the general introductory course for MIS majors, it is common to cover the 11 core chapters. Beyond that, it is common to cover a few hands-on mini-chapters (such as Chapters 3a and 4a) using class demos and, if equipment is available, hands-on homework. It is also common to cover the case study mini-chapters (such as Chapters 1a and 5a) by assigning them as homework and going over the results with the students. Selective coverage of the hands-on exercises at the book's website is common.

In addition, there typically is time to cover about one advanced module's worth of material (either an advanced module or parts of a few advanced modules). Some teachers cover Chapter 10 in abbreviated format and cover applications in other classes and so free up another advanced module's worth of material. However, some teachers cover material in the advanced modules only slightly if at all, preferring to focus on the core chapters and the mini-chapters (small chapters that end with an "a"), or preferring to cover other information.

Schools on quarter systems can cover the same material if they have equivalent contact time to semester courses; if they have fewer contact hours, however, their coverage may have to limit their courses to the core chapters.

Two-Term Networking Course

Some schools have two-term networking courses. Those courses can cover the whole book. I find it best to cover the material in the advanced modules after the basic chapter they support. If the core material is covered in one term and the advanced material is covered the next, student forgetting will require going over the first term's material in some detail. Of course, this may be a benefit.

In addition, it would be extremely helpful to give students hands-on systems administration experience with Microsoft Windows and a UNIX network operating system (including LINUX). This knowledge is used widely by systems administrators.

MBA Course

MBAs are difficult to teach because they like technical depth but are more focused on management. The 11 core chapters provide the technical depth they will need. Whether to use the hands-on mini-chapters (such as Chapters 3a and 4a) is a difficult design issue because many MBAs "don't want to be technicians." In many cases, these exercises can be pointed out and left to them to do if they wish, and many will.

Cases studies are very important for MBAs. The mini-chapter case studies (such as Chapters 1a and 5a) are important because they are long enough to generate some class discussion, and the many small case studies at the book's website are attractive because they show the MBAs what real companies are doing. The selective use of hands-on exercises at the website is likely to be valuable.

In addition, in MBA courses, it is common to give term projects in which the MBAs examine an actual networking situation and make recommendations. If they do in-class presentations, this will reduce coverage of material in the book correspondingly.

About the Author

Dr. Ray Panko (Ray@Panko.com) is a professor of IT management in the College of Business Administration of the University of Hawaii. Before coming to the university, he was a project manager at Stanford Research Institute (now SRI International), where he conducted research for nearly every major telecommunications firm. He received his BS summa cum laude in physics and MBA from Seattle University. He received his doctorate in communication from Stanford University, where he graduated with a 4.0 GPA and where his dissertation was conducted under contract to the Office of the President of the United States.

His interest in networking began in the early 1970s, when the interdisciplinary Stanford "communications mafia" was at its peak and when a young doctoral student could work on verifying the effectiveness of the small satellite dishes we use today, could manage the design of a campus-wide LAN using cable television technology, and could pick a dissertation topic relevant enough for the White House to fund. Stanford Research Institute was even more fun because the author got to work on the ARPANET during its first few years, participate in discussions that defined e-mail, and work for Doug Engelbart, who invented the mouse and outline processing and who built the world's first working hypertext system and distributed team support system. In retrospect, it is amazing that many of the things he worked on then took so many years to come to fruition.

At the University of Hawaii, he discovered that teaching networking was even more fun than conducting research in networking and that writing a textbook could introduce thousands of students to this exciting field.

Brief Contents