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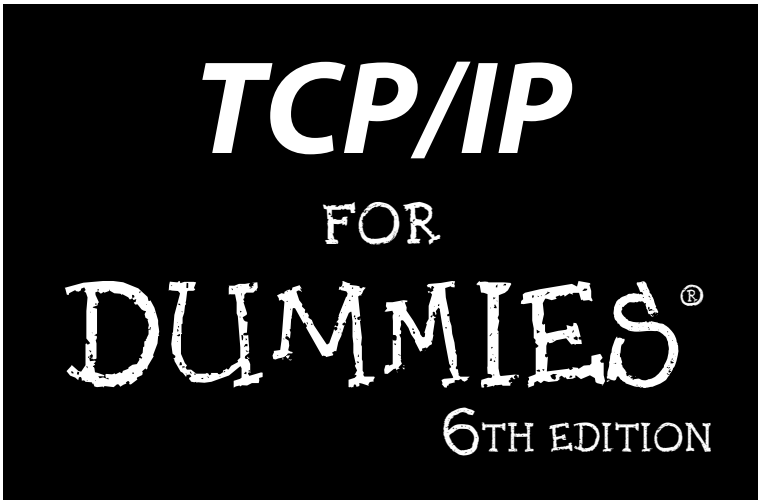
Candace Leiden
Marshall Wilensky

Foreword by Scott Bradner, University Technology Security Officer, Harvard University & ICANN Trustee



by Candace Leiden and Marshall Wilensky

Foreword by Scott Bradner
University Technology Security Officer, Harvard University

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About the Authors

Forced to learn about computers because she was afraid of slide rules, **Candace Leiden** has worked as a software developer, system administrator, and database designer and administrator. Formerly the president of Cardinal Consulting, Inc., Candace is now a systems and database performance consultant and instructional design consultant for international courseware in those areas. Her customers have included Cardinal Consulting, Compaq Computer, Digital Equipment Corporation, the United Nations, several major pharmaceutical corporations, Oracle Corporation, and Hewlett-Packard. Candace is an internationally recognized speaker on relational databases and the Linux and Unix operating systems. Candace is also the author of *Linux Bible* (Wiley Publishing). Candace met Marshall Wilensky in 1981, when they worked at the same company. She taught him everything he knows.

Marshall Wilensky has been wrangling computers and networks for more than 30 years (and still has fewer wrinkles than Candace and less gray hair). In corporate life, he has had the privilege of working for companies ranging from 25 people (who are 25 years old) to more than 300,000 worldwide. He has been a consultant, a programmer, a system administrator, and a network manager for large multivendor and multiprotocol networks, including those at the Harvard University Graduate School of Business Administration.

Marshall met Candace Leiden in 1981 when they worked at the same company. He taught her everything she knows. They are also, most importantly, married (to each other).

Candace and Marshall are both members-at-large of ICANN (Internet Corporation for Assigned Names and Numbers).

Dedication

Candace dedicates this book to Marshall Wilensky (no one knows the meaning of the phrase "in sickness and in health" better than Marshall) and to Emily Duncan, who is wise beyond her years. Even though she has been through some tough times, Emily rules!

Marshall dedicates this edition of the book to his late parents, Leo and Estelle Wilensky, and to Roxcy Platte and the people who help him with the toughest subject he has ever tackled.

In memory of:

Helen Louise Duncan

Christine Evans Staley

They are missed every day.

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Finally, thank you to Cynthia Woods, a gifted and inspiring musician, who allowed us to use her beautiful Web page as one of our examples.

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Foreword

For both good and ill, modern society around the world has been transformed by the Internet. But the Internet was not the first data communications network, not by a long shot. So what was it about the Internet that enabled the revolution? In a very basic way, it was the use of TCP/IP. TCP/IP enabled the Internet to be the first data network where the use could be driven by the users and not controlled by the carriers. TCP/IP is an end-to-end protocol. The network is there to carry the bits from any device at the edge of the network to any other device. This stands in stark contrast to X.25, frame relay, ATM, and other carrier-managed data networks, where the carrier determined who you could talk to, and in an even starker contrast to the phone network, where the carrier determined what you could do.

This end-to-end architecture has resulted in an amazing proliferation of applications because the network does not get in the way of individual entrepreneurs developing the next great thing and running it over the Internet. It also did not get in the way of millions of people putting up their own Web pages, or, with somewhat more controversy, swapping music and movie files. Even if you take into account the Internet boom and subsequent bust, the Internet, and TCP/IP, are here to stay. And, while here, they will continue to radically change the way we interact with employers, service providers, each other, and the world at large.

You can easily go through life without having to understand how this Internet thing works because it will continue to work even if you do not understand it. I do not have any meaningful understanding of the Theory of Relativity yet make use of its implications every day.

TCP/IP For Dummies, 6th Edition, is for those of you who aren't just curious about how things work, but who want to actually understand what's behind the curtain. (Hint: It's not the Wizard of Oz.)

Scott Bradner
University Technology Security Officer, Harvard University

Introduction

TCP/IP is the glue that holds together the Internet and the World Wide Web. To be well connected (network-wise, that is), sooner or later you have to become familiar with TCP/IP applications and services. If you want to understand what TCP/IP is, what it's for, why you need it, and what to do with it, and you just don't know where to start — this book is for you.

If you're on a network, whether you know it or not, odds are, you're working with TCP/IP and its many pieces and parts. We help you understand how it all fits together. We also give you plenty of hands-on tips so that you can get all those pieces and parts set up and running.

We take the mystery out of TCP/IP by giving you down-to-earth explanations for all the buzzwords and technical jargon that TCP/IP loves.

This isn't a formal tutorial; skip around and taste TCP/IP in little bites. If you need to impress your boss and colleagues with buzzwords, you can find out just enough to toss them around intelligently with the technocrats at meetings and parties. Or, you can go further and discover how to set up and use the most important features and tools. If you want the full TCP/IP banquet, you can explore the technical tasks that take place behind the scenes to make the Internet and the Web work. It's right here in your hands.

About This Book

We hope you find *TCP/IP For Dummies,* 6th Edition, to be a fun and fast way to dive into the guts of the Internet. The book is both an introduction to the basics and a reference to help you work with Internet applications and tools on all kinds of connected computers. We added and updated the latest Internetworking protocols and servers — with examples from Microsoft Windows Server 2008, Windows 7, Windows Vista, Windows XP, Linux, Unix, and Mac OS X. Here are just a few of the subjects we describe:

- Uncover the relationships among TCP/IP, the Net, and the Web.
- Get up and running and *keep* running on the Internet, whether you have a small network or a big enterprise network and whether it's wired or wireless.

- Install and configure TCP/IP client and server applications and services.
- Phone home without the phone or the bill, thanks to VoIP.
- Build and enforce security everywhere on your network.
- Get in on all the newest Internet security protocols and trends.
- Boldly go to the next generation: IPv6.

This book is loaded with information. But don't try to read it from cover to cover in one sitting — you may hurt yourself. If your head explodes and bits and bytes go flying, please don't blame us.

Conventions Used in This Book

All commands that you need to enter yourself appear either in bold, **like this**, or on a separate line, like this:

```
COMMAND to type
```

To enter this command, you type **COMMAND to type** exactly as you see it here and then press Enter.

When you type commands, be careful to use the same upper- and lowercase letters that we show you. (Some computer systems are fussy about this issue.)

When we want you to move through a series of menus or buttons, we say "Click" once and then point to the next place with a command arrow (➪).

Whenever we show you something that's displayed onscreen (such as an error message or a response to your input), it looks like this:

```
A TCP/IP message on your screen
```

Foolish Assumptions

In writing this book, we tried not to make too many assumptions about you. We figure that you've done a little Web browsing and e-mailing. Our only assumption is that you're not really a dummy — you're just trying something new. Good for you!

How This Book Is Organized

This book contains five parts, each of which contains several chapters. We don't expect you to read the whole book from cover to cover, but please feel free to do so. Instead, you can glance at the table of contents for the topic you're interested in and go from there. The layout of the book is easy to follow. Here's a quick look at what you can find in each major part.

Part I: TCP/IP from Names to Addresses

Part I starts at the beginning with the buzzwords and how TCP/IP and the Internet are joined at the hip. You also find out that, contrary to its name, TCP/IP is so much more than just two protocols. We give you a quick look at the most important protocols, and you get to see all the lingo that should take you far through this century.

You'll find that as much as people like names, computers like numbers even more. After you get some of the buzzwords under your belt, the chapters in Part I explain what an Internet protocol (IP) address is, how to build one, how to use it, and how to be frugal and save enough Internet addresses for someone else. We clue you in on different ways to make IP addresses go further. No worries — the Internet won't get full.

Part II: Getting Connected

After you know how IP addresses are constructed, we move on to setting up your TCP/IP network, both wired and wireless, to connect to the world (the Internet). In this part of the book, we show you how hardware and software work together to make a network. We discuss just the minimum hardware you need to understand.

Then we throw in IPv6, which puts you ahead of most people in understanding the next generation of Internet addresses. If you're not ready to go where no one (well, hardly anyone) has gone before, don't worry — you can skip Chapter 9 entirely.

Part III: Configuring Clients and Servers: Web, E-Mail, and Chat

TCP/IP is a big set of protocols, services, and applications. Whether you're aware of it or not, you use TCP/IP applications and services to do everything from reading news to exchanging e-mail and online conversations with your friends to copying good stuff like games, technical articles, and even TCP/IP itself. This section explains how these applications and services work behind the scenes with client/server technology. The numerous hands-on sections help you configure popular applications and services for both clients and servers.

Security is one of the stars of Part III. Hackers love to try to break into your Web, e-mail, and chat applications, and we love to show you how to thwart their every move. We throw in a quick-start security guide to get you going. If you're interested in online shopping or banking, we walk you through a secure Internet credit card transaction.

Part IV: Even More TCP/IP Applications and Services

"How could there possibly be more?" you might ask. Well, we told you that TCP/IP consists of much more than just a couple of protocols — for example, there's Mobile IP, for when you take your laptop to your favorite café rather than to your office. If you have a smartphone or organizer, such as a Palm or BlackBerry, you need to know this stuff. But wait! There's more. How about saving big bucks on phone calls? With or without a phone? Voice over Internet Protocol, or just VoIP, lets you make calls, even international ones, for free. Finally, Part IV covers remote access applications, from sharing files to working on someone else's computer when you're 5,000 miles away.

Part V: Network Troubleshooting and Security

Part V delves into some advanced topics. If you're a system or network administrator, you may need to know more than just the basics about network hardware. We hope that after you install and configure TCP/IP and your network applications, nothing ever goes wrong for you, but stuff happens. Part V steps you through a basic troubleshooting procedure so that you can figure out what went wrong and where. Then you can fix it.

The rest of Part V is devoted to security. You find practical security tips, and you can delve deeper, to see how to use encryption, authentication, digital certificates, and signatures. You get hands-on advice for setting up a software firewall and the Kerberos authentication server.

Part VI: The Part of Tens

You may already know that every *For Dummies* book has one of these parts. In it, you can find security tips, Internet traffic factoids, advice about places to go and things to do (even if you never leave your computer), and more security pointers. And all this happens in, roughly, sets of ten.

Icons Used in This Book

Signals nerdy technofacts that you can easily skip without hurting your TCP/IP education. But if you're even a part-time techie, you probably love this stuff.

Indicates nifty shortcuts that make your life easier.

Lets you know that a loaded gun is pointed directly at your foot. Watch out!

Marks information that's important to commit to memory. To siphon off the most important information in each chapter, just skim through these icons.

Marks important TCP/IP security issues. *Lots* of security icons are in this book.

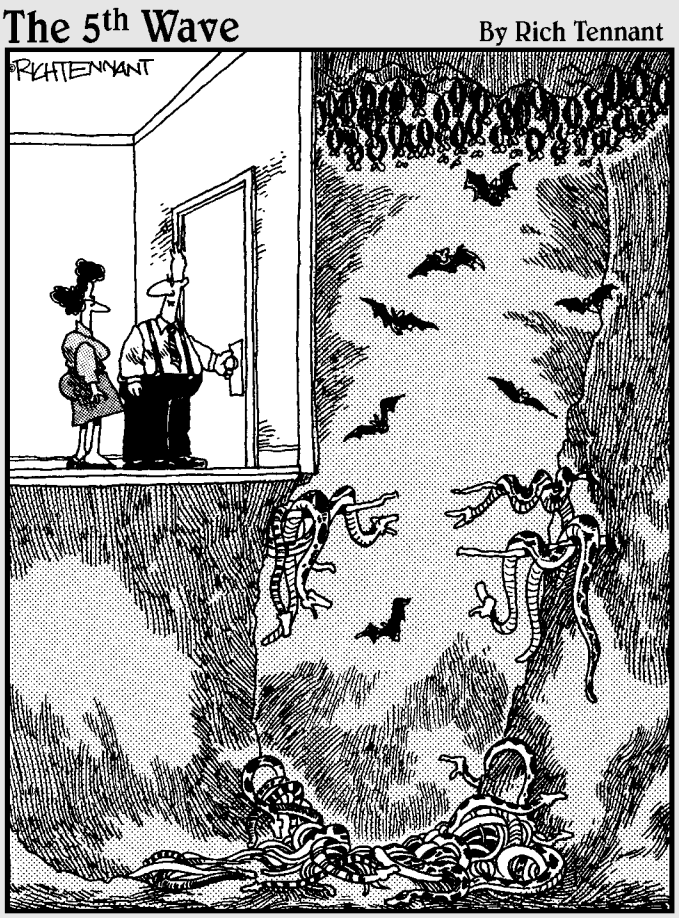
Where to Go from Here

Check out the table of contents or the index and decide where you want to start. If you're an information technology manager, you're probably interested in buzzwords and you know why everyone is on the TCP/IP bandwagon. If you're a system or network administrator, start with Chapter 2 or 4, where we describe the major protocols and what they do. Chapters 12, 14, 20, and 21 talk about Internet security — a topic that's for everyone concerned that their personal data is at risk.

Or, you can just turn the pages one by one. We don't mind. Really.

Part I

TCP/IP from Names to Addresses



"This part of the test tells us whether you are personally suited to the job of network administrator."

In this part . . .

You can't play the game if you don't know the rules. And TCP/IP is the set of rules, or *protocols,* for networks. TCP/IP is the software underpinning of the Internet and its World Wide Web. TCP/IP also includes services and applications that work with the protocols. Before we get into the hairy details of the protocols themselves, we give you some background on the people and committees who decide the direction of TCP/IP's growth. Did you know that you can be part of these groups? We tell you how. You also become familiar with TCP/IP and Internet buzzwords.

Part I then delves into the ingredients of the TCP/IP suite: the protocols and services themselves and IP addressing. You see how the protocols fit into the layers of the TCP/IP network model, and you take a look at the most important ones. TCP/IP is a *suite* because it consists of more protocols than the two it's named for, plus a set of services and applications. The TCP/IP protocols, services, and applications in the suite work together just like the rooms in a hotel suite or the pieces in a furniture suite work together. The set of protocols is also referred to as a *stack.*

From there, we go into Internet addressing.

People love names. Computers love numbers. You'll hear this in each part of this book.

If your computer is named Woodstock, for example, the Internet may think of it as 198.162.1.4. You get to see how to build and understand these numeric addresses. Also, if you're worried because you think that the Internet is running low on addresses, Part I eases your worries by cluing you in to a couple of different ways to make IP addresses go further: subnetting and NAT (Network Address Translation).

Bear in mind that TCP/IP stays alive by morphing regularly — at times, daily. So, the list of protocols we describe here — the Internet's rules — will be even longer by the time you read this book.

Chapter 1

Understanding TCP/IP Basics

In This Chapter

- Protocols in this chapter: IP, TCP, IPSec, PPTP, L2TP
- Introducing TCP/IP
- Defining a protocol
- Understanding RFCs — the protocol documentation
- Differentiating between intranets, extranets, and Virtual Private Networks (VPNs)
- Figuring out who's in charge of TCP/IP and the Internet
- Investigating different types of networks that rely on TCP/IP software

You bought or borrowed this book, or maybe you're just flipping through it to pick up some information and tips about TCP/IP and its pieces and parts. Transmission Control Protocol/Internet Protocol, or TCP/IP, is the internationally accepted software for networking in general and, specifically, for making the Internet's services possible.

As you read this book, you get a behind-the-scenes look at how TCP/IP makes the Internet work. You also see how to use TCP/IP to set up your own home, office, or even international network. This chapter gets started by defining a protocol in general and TCP/IP protocols specifically. Proposals known as Requests for Comment, or *RFCs,* document how TCP/IP should function. You may wonder who's in charge of defining these protocols that rule the Internet. The answer is: lots of people who join international committees. This chapter describes the main Internet governing committees and what they do.

The Internet is one giant worldwide network that consists of tens of thousands of other networks. We give you an idea in this chapter of the different kinds of networks that connect via TCP/IP into the Internet.

The TCP/IP pronunciation guide

Pronouncing TCP/IP is easy — you just say the name of each letter and ignore the slash (/). Ready? It sounds like this:

"Tee cee pee eye pee"

Skip the silly jokes, please. We've made them all. By the way, some people find five letters too much to pronounce, so they just say "IP" to refer to the whole thing.

Following Rules for the Internet: TCP/IP Protocols

A *protocol* is a set of behavior-related rules that people follow. Some protocols are formally defined. For example, when people meet and greet each other, they might say, "Enchante de faire votre conaissance" or "How do you do"? We also hear our niece, Emily, and her friends saying "Hey, dude!" All these examples are widely accepted behaviors for people to start communicating — they are protocols. The more formal greetings are written down in etiquette books. "Hey, dude" has become accepted (at least by people much younger than we are) because of its wide use. Common ways of connecting aren't enough, though. After you meet, you need a common language in order to communicate. Just as people connect and communicate in accepted ways, computers connect and communicate with each other and with you. In the world of computers and networks, TCP/IP is a common language used for both connection and communication.

Although TCP/IP sounds like it consists of just two protocols, it's a whole set of protocols for connecting computers to the Internet. This set of protocols is the TCP/IP *stack,* or *protocol suite.* We describe in Chapter 2 the most well-known protocols in the TCP/IP stack. Before we get to the protocols themselves, the following sections look at who's in charge of the Internet and who decides what gets to be a standard part of the TCP/IP protocol suite. You also get familiar with Requests for Comments (RFCs), the documents that describe TCP/IP standards.

Who's in charge of the Internet and TCP/IP?

You're in charge. Or, you might say that everyone is, and no one is, in charge of the Internet and TCP/IP. No one person, organization, corporation, or government owns or controls the TCP/IP protocols or the Internet. Moreover, no