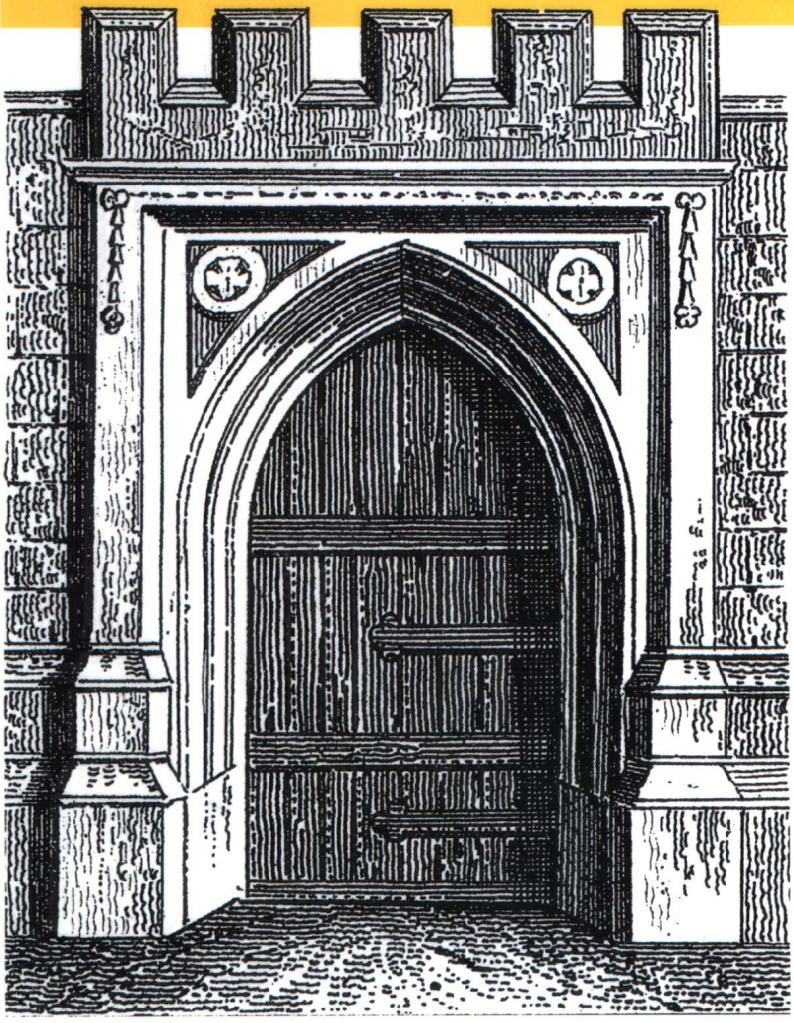
构建Internet防火墙(影印版)

2nd Edition

Covers Unix, Windows NT, and Linux

Building Internet

Firewalls



Elizabeth D. Zwicky, Simon Cooper & D. Brent Chapman 著

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从最畅销的*The Whole Internet User's Guide & Catalog*(被纽约公共图书馆评为20世纪最重要的50本书之一)到GNN(最早的Internet门户和商业网站)，再到WebSite(第一个桌面PC的Web服务器软件)，O'Reilly & Associates一直处于Internet发展的最前沿。

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出版说明

计算机网络与通信技术的成熟与广泛应用，以及Internet与Web的迅速发展，为人类的工业生产、商业活动和日常生活都带来了巨大的影响。网络与通信技术在我国的很多领域也已经广泛应用，并且取得了巨大的效益。然而，该领域的技术创新的速度之快也是有目共睹的。为了帮助国内技术人员和网络管理人员在第一时间掌握国外最新的技术，清华大学出版社引进了美国O'Reilly & Associates公司的一批、在计算机网络理论和Opensource方面代表前沿技术或者在某专项领域内享有盛名的著作，以飨读者。本套丛书采用影印版的形式，力求与国外图书“同步”出版，“原汁原味”地展现给读者各种权威技术理论和技术术语，适合于相关行业的高级技术人员、科研机构研究人员和高校教师阅读。

本批图书包括以下几种：

- 《802.11安全手册（影印版）》
- 《构建Internet防火墙（影印版）》
- 《Java技术手册（影印版）》
- 《Open Sources（影印版）》
- 《WWW信息体系结构（影印版）》
- 《LINUX RAID管理（影印版）》
- 《Peer-to-Peer（影印版）》
- 《Java实例技术手册（影印版）》
- 《Free As In Freedom（影印版）》
- 《Unix操作系统（影印版）》

Preface

This book is a practical guide to building your own firewall. It provides step-by-step explanations of how to design and install a firewall at your site and how to configure Internet services such as electronic mail, FTP, the World Wide Web, and others to work with a firewall. Firewalls are complex, though, and we can't boil everything down to simple rules. Too much depends on exactly what hardware, operating system, and networking you are using at your site, and what you want your users to be able to do and not do. We've tried to give you enough rules, examples, and resources here so you'll be able to do the rest on your own.

What is a firewall, and what does it do for you? A firewall is a way to restrict access between the Internet and your internal network. You typically install a firewall at the point of maximum leverage, the point where your network connects to the Internet. The existence of a firewall at your site can greatly reduce the odds that outside attackers will penetrate your internal systems and networks. The firewall can also keep your own users from compromising your systems by sending dangerous information—unencrypted passwords and sensitive data—to the outside world.

The attacks on Internet-connected systems we are seeing today are more serious and more technically complex than those in the past. To keep these attacks from compromising our systems, we need all the help we can get. Firewalls are a highly effective way of protecting sites from these attacks. For that reason, we strongly recommend you include a firewall in your site's overall Internet security plan. However, a firewall should be only one component in that plan. It's also vital that you establish a security policy, that you implement strong host security, and that you consider the use of authentication and encryption devices that work with the firewalls you install. This book will touch on each of these topics while maintaining its focus on firewalls.

Scope of This Book

This book is divided into five parts.

Part I, *Network Security*, explores the problem of Internet security and focuses on firewalls as part of an effective strategy to address that problem.

- Chapter 1, *Why Internet Firewalls?*, introduces the major risks associated with using the Internet today; discusses what to protect, and what to protect against; discusses various security models; and introduces firewalls in the context of what they can and can't do for your site's security.
- Chapter 2, *Internet Services*, outlines the services users want and need from the Internet, and summarizes the security problems posed by those services.
- Chapter 3, *Security Strategies*, outlines the basic security principles an organization needs to understand before it adopts a security policy and invests in specific security mechanisms.

Part II, *Building Firewalls*, describes how to build firewalls.

- Chapter 4, *Packets and Protocols*, describes the basic network concepts firewalls work with.
- Chapter 5, *Firewall Technologies*, explains the terms and technologies used in building firewalls.
- Chapter 6, *Firewall Architectures*, describes the major architectures used in constructing firewalls, and the situations they are best suited to.
- Chapter 7, *Firewall Design*, presents the process of designing a firewall.
- Chapter 8, *Packet Filtering*, describes how packet filtering systems work, and discusses what you can and can't accomplish with them in building a firewall.
- Chapter 9, *Proxy Systems*, describes how proxy clients and servers work, and how to use these systems in building a firewall.
- Chapter 10, *Bastion Hosts*, presents a general overview of the process of designing and building the bastion hosts used in many firewall configurations.
- Chapter 11, *Unix and Linux Bastion Hosts*, presents the details of designing and building a Unix or Linux bastion host.
- Chapter 12, *Windows NT and Windows 2000 Bastion Hosts*, presents the details of designing and building a Windows NT bastion host.

Part III, *Internet Services*, describes how to configure services in the firewall environment.

- Chapter 13, *Internet Services and Firewalls*, describes the general issues involved in selecting and configuring services in the firewall environment.

- Chapter 14, *Intermediary Protocols*, discusses basic protocols that are used by multiple services.
- Chapter 15, *The World Wide Web*, discusses the Web and related services.
- Chapter 16, *Electronic Mail and News*, discusses services used for transferring electronic mail and Usenet news.
- Chapter 17, *File Transfer, File Sharing, and Printing*, discusses the services used for moving files from one place to another.
- Chapter 18, *Remote Access to Hosts*, discusses services that allow you to use one computer from another computer.
- Chapter 19, *Real-Time Conferencing Services*, discusses services that allow people to interact with each other online.
- Chapter 20, *Naming and Directory Services*, discusses the services used to distribute information about hosts and users.
- Chapter 21, *Authentication and Auditing Services*, discusses services used to identify users before they get access to resources, to keep track of what sort of access they should have, and to keep records of who accessed what and when.
- Chapter 22, *Administrative Services*, discusses other services used to administer machines and networks.
- Chapter 23, *Databases and Games*, discusses the remaining two major classes of popular Internet services, databases and games.
- Chapter 24, *Two Sample Firewalls*, presents two sample configurations for basic firewalls.

Part IV, *Keeping Your Site Secure*, describes how to establish a security policy for your site, maintain your firewall, and handle the security problems that may occur with even the most effective firewalls.

- Chapter 25, *Security Policies*, discusses the importance of having a clear and well-understood security policy for your site, and what that policy should and should not contain. It also discusses ways of getting management and users to accept the policy.
- Chapter 26, *Maintaining Firewalls*, describes how to maintain security at your firewall over time and how to keep yourself aware of new Internet security threats and technologies.
- Chapter 27, *Responding to Security Incidents*, describes what to do when a break-in occurs, or when you suspect that your security is being breached.

Part V, *Appendixes*, consists of the following summary appendixes:

- Appendix A, *Resources*, contains a list of places you can go for further information and help with Internet security: World Wide Web pages, FTP sites, mailing lists, newsgroups, response teams, books, papers, and conferences.
- Appendix B, *Tools*, summarizes the best freely available firewall tools and how to get them.
- Appendix C, *Cryptography*, contains background information on cryptography that is useful to anyone trying to decrypt the marketing materials for security products.

Audience

Who should read this book? Although the book is aimed primarily at those who need to build firewalls, large parts of it are appropriate for everyone who is concerned about Internet security. This list tells you what sections are particularly applicable to you:

System administrators
: You should read the entire book.

Senior managers
: You should read at least Part I of the book. The chapters in Part I will introduce you to the various types of Internet threats, services, and security approaches and strategies. These chapters will also introduce you to firewalls and describe what firewalls can and cannot do to enforce Internet security. You should also read Chapter 5, which provides an overview of firewall technologies. In addition, Appendix A will tell you where to go for more information and resources.

Information technology managers and users
: You should read all of the chapters we've cited for the managers in the previous category. In addition, you should read Part IV, which explains the kinds of issues that may arise at your site over time—for example, how to develop a security policy, keep up to date, and react if someone attacks your site.

Although this book provides general concepts of firewalls appropriate to any site, it focuses on "average" sites: small to large commercial or educational sites. If you are setting up a personal firewall, you may wish to read just Part I, Chapter 5, and the service chapters appropriate to the services you wish to run. If you are setting up a firewall for an extremely large site, all of the chapters will be useful to you, but you may find that you need to use additional techniques.

Platforms

To a large extent, this book is platform-independent. Because most of the information provided here consists of general principles, most of it should be applicable to you, regardless of what equipment, software, and networking you are using. The most platform-specific issue is what type of system to use as a bastion host. People have successfully built bastion hosts (which we describe in Chapter 10) using all kinds of computers, including Unix systems, Windows NT machines, Macintoshes, VMS VAXes, and others.

Having said this, we must acknowledge that this book is strongly oriented towards Unix (including Linux), with Windows NT as a major secondary theme. There are several reasons for this orientation. First, these operating systems are the dominant operating systems in the Internet world. Unix is still the predominant operating system for Internet servers, although Windows NT is a strong presence. Another reason is, of course, that our own experience is primarily in the Unix world; we have entered the world of Windows NT only recently, as it started to intersect with the world of the Internet. Although we do speak Windows NT, we do so with a strong Unix accent.

Linux, while it is not strictly speaking Unix, is a close relative of the Unix we have spent our careers working with. In many cases, it is truer to the Unix tradition than commercial operating systems entitled to use the Unix trademark. While we do mention Linux by name in some places, you should bear in mind that all of our statements about Unix are meant to include Linux except when we explicitly state otherwise.

Similarly, when we mention "Windows NT", unless we explicitly mention versions, we mean both Windows NT 4 and Windows 2000. Windows 2000 is a direct descendant of Windows NT 4 and behaves like it in most important respects. We call out differences where appropriate (although you should bear in mind that Windows 2000 was being released as this book went to press; both the operating system and the world's experience with it are bound to have changed by the time you read this).

Products

It's impossible to give a complete list of commercial and publicly available products in this book because new products are constantly being introduced and capabilities are constantly being added to existing products. Instead, we concentrate on discussing generic features and capabilities, and the consequences of having—or not having—particular capabilities, so that you can make your own evaluation of the products currently available to you. We do periodically mention individual

products, some commercial and some publicly available, particularly when there are striking features of well-known products. This is not intended to be an endorsement of the products we mention, or a slight to products that we omit.

Examples

Writing a book of this nature requires a large number of examples with hostnames and addresses in them. In order to avoid offending or inconveniencing people, we have attempted to use only names and addresses that are not in use. In most cases, we have used names and addresses that are reserved and cannot be publicly registered. In particular, this is why most of the example hosts in this book are in the ".example" domain (reserved for this use in RFC 2606). In a few cases where we needed large numbers of hostnames and felt that using the reserved example namespace would be confusing, we have used names that can be registered; we have attempted to use names that are not currently registered and do not seem likely to be registered. We apologize to anybody who inadvertently uses one of these names and is inconvenienced.

We also apologize to those readers who have memorized the entire reserved IP address space, and find it upsetting that many of our illustrations show reserved IP addresses in use over the Internet. This is, of course, impossible in practice, and we show it only to avoid attracting undesirable attention to addresses that can be accessed over the Internet.

Conventions Used in This Book

The following conventions are used in this book:

Italic
: Used for file and directory names and URLs, and for the first mention of new terms under discussion.

`Constant width`
: Used for code examples.

`Constant width italic`
: In some code examples, indicates an element (e.g., a filename) that you supply.

The following icon is used in this book:

Indicates a tip, suggestion, or general note.

Comments and Questions

We have tested and verified the information in this book to the best of our ability, but you may find that features have changed (or even that we have made mistakes!). Please let us know about any errors you find, as well as your suggestions for future editions, by writing to:

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Acknowledgments for the Second Edition

As unlikely as it may seem, we still had no idea how much time and effort the second edition would take when we started working on it; what we expected to be a relatively simple effort has turned into a marathon. Even the smallest revision requires many hands, and a fully new edition requires what seems like a cast of thousands.

Thanks to those who reviewed the second edition and made helpful comments: Steve Beaty, David LeBlanc, Phil Cox, Eric Pearce, Chuck Phillips, Greg Rose, and Wietse Venema—and to Bruce Schneier and Diana Smetters who read Appendix C on a four-hour turnaround! Thanks to the entire editorial and production team at O'Reilly, especially project manager Madeleine Newell and production editor Nancy Crumpton.

Elizabeth says: My thanks to my friends, family, and colleagues for their patience and aid; my monomaniacal interest in network protocols coupled with emotional instability and intermittent overwork have required more than a reasonable and

customary amount of tolerance. I am particularly indebted to Arnold Zwicky, Diana Smetters, Jeanne Dusseault, and Brent Chapman. Special thanks are due to my second father, Jacques Transue, who required me to take slow and calm breaks from writing. Thanks to Debby Russell and Sue Miller at O'Reilly for their deft, patient, and calm job of editing; and to Simon, who expected a simple writing project, got his life disrupted for more than a year and a half, and kept working anyway, even though we insisted on spelling everything in American instead of proper English. And thanks to the many O'Reilly people who helped to produce this book.

Simon says: I would like to thank my colleagues, my friends, and my family for their understanding and support during this project. Particular thanks go to Beryl Cooper, Mel Pleasant, Landon Curt Noll, Greg Bossert, James R. Martin II, Alesia Bischoff, and Cherry Mill for their encouragement and patience. A special mention goes to my ice hockey teammates—thanks for such an active alternative to writing. Enormous thanks to Elizabeth for asking me to coauthor and for coaching me through the process. Finally, thanks to Debby, Sue, and the staff of O'Reilly for putting this book into the hands of our readers.

Acknowledgments for the First Edition

Note: We've preserved these acknowledgments for the first edition because we continue to be grateful to the people who helped us with that edition. Note, however, that several parts of the first edition (e.g., the foreword and the TCP/IP appendix) are no longer included in the book.

When we set out to write this book, we had no idea that it would consume so much time and energy. We would never have succeeded without the help of many people.

Special thanks to Ed DeHart and Craig Hunt. Ed worked with Brent in the early stages of this book and wrote the foreword to it; we appreciate all that he has done to help. TCP/IP is essential for understanding the basics of firewall construction, and Craig Hunt, author of *TCP/IP Network Administration* (O'Reilly & Associates) has kindly let us excerpt much of that book's Chapters 1 and 2 in this book's Appendix C so readers who do not already have a TCP/IP background can get a jump start.

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Brent says: I would like to extend personal thanks to my friends and family, for keeping me going for a year and a half while I worked on the book; to my staff at Great Circle Associates, for keeping my business going; to the many hundreds of folks who've attended my Internet Security Firewalls Tutorial, for providing the impetus for this whole endeavor (and for keeping my bills paid!); and to the many thousands of subscribers to the Firewalls mailing list on the Internet, for providing a stimulating environment to develop many of the ideas found in this book. I also owe a lot of thanks to Debby Russell, our editor at O'Reilly & Associates, for all her help and guidance, and to our technical reviewers, for all their wonderful comments and suggestions. Most of all, though, I'd like to thank my very good friend and coauthor, Elizabeth Zwicky, without whose collaboration and encouragement this book probably never would have been finished, and certainly wouldn't have been as good.

Elizabeth says: My thanks go to my friends, my family, and my colleagues at Silicon Graphics, for an almost infinite patience with my tendency to alternate between obsessing about the book and refusing to discuss anything even tangentially related to it. I'd like to particularly thank Arnold Zwicky, Diana Smetters, Greg Rose, Eliot Lear, and Jeanne Dusseault for their expert moral support (often during similar crises of their own). But the most thanks for this effort have to go to Debby and Brent, for giving me a chance to be part of an unexpected but extremely rewarding project.

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