

UNIX NETWORK PROGRAMMING

Networking APIs: Sockets and XTI

The only guide to Unix network programming APIs you'll ever need!

Whether you write Web servers, client/server applications, or any other network software, you need to understand networking APIs—especially sockets—in greater detail than ever before. You need **UNIX Network Programming, Volume 1, Second Edition**.

In this book, leading Unix networking expert, W. Richard Stevens, offers unprecedented, start-to-finish guidance on making the most of sockets, the de facto standard for Unix network programming—as well as extensive coverage of the X/Open Transport Interface (XTI).

Stevens begins by introducing virtually every basic capability of TCP and UDP sockets, including socket functions and options, I/O multiplexing, and name and address conversions. He presents detailed coverage of the Posix.1g standard for sockets and Posix.1 threads. He also introduces advanced techniques for:

- | | |
|---------------------------------|-------------------------------------|
| ◆ IPv4/IPv6 interoperability | ◆ Multithreading |
| ◆ Nonblocking I/O | ◆ Debugging techniques |
| ◆ Routing sockets | ◆ Unix domain protocols |
| ◆ Broadcasting and multicasting | ◆ Raw sockets |
| ◆ IP options | ◆ Client/server design alternatives |

Learn how to choose among today's leading client/server design approaches, including TCP iterative, concurrent, preforked and prethreaded servers. Master the X/Open Transport Interface, including XTI TCP clients and servers, name and address functions, options, streams, and additional functions.

The Internet/intranet revolution has dramatically increased the demand for developers with a sophisticated understanding of network programming APIs, especially sockets. One book contains all you need to know: **UNIX Network Programming, Volume 1, Second Edition**.

ABOUT THE AUTHOR

W. RICHARD STEVENS is author of *UNIX Network Programming, First Edition*, widely recognized as the classic text in Unix networking. He is also the author of *Advanced Programming in the UNIX Environment* and the *TCP/IP Illustrated Series*. He is an acknowledged Unix and networking expert, sought-after instructor, and occasional consultant.

PRENTICE HALL
Upper Saddle River, NJ 07458

<http://www.phptr.com>

ISBN 0-13-490012-X



9 780134 900124

90000



EVENTS

Networking APIs: Sockets and XTI

UNIX NETWORK PROGRAMMING

Volume

SECOND EDITION



DOCKET
ALARM

Find authenticated court documents without watermarks at docketalarm.com.

UNIX



Prentice Hall
Upper Saddle River, NJ

Library of Congress Cataloging in Publication Data
Stevens, W. Richard
UNIX network programming / by W. Richard Stevens. -- 2nd ed.
p. cm.
Includes index.
ISBN 0-13-490012-X
1. UNIX (Computer file) 2. Computer networks. 3. Internet
programming. I. Title.
QA76.76.063S755 1997
005.7'127768--dc21 97-31761
CIP

Editorial/Production Supervision: *Eileen Clark*
Acquisitions Editor: *Mary Franz*
Marketing Manager: *Miles Williams*
Buyer: *Alexis R. Heydt*
Cover Design: *Scott Weiss*
Cover Design Direction: *Jerry Votta*
Editorial Assistant: *Noreen Regina*



© 1998 Prentice Hall PTR
Prentice-Hall, Inc.
A Simon & Schuster Company
Upper Saddle River, NJ 07458

Prentice Hall books are widely used by corporations and government agencies for training, marketing, and resale. The publisher offers discounts on this book when ordered in bulk quantities.

For more information, contact

Corporate Sales Department,
Phone: 800-382-3419; FAX: 201-236-7141
E-mail (Internet): corpsales@prenhall.com

Or write: Prentice Hall PTR

Corp. Sales Department
One Lake Street
Upper Saddle River, NJ 07458

All rights reserved. No part of this book may be reproduced, in any form or by any means, without permission in writing from the publisher.

Printed in the United States of America

1098765

ISBN 0-13-490012-X

Prentice-Hall International (UK) Limited, *London*
Prentice-Hall of Australia Pty. Limited, *Sydney*
Prentice-Hall Canada Inc., *Toronto*
Prentice-Hall Hispanoamericana, S.A., *Mexico*
Prentice-Hall of India Private Limited, *New Delhi*
Prentice-Hall of Japan, Inc., *Tokyo*
Simon & Schuster Asia Pte. Ltd., *Singapore*
Editora Prentice-Hall do Brasil, Ltda., *Rio de Janeiro*

003

2.6	TIME_WAIT State	40
2.7	Port Numbers	41
2.8	TCP Port Numbers and Concurrent Servers	44
2.9	Buffer Sizes and Limitations	46
2.10	Standard Internet Services	50
2.11	Protocol Usage by Common Internet Applications	52
2.12	Summary	52

Part 2. Elementary Sockets **55**

Chapter 3. Sockets Introduction **57**

3.1	Introduction	57
3.2	Socket Address Structures	57
3.3	Value-Result Arguments	63
3.4	Byte Ordering Functions	66
3.5	Byte Manipulation Functions	69
3.6	inet_aton, inet_addr, and inet_ntoa Functions	70
3.7	inet_pton and inet_ntop Functions	72
3.8	sock_ntop and Related Functions	75
3.9	readn, writen, and readline Functions	77
3.10	isfdtype Function	81
3.11	Summary	82

Chapter 4. Elementary TCP Sockets **85**

4.1	Introduction	85
4.2	socket Function	85
4.3	connect Function	89
4.4	bind Function	91
4.5	listen Function	93
4.6	accept Function	99
4.7	fork and exec Functions	102
4.8	Concurrent Servers	104
4.9	close Function	107
4.10	getsockname and getpeername Functions	107
4.11	Summary	110

Chapter 5. TCP Client-Server Example **111**

5.1	Introduction	111
5.2	TCP Echo Server: main Function	112
5.3	TCP Echo Server: str_echo Function	113
5.4	TCP Echo Client: main Function	113
5.5	TCP Echo Client: str_cli Function	115
5.6	Normal Startup	115
5.7	Normal Termination	117
5.8	Posix Signal Handling	119
5.9	Handling SIGCHLD Signals	122
5.10	wait and waitpid Functions	124

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.