

# Table of Contents

<b><i>Introduction</i></b> .....	<b>1</b>
About This Book .....	1
Conventions Used in This Book .....	2
Foolish Assumptions .....	2
How This Book Is Organized .....	3
Part I: TCP/IP from Names to Addresses .....	3
Part II: Getting Connected .....	3
Part III: Configuring Clients and Servers: Web, E-Mail, and Chat .....	4
Part IV: Even More TCP/IP Applications and Services .....	4
Part V: Network Troubleshooting and Security .....	4
Part VI: The Part of Tens .....	5
Icons Used in This Book .....	5
Where to Go from Here .....	6
<b><i>Part I: TCP/IP from Names to Addresses</i></b> .....	<b>7</b>
<b>Chapter 1: Understanding TCP/IP Basics</b> .....	<b>9</b>
Following Rules for the Internet: TCP/IP Protocols .....	10
Who's in charge of the Internet and TCP/IP? .....	10
Checking out RFCs: The written rules .....	12
Examining Other Standards Organizations That Add to the Rules .....	13
Distinguishing Between the Internet, an Internet, and an Intranet .....	13
Extending Intranets to Extranets .....	14
Introducing Virtual Private Networks .....	15
Exploring Geographically Based Networks .....	16
Networks connected by wires and cables .....	16
Wireless networks .....	17
The geography of TCP/IP .....	17
<b>Chapter 2: Layering TCP/IP Protocols</b> .....	<b>19</b>
Taking a Timeout for Hardware .....	19
Starting with network connection media .....	20
Colliding with Ethernet .....	20
Stacking the TCP/IP Layers .....	22
Layer 1: The physical layer .....	23
Layer 2: The data link layer .....	24
Layer 3: The internet layer .....	24
Layer 4: The transport layer .....	24
Layer 5: The application layer .....	25

Chewing through Network Layers: A Packet's Journey.....	25
Understanding TCP/IP: More than just protocols .....	27
Determining whether your network has a protocol, an application, or a service.....	27
Plowing through the Protocol List (In Case You Thought Only Two Existed).....	28
Physical layer protocols .....	29
Data link layer protocols.....	29
Internet layer protocols.....	29
Transport layer protocols .....	31
Application layer protocols.....	36

### **Chapter 3: Serving Up Clients and Servers ..... 43**

Understanding the Server Side .....	43
Examining the server's job .....	44
Identifying types of servers .....	44
Using dedicated servers.....	45
Understanding the Client Side .....	45
Defining a client.....	45
Clients, clients everywhere .....	46
Answering the Question "Are You Being Served?".....	46
Supporting TCP/IP with Client/Server and Vice Versa .....	47
Recognizing Other Internetworking Styles: Peer-to-Peer Computing.....	47
Determining whether peer-to-peer workgroups are still handy ....	48
P2P applications --- P2P across the Internet.....	48

### **Chapter 4: Nice Names and Appetizing Addresses ..... 51**

What Did You Say Your Host's Name Is?.....	52
Playing the numbers game .....	52
Identifying a computer as uniquely yours.....	53
Translating names into numbers .....	54
Taking a Closer Look at IP Addresses.....	54
Savoring Classful Addressing.....	55
Recognizing the Parts of an IP Address .....	56
Class A is for a few enormous networks .....	57
Class B is for lots of big networks.....	57
Class C is for millions of small networks .....	57
Class D is for multicasting .....	57
Biting Down on Bits and Bytes.....	58
Obtaining an IP Address .....	60
Choosing whether to go public or stay private .....	60
Obeying the network police .....	61
Obtaining a globally unique IP address .....	61
Acquiring a static address .....	62
Getting dynamic addresses with DHCP .....	62
Finding out your IP address .....	62

Resolving Names and Addresses with DNS.....	64
Understanding the minimum amount of information about DNS.....	64
Using DNS to “Do Nifty Searches”.....	65
Describing Fully Qualified Domain Names (FQDNs) .....	65
Branching out into domains .....	66
Stalking new domains.....	68
Determining Whether the Internet Will Ever Fill Up .....	68
Choking on bandwidth .....	68
Panicking about not having enough addresses .....	69
Dishing Up More Kinds of Addresses .....	69
MAC: Media Access Control .....	69
Port numbers.....	70

## **Chapter 5: Need More Addresses? Try Subnetting and NAT . . . . . 73**

Working with Subnets and Subnet Masks .....	74
Defining subnet masks .....	76
Why a network has a mask when it has no subnets.....	76
Subnetting 101 .....	77
Letting the DHCP Protocol Do the Work for You .....	79
One administrator’s nightmare is another’s fantasy.....	80
Understanding how the DHCP protocol works — it’s client/server again.....	81
Being evicted after your lease expires.....	82
Sharing Addresses with Network Address Translation (NAT).....	83
Understanding how NAT works .....	83
Securing NAT.....	84
Using NAT and DHCP to work together .....	84
Swallowing NAT incompatibilities .....	86
Digesting NAT-PT (Network Address Translation-Protocol Translation) .....	87

## **Part II: Getting Connected .....** 89

### **Chapter 6: Configuring a TCP/IP Network — the Software Side . . . 91**

Installing TCP/IP? Probably Not .....	91
Detecting whether TCP/IP is installed.....	92
Determining whether it’s IPv4, IPv6, or both .....	92
Savoring TCP/IP right out of the box.....	93
Six Steps to a Complete TCP/IP Configuration.....	94
Step 1: Determining whether your computer is a client or server or both .....	95
Step 2: Gathering client information .....	95
Step 3: Setting up your NIC(s) .....	95



- Step 4: Deciding on a static IP address or a DHCP leased address ..... 96
- Step 5: Choosing how your host will translate names into IP addresses ..... 97
- Step 6: Gathering server information ..... 97
- Setting TCP/IP Client Properties..... 97
  - Configuring TCP/IP on a Mac OS X client..... 98
  - Configuring TCP/IP on a Linux or Unix client..... 100
  - Configuring a TCP/IP client on Windows Vista ..... 102
  - Configuring a TCP/IP client on Windows XP ..... 103
- Setting TCP/IP Server Properties..... 104
- Installing TCP/IP from Scratch..... 105
- Feasting on Network Files..... 107
  - The local hosts file..... 107
  - The trusted hosts file, hosts.equiv ..... 109
  - Freddie's nightmare: Your personal trust file ..... 110
  - The services file ..... 111
- Daemons Aren't Devils..... 113
  - Relishing your daemons..... 113
  - Finding the daemons on your computer ..... 113

**Chapter 7: Networking SOHO with Wireless ..... 115**

- Gulping the Minimum Hardware Details ..... 116
  - NICs..... 116
  - Routers ..... 117
- Setting Up a Home Wireless Network in Four Steps ..... 118
  - Step 1: Choose your wireless hardware..... 118
  - Step 2: Connect your wireless router ..... 120
  - Step 3: Set up your wireless router ..... 121
  - Step 4: Connect your computers ..... 124
- Securing Your Network..... 124
  - Securing the wired side..... 125
  - Securing the wireless side ..... 125
- Broadband for Everyone? We Hope ..... 128
  - Level 1: Using wireless hotspots..... 128
  - Level 2: Paying for broadband wireless service ..... 129
  - Level 3: Going anywhere you want to connect to the Internet with WiMAX ..... 129

**Chapter 8: Advancing into Routing Protocols ..... 131**

- Understanding Routing Lingo ..... 132
- Routing Through the Layers — the Journey of a Packet..... 135
  - A new message heads out across the Net ..... 135
  - The message visits the router ..... 137
  - Into an Internet router and out again ..... 139
  - Reaching the destination ..... 140

Getting a Handle on How Routers Work .....	143
Getting Started with Routers.....	146
Swallowing Routing Protocols .....	148
Nibbling on IGP protocols.....	149
Exterior Gateway Protocols (EGP) .....	152
Understanding How BGP Routers Work .....	154
Juicing Up Routing with CIDR .....	154
C Is for Classless .....	156
CIDR pressing the routing tables .....	157
You say “subnet,” aggregating.net says “aggregate”.....	159
Securing Your Router.....	159
Coring the apple with Denial of Service (DoS) Attacks.....	160
Hijacking routers.....	160
Eavesdropping on BGP.....	161
It’s so sad .....	161
S-BGP (Secure BGP): Proposals to make EGP routing secure.....	161

## **Chapter 9: IPv6: IP on Steroids. .... 163**

Say Hello to IPv6 .....	163
Digesting IPv4 limitations .....	164
Absorbing IPv6 advantages .....	164
If It Ain’t Broke, Don’t Fix It — Unless It Can Be Improved .....	165
Wow! Eight Sections in an IPv6 Address?.....	165
Why use hexadecimal?.....	166
There’s good news and there’s bad news .....	166
Take advantage of IPv6 address shortcuts.....	167
Special IPv6 Addresses .....	169
IPv6 — and the Using Is Easy.....	169
Checking out the network with autodiscovery.....	170
Ensuring that your address is unique .....	171
Automatically assigning addresses .....	172
Realizing that autoregistration says “Let us serve you”.....	172
IPv6 Installation .....	173
Configuring IPv6 on Windows XP and Windows Server 2003.....	173
Welcoming IPv6 to Mac OS X.....	175
Getting started with IPv6 in Unix and Linux.....	175
Other Delicious IPv6 Morsels.....	176
Security for all .....	176
Faster, better multimedia .....	178
Support for real-time applications.....	178
Improved support for mobile computing .....	178
Share the Planet — IPv6 and IPv4 Can Coexist.....	179
Stacking IPv4 and IPv6.....	179
Tunneling IPv6 through IPv4 .....	180
Whew — You Made It!.....	180

**Chapter 10: Serving Up DNS (The Domain Name System) . . . . . 181**

Taking a Look at the DNS Components .....	182
Going Back to DNS Basics.....	183
Revisiting Client/Server with DNS .....	184
Dishing up DNS client/server definitions.....	184
Snacking on resolvers and name servers .....	184
Who's in charge here?.....	186
Serving a DNS client's needs .....	186
Oops! Can't help you .....	187
Who's Responsible for Name and Address Information?.....	187
Understanding Servers and Authority .....	189
Primary name server: Master of your domain .....	189
Secondary name servers.....	190
Caching servers.....	192
Understanding Domains and Zones .....	193
Problem Solving with Dynamic DNS (DYNDNS).....	195
Diving into DNSSEC (DNS Security Extensions).....	195
Why does DNS need DNSSEC?.....	196
Glimpsing behind the scenes of DNSSEC.....	197

**Part III: Configuring Clients and Servers:  
Web, E-Mail, and Chat..... 199****Chapter 11: Digesting Web Clients and Servers. . . . . 201**

Standardizing Web Services.....	201
Deciphering the Languages of the Web .....	202
HTML.....	202
HTML 4.....	204
XML.....	205
XHTML.....	205
HTML + MIME = MHTML .....	205
Java and other Web dialects .....	205
Hypertext and hypermedia.....	206
Understanding How Web Browsing Works .....	207
Serving up a Web page.....	207
Storing user information as cookies.....	209
Managing cookies with your browser .....	210
Dishing up multimedia over the Internet.....	212
Feeding Web Pages with Atom and RSS.....	214
Reducing the Web's Wide Waistline to Increase Speed.....	215
Proxy Serving for Speed and Security.....	218
Caching pages .....	219
Improving security with filtering .....	220
Setting up a proxy client .....	220
Finishing touches.....	223

Setting Up a Caching Proxy Server.....	223
Outlining the general steps for installing and configuring squid.....	223
Configuring squid for Microsoft Windows Server 2008 .....	224
Browsing Securely.....	228
Ensuring that a site is secure .....	228
Using your browser's security features.....	229
Setting Up a Web Server .....	230
Setting up the Apache HTTP Server .....	231
Speeding up Apache.....	234
Making Apache more secure.....	234
Adding Security to HTTP.....	235
Taking a look at HTTPS.....	236
Getting up to speed on SSL.....	236
Stepping through an SSL Transaction.....	237
Using Digital Certificates for Secure Web Browsing .....	238
<b>Chapter 12: Minimum Security Facilities.....</b>	<b>239</b>
What's the Worst That Could Happen?.....	239
Jump-Starting Security with the Big Three.....	240
Installing a personal firewall.....	241
Vaccinating your system with the anti-s.....	242
Encrypting data so snoopers can't read it .....	243
Adding a Few More Basic Protections .....	243
<b>Chapter 13: Eating Up E-Mail .....</b>	<b>245</b>
Getting the Big Picture about How E-Mail Works.....	245
Feasting on E-Mail's Client-Server Delights .....	246
E-mail clients .....	246
E-mail clients versus Web mail clients.....	247
E-mail servers .....	247
Postfix: Configuring the fastest-growing MTA.....	249
Sharpening the Finer Points of Mail Servers.....	252
Transferring e-mail by way of store-and-forward .....	253
Transferring e-mail by way of DNS MX records.....	254
Understanding How SMTP Works with MTAs.....	255
Defining E-Mail Protocols .....	255
Adding More Protocols to the Mix .....	256
POP3 .....	256
IMAP4 .....	257
HTTP.....	258
LDAP .....	258
DNS and its MX records .....	258

<b>Chapter 14: Securing E-Mail</b> .....	<b>261</b>
Common Sense: The Most Important Tool in Your Security Arsenal...	261
Being Aware of Possible Attacks .....	262
Phishing.....	263
Popping up and under.....	263
Getting spied on.....	263
Meeting malware.....	265
Bombing.....	265
Have you got anything without spam? Spam, spam, spam! .....	266
Spoofing.....	267
Finding Out Whether You're a Victim.....	267
Playing Hide-and-Seek with Your E-Mail Address.....	268
Layering Security .....	269
Layer 1: Letting your ISP protect your network.....	269
Layer 2: Building your own walls.....	270
Layer 3: Securing e-mail on the server side.....	271
Layer 4: Securing e-mail on the client side.....	274
Layer 5: Suitely extending e-mail security.....	278
Using Secure Mail Clients and Servers.....	278
Setting up a secure IMAP or POP client.....	279
Setting up a secure mail server.....	281
Encrypting e-mail.....	281
<b>Chapter 15: Beyond E-Mail: Social Networking and Online Communities</b> .....	<b>285</b>
Thumbing to Talk About.....	286
Choosing a Communication Method.....	287
Getting together with IRC .....	288
Jabbering with XMPP .....	288
Feeding Your Craving for News .....	289
Getting Even More Social.....	290
<b>Part IV: Even More TCP/IP Applications and Services</b> .....	<b>291</b>
<b>Chapter 16: Mobile IP — The Moveable Feast</b> .....	<b>293</b>
Going Mobile .....	294
Understanding How Mobile IP Works .....	294
Sailing into the Future: Potential Mobile IPv6 Enhancements .....	296
Mobilizing Security.....	297
Understanding the risks.....	297
Using basic techniques to protect your mobile devices .....	298

<b>Chapter 17: Saving Money with VoIP (Voice Over Internet Protocol)</b> .....	<b>299</b>
Getting the Scoop on VoIP .....	299
Getting Started Using VoIP .....	300
Step 1: Get broadband .....	300
Step 2: Decide how to call .....	301
Step 3: Make the call .....	302
Step 4: Convert the bits back into voice (with VoIP software) ....	303
Step 5: Converse .....	303
Yo-Yo Dieting: Understanding How VoIP Packets Move through the Layers .....	304
Trekking the Protocols from RTP to H.323 .....	304
Talking the talk with the TCP/IP stack and more .....	305
Ingesting VoIP standards from the ITU .....	306
Vomiting and Other Vicious VoIP Vices .....	306
Securing Your Calls from VoIP Violation .....	306
You, too, can be a secret agent .....	307
Authenticating VoIP-ers .....	307
Keeping voice attacks separate from data .....	308
Defending with firewalls .....	308
Testing Your VoIP Security .....	308
 <b>Chapter 18: File and Print Sharing Services</b> .....	 <b>309</b>
Defining Basic File Sharing Terms .....	309
Using FTP to Copy Files .....	310
Understanding how FTP works .....	310
Using anonymous FTP to get good stuff .....	311
Choosing your FTP client .....	312
Transferring the files .....	312
Securing FTP file transfers .....	315
Using rcp or scp to Copy Files .....	316
Sharing Network File Systems .....	317
Nifty file sharing with NFS (Network File System) .....	317
Solving the buried file update problem with NFSv4 .....	318
Examining the mount Protocol .....	319
Automounting .....	320
Configuring an NFS Server .....	320
Step 1: Edit the exports file .....	321
Step 2: Update the netgroup file .....	321
Step 3: Start the daemons .....	322
Configuring an NFS Client .....	323

Picking Up Some NFS Performance Tips .....	324
Hardware tips .....	324
Server tips .....	325
Client tips .....	325
Weighing performance against security .....	325
Getting NFS Security Tips .....	325
Sharing Files Off the Stack .....	326
Using Windows network shares .....	326
Using Samba to share file and print services .....	327
Working with Network Print Services .....	328
Valuing IPP features .....	329
Setting up Windows Server 2008 print servers over IPP .....	330
Printing with the Common Unix Print System (CUPS) .....	331
<b>Chapter 19: Sharing Compute Power .....</b>	<b>333</b>
Sharing Network Resources .....	333
Accessing Remote Computers .....	334
Using a telnet client .....	334
“R” you ready for more remote access? .....	335
Executing commands with rsh and rexec .....	335
Securing Remote Access Sessions .....	336
Taking Control of Remote Desktops .....	337
Sharing Clustered Resources .....	338
Clustering for high availability .....	338
Clustering for load balancing .....	338
Clustering for supercomputing .....	339
Sharing Compute Power with Grid and Volunteer Computing .....	339
<b>Part V: Network Troubleshooting and Security .....</b>	<b>341</b>
<b>Chapter 20: Staying with Security Protocols .....</b>	<b>343</b>
Determining Who Is Responsible for Network Security .....	344
Following the Forensic Trail: Examining the Steps for Securing Your Network .....	344
Step 1: Prescribing Preventive Medicine for Security .....	345
Step 2: Observing Symptoms of Malware Infection .....	347
Uncovering more contagions .....	348
Step 3: Diagnosing Security Ailments with netstat, ps, and Logging .....	355
Monitoring network use with ps .....	355
Nosing around with netstat .....	357
Examining logs for symptoms of disease .....	362
Syslog-ing into the next generation .....	363
Microsoft proprietary event logging .....	370

<b>Chapter 21: Relishing More Meaty Security</b> .....	<b>373</b>
Defining Encryption.....	374
Advancing Encryption with Advanced Encryption Standard (AES) .....	375
Peering into Authentication .....	376
Do you have any ID? A digital certificate will do .....	377
Getting digital certificates.....	377
Using digital certificates.....	378
Checking your certificates .....	379
Coping with certificate problems .....	380
IPSec (IP Security Protocol): More Authentication.....	381
Kerberos — Guardian or Fiend? .....	382
Understanding Kerberos concepts.....	382
Playing at Casino Kerberos.....	383
Training the dog — one step per head .....	384
Setting up a Kerberos server step by step .....	385
Setting up a Kerberos client step by step.....	387
 <b>Chapter 22: Troubleshooting Connectivity and Performance Problems</b> .....	 <b>389</b>
Chasing Network Problems from End to End .....	390
Getting Started with Ping.....	390
Pinging away with lots of options.....	391
And now, for “some-ping” completely different:	
Running ping graphically .....	393
Death by ping .....	395
Diagnosing Problems Step by Step.....	396
Pinging yourself and others.....	396
Using nslookup to query a name server .....	401
Using traceroute (tracert) to find network problems.....	403
Simplifying SNMP, the Simple Network Management Protocol.....	406
Just barely describing how SNMP works.....	406
Using SMNP programming free .....	407
 <b>Part VI: The Part of Tens</b> .....	 <b>411</b>
<b>Chapter 23: Ten More Uses for TCP/IP</b> .....	<b>413</b>
<b>Chapter 24: Ten More Resources for Information about TCP/IP Security</b> .....	<b>417</b>
 <b>Index</b> .....	 <b>421</b>