

Index

We have alphabetized files under their last components. And in most cases, *only* the last component is listed. For example, to find index entries relating to the **/etc/passwd** file, look under **passwd**. Our friendly Linux distributors have forced our hand by hiding standard files in new and inventive directories on each system.

A

- A DNS records 396, 407
- A6 DNS records 404
- AAAA DNS records 404
- Abell, Vic 74
- access agents, email 533
- access control lists *see* ACLs
- access database, **sendmail** 589, 591–594
- accounts *see* user accounts
- ACLs, DNS 429–430, 451–453
- ACLs, filesystem 88–92, 833
- ACLs, firewall 701–708
- Adams, Rick 320
- address match lists, BIND 422
- Address Resolution Protocol (ARP) 275, 296–297, 315
- addresses, email 95, 535
- addresses, Ethernet (aka MAC) 280, 292
- addresses, IP *see* IP addresses
- addresses, SCSI 117
- adjtimex** system call 903
- ADSM/TSM backup system 197
- agetty** process 855–858
- aio** daemon 894
- air conditioning 796–798
- AirPort 360
- AIT backup tapes 166
- Albitz, Paul 423
- aliases** file 106, 545–551
- aliases, email 544–551
 - see also* email
 - see also* **sendmail**
 - abuse 548, 594
 - distribution 156
 - examples 548
 - file format 545
 - global 95
 - hashed database 551
 - loops 546, 550
 - and mailing lists 551–554
 - for new users 95
 - postmaster 545
 - root 548
- aliases.db** file 551
- alien** 235
- Allman, Eric 209, 530, 558, 566, 595
- allow-recursion option, DNS 425
- allow-update clause, DNS 433, 450
- always_add_domain feature, **sendmail** 575
- Amanda backup system 197
- amavisd** email virus filter 637
- amd** 895
- American Power Conversion (APC) 799
- American Registry for Internet Numbers (ARIN) 288–289, 293, 371
- Amstadt, Bob 825
- Anaconda 226
- anacron** 156, 887
- Analog Apache log analyzer 727
- Anderson, Paul 261
- anonymous FTP *see* FTP
- Anvin, H. Peter 225
- Apache *see* web hosting
- Apache Software Foundation 12, 724
- /etc/apache2** directory 724
- APC (American Power Conversion) 799
- APNIC (Asia-Pacific Network Information Center) 383
- appropriate use policies (AUPs) 954
- APT, software tool 241–246
- apt-ftparchive** 244
- apt-get** 241–246
- apt-proxy** 244
- ARIN (American Registry for Internet Numbers) 288–289, 293, 371
- ARK language 262
- Armstrong, Jason 620
- ARP (Address Resolution Protocol) 275, 296–297, 315
- arp** command 296
- ARPANET 272
- Arusha Project 261
- Asia-Pacific Network Information Center (APNIC) 383
- at** 887
- AT&T Bell Labs 5
- ata** daemon 894

ATA/ATAPI interface *see* IDE
 ATAPI CD-ROM device names 873
atd 887
 Athena, Project 741
 Atkins, Todd 220
 ATM networks 362–363
auth.log file 206
 authors, contacting xxxvi
/etc/auto.master file 497–498
automount script 497
automount daemon 497–499, 895
 automounters
 amd 895
 automount 497–499, 895
 configuration 498–500
 NFS and 497–500
 Windows 834
 autonomous systems 340
AutoYaST 230
 AUUG group 965
 avoid-v4-udp-ports option, DNS 427
 AWStats Apache log analyzer 727

B

backspace vs. delete keys 859
 backup software and systems
 see also backups
 see also Bacula
 ADSM/TSM 197
 Amanda 197
 Bacula 179–196
 commercial systems 197–198
 cpio 178
 dd 178
 dump/restore 169–176
 tar 177–178
 Veritas 198
 backups 158–198
 see also backup software and systems
 see also Bacula
 see also media, backup
 compression 164
 of a damaged disk 133
 designing data for 163
 disaster planning 939
 filesystem size 161
 fitting on media 160
 full restore 175–176
 hints 159–163

backups *continued*
 incremental 170
 interval between 159
 off-site storage 161
 programs 177–197
 to removable disks 165
 restoring 173–177, 939
 schedules 171–173
 security 161, 686
 setting up 169–176
 for upgrades 176–177
 when to make 162
 for Windows 197
 Bacula 179–196
 see also Bacula configuration files
 architecture 180
 client file daemon 188
 daemons, starting 189
 installation 181–182
 manual backup 190–192
 media pools 190
 restoring files 192–195
 troubleshooting 195–196
 Bacula configuration files 182–189
 see also Bacula
 /etc/bacula directory 182
 /etc/bacula-dir.conf file 183–187
 /etc/bacula/bacula-fd.conf file 189
 bacula-sd.conf file 187
 bconsole.conf file 188
 bad blocks, disk 123
 Bailey, Mick 885
 Baretta, Anne 860
bash shell 4, 32, 98
.bash_profile file 105
.bashrc file 105
 Bastille Linux 710
 baud rate 863
 BCP documents 275
 Beowulf clusters 964
 Bergen Linux User Group 961
 Berkeley DB library 169, 253–254, 551, 560, 577, 628
 Berkeley Internet Name Domain system *see* BIND
 Berkeley UNIX 5
 BGP routing protocol 339
 bidirectional modems 864
/bin directory 75

BIND
 see also DNS
 see also name servers
 see also **named**
 ACLs 451–453
 address match lists 422
 client configuration 418–420
 components 411
 configuration 420–446
 configuration examples 439–446
 configuration files 421–423
 debugging 466–478
 distribution-specific information 478–481
 DNSSEC 387, 456–463
.key DNSSEC key file 454
dnssec-keygen 454, 458
dnssec-signzone 460–461
doc (domain obscenity control) 476–478
 documentation 481–482
 forwarding zone, configuring 436
 hardware requirements 421
 incremental zone transfers 388, 429, 447
 ISC configuration example 444
 keys, generating 458
 KSK (key signing key) 458, 460
 localhost zone configuration example 439
 logging 411, 432, 446, 466–471
 loopback address 437
 master server, configuring 433
/etc/named directory 424
/etc/named.conf file 421–446, 450–451, 470, 480–481
named-checkconf 421, 455, 478
named-checkzone 421, 478
nanny script 446
 notification options 424
nsupdate 449
 performance 478
.private DNSSEC key file 454
 query forwarding 427
/etc/resolv.conf file 418–420
 resolver testing 420
rndc 436–438, 447, 471–473
/etc/rndc.conf file 437
/etc/rndc.key file 437
rndc-confgen 437
 root server hints 435
root.cache file 435

- BIND *continued*
 security 417, 424, 451–464
 shell interfaces *see* **dig** and **nslookup**
 signed zones, creating 458
 slave server, configuring 434
 split DNS 438–439, 441–444
 statistics 473
 stub zones, configuring 434
/etc/syslog.conf file 466
 updating zone files 447–450
 versions 410–411
 zone transfers 413, 425, 447–448
- BIOSes 25–26
 bootstrapping and IDE 113
 on SCSI cards 134
- black hole lists, spam 598, 635
- blackhole option, DNS 428
- Blandy, Jim 253
- block device files 77, 79, 871
- blocking factor, tape 177
- bogus directive, DNS 431
- /boot** directory 75
- boot loaders 23, 26–31, 124, 138
 GRUB 26–28, 30, 32
 LILO 28–29, 31–32
 multibooting 30
- boot.log** file 207
- boot.msg** file 206
- BOOTP protocol 312
- /etc/bootparams** file 899
- bootstrapping 21–25
 automatic vs. manual 22
 device probing 23
 directly to **bash** 37
 filesystem checking 132
fsck and 25
 kernel initialization 23
 kernel options 29
 kernel threads 23
 mounting NFS filesystems 495
 multibooting 30–31
 options 883
 PC-specific issues 25
 single-user mode 22, 24–25, 31–33
 startup scripts 32–40
/etc/sysconfig directory 37–38
- breakout boxes 865
- broadcast addresses 281
- broadcast domain 352
- broadcast storms 301, 357
- browsers, web 720
- BSD (Berkeley UNIX) 6
- BSD FFS filesystem 120
- BugTraq 713
- Burgess, Mark 260
- bus errors 58
- BUS signal 58
- butt blocks (RJ-45 connectors) 851
- byte swapping 178
-
- ## C
-
- CA (Certificate Authority) 731
- cable modems 365
- cables
see also connectors
 10*Base* 352–355
 Category * 352–355, 366
 DB-9 to DB-25 848
 Ethernet 278, 353–355
 IDE 114
 labeling 370, 934
 mini DIN-8 to DB-25 848
 modem 846
 null modem 846–847
 RJ-45 to DB-25 850
 SATA 114
 SCSI 115–117
 serial, length limits 853
 STP 844
 straight-through 846
 UTP 844
 Yost RJ-45 standard 850–852
- Cacti performance monitoring tool 664
- CAIDA (Cooperative Association for Internet Data Analysis) 291, 402
- Card, Rémy 120
- ccTLDs 379
- cdebconf** 231
- cdebootstrap** 231
- CentOS 7
- Cerf, Vint 273
- CERT 712
- Certificate Authority (CA) 731
- Certificate Signing Request (CSR) 731
- Certified Information Systems Auditor (CISA) 675
- cf/cf** directory, **sendmail** 568
- cfengine** 260
- CGI scripting 722
- chage** password aging program 680
- ChaosNet 390
- Chapman, Brent 552
- character device files 77, 79, 871
- chat** 325
- chat scripts, PPP 323, 326–328
- Chatsworth Products 799
- chattr** 87
- checklists, system administration 943
- checksendmail** 617
- chfn** 98
- chgrp** 86
- chkconfig** 36, 39, 520
- chmod** 81, 84–86, 89
- chown** 86
- chroot**
 for FTP 735
 for **named** 451, 453
 for Postfix 625
 for **sendmail** 607
- chsh** 98–99
- ci**, RCS check in 249–250
- CIA triad 673
- CIDR (Classless Inter-Domain Routing) 283, 286–288
- CIFS *see* Samba
- CIM (Common Information Module) system configuration 262
- CISA (Certified Information Systems Auditor) 675
- Cisco routers 346–348, 701, 714
- CiscoWorks 667
- CISSP (Certified Information Systems Security Professional) 674
- clocks, synchronization 902
- clone** system call 56
- closelog** routine 218–220
- CNAME DNS records 399
- co**, RCS check out 249, 251
- COBIT (Control Objectives for Information and related Technology) 960
- commands, finding 15
- commands, scheduling 150–157
- Computer Systems Research Group (CSRG) 5
- concentrators *see* Ethernet, hubs
- confCOPY_ERRORS_TO option, **sendmail** 569
- .config** file for kernel 877–878
- configuration files
 copying 505–511
 pulling 510
 pushing 505–510
 sharing 502–526

ConnectionRateThrottle option,
sendmail 608

connectors
see also cables 843
 DB-25 844–847
 DB-9 848
 IDE 113
 mini DIN-8 847
 RJ-45 849
 RS-232 to USB adapters 865
 SCSI 115–117

console emulators 859

/dev/console file 218

console, logging to 218

CONT signal 58, 61, 68

contacting the authors xxxvi

control characters
 in filenames 77
 and the terminal driver 859–861

control terminal 56

controls statement, DNS 436–438

conventions used in this book 9–10

cookies, NFS 486

cooling systems 940

Cooper, Mendel 11

Cooperative Association for Inter-
 net Data Analysis (CAIDA) 402

copyright issues 950

Corbet, Jonathan 325

core files 154

Council of European National Top-
 level Domain Registries 383

country code top-level domains 379

cpio 178

CPIP 961

CPU
 load averages 808
 statistics 808
 usage, analyzing 806–809, 813

cracklib 682

cron daemon 150–156, 887
 common uses 154–156
 configuration (crontab) files
 151–153, 887
 logs 151
 management 153
 skipped commands 156
 to automate logging 201

/etc/cron.allow file 153

/etc/cron.deny file 153

crond *see* **cron** daemon

crontab command 153

crontab files 151–153, 887

crypt library routine 679

Crypto-Gram newsletter 713

cryptography
 DES algorithm 679
 Diffie-Hellman key exchange
 456, 679
 in DNS 387, 453–463
 IPsec 709
 in LDAP 526
 legal issues 949
 MD5 algorithm 96, 454
 password encryption 94, 96,
 542, 830
 public key 456
 in **sendmail** 603–610
 SSL 730

.cshrc file 105

CSLIP protocol 320

CSMA/CD (Ethernet) 351

CSR (Certificate Signing Request)
 731

CSRG (Computer Systems Research
 Group) 5

ctime file attribute 83

CTS (clear to send) signal 853

cu 864

CUPS 767–790, 894
 administration 772–780
 architecture 767–772
 command line utilities 779
 comparison to ATT/BSD print-
 ing 779
 compatibility commands 778
 configuration examples 775
 documentation 780
 filters 771–772
 HTTP and 769
 logging 781
 network printing 768
 PPD printer description files
 770–771
 print queues 767
 printer autoconfiguration 774
 printer classes 775
 printing a document 767
 removing a printer 776
 startup scripts 773, 780
 troubleshooting 780–782

/etc/cups directory 772

cupsd daemon 768, 780

/etc/cups/cupsd.conf file 768, 773,
 781

cupsdconf 773

CVS 251–253

Cygwin X server tools 823, 827

cylinders, disk 120

cyrus mailer 573

D

daemons
see also individual daemon
 names
 booting 898
 configuration 898
 email 897
 kernel 893
 network 900–901
 NFS 895–896
 printing 894
 remote command execution 898
 remote login 898
 Samba 895–896
sendmail queue runner 613

damaged filesystems 133

DARPA (Defense Advanced Re-
 search Project Agency) 272, 712

data center
 cooling 797
 power 798
 racks 799
 standards 800
 temperature monitoring 798
 tool box 800
 wiring tracks 799

data compression, modems 864

databases
see also MySQL
 administrative 504, 511
 DNS 378, 389–409
 Foomatic printer database 771,
 782
 NIS 511–512
sendmail 577–578, 591–594
 of supported USB devices 784

datasize option, DNS 426

date 203

Dawson, Terry 12

DB-25 connectors 844–847

DB-9 connectors 848

dbm/ndbm library 577

DCD (data carrier detect) signal
 852–853

DCE (Data Communications Equip-
 ment) interface 845–847

dd 133, 178

DDS/DAT tapes 166

.deb software package format 235

- Debian network configuration 310
- debian-installer** 231
- debugging *see* troubleshooting
- DEC VT100 terminal 858
- DeCSS 950
- default route 305, 329, 336
- DEFAULT_HOME variable in **log-in.defs** 98
- DefaultUser option, **sendmail** 547, 603
- DELAY_LA option, **sendmail** 608, 613
- delegation-only option, DNS 429
- delete vs. backspace keys 859
- delivery agents, email 532
- denial of service (DOS) attacks 213, 397, 511, 608, 817
- Deraison, Renaud 690
- DES encryption 679
- desktop environments 757–759
- /dev** directory 75, 79, 870–872
- device drivers 79, 868–870
 - adding to kernel 878–880
 - device awareness 880
 - device numbers 870–872
 - hot-plugging 882–883
 - loadable modules 880–882
 - MODULE_DEVICE_TABLE macro 880
 - for PC hardware 870
 - printer 765
 - serial 872
 - terminal and control characters 859–861
 - Windows printer 838–839
- device files 79
 - attributes 84
 - block vs. character 871
 - creating 871
 - for disks 122
 - major/minor device numbers 870–872
 - MAKEDEV** script 79, 872
 - names 872–873
 - security 684
 - for serial ports 853–855, 872
 - for tape drives 171, 873
 - udev** 79
- devices, pseudo 871
- df** 127, 494
- DFS (Distributed File System, Windows) 834
- DHCP (Dynamic Host Configuration Protocol) 311–314
 - backward compatibility 312
 - BIND and 449
 - client configuration 314
 - daemon 899
 - duplicate addresses 314
 - server configuration 313–314
- dhcp.leases** file 313–314
- dhcpcd** daemon 313–314
- dhcpcd** daemon 899
- /etc/dhcpcd.conf** file 313–314
- dial-in modems 855
- dial-out programs 864
- dial-up networks *see* PPP protocol
- Diffie-Hellman key exchange 456, 679
- dig** 408, 410, 435, 452, 473–476
- Digital Millennium Copyright Act (DMCA) 950
- directed broadcasts, network 317
- directories 76–78
- directories, copying 177
- directory indexes 611
- directory statement, DNS 424
- disaster
 - planning for 163, 939
 - power supplies 940
 - recovery 710–712, 938–943
- diskless clients 232–234, 898
- disks
 - see also* LVM, RAID, SATA, IDE, and SCSI
 - as backup media 168
 - boot loaders 124
 - checking 131–133
 - connecting 122
 - device files for 122
 - displaying free space 127
 - failure and RAID 139
 - Fibre Channel 112
 - formatting 123
 - geometry 119–120
 - hot-swappable 112, 116, 145
 - I/O analysis 813–815
 - IDE 112–114, 118, 130
 - installing 122–129, 133–138
 - interfaces 111–119
 - labels 124–125
 - LBA (Logical Block Addressing) 112
 - load balancing 805, 814
- disks *continued*
 - partitions 124–125, 134–136
 - PATA *see* IDE
 - performance 806–816
 - performance tuning 130
 - quotas 486
 - RAID 805
 - RAM 815
 - reallocating storage space 146
 - removable 165
 - SCSI 112, 114–118
 - Serial ATA *see* SATA
 - swap space 812, 814
 - testing 123
 - tracks and sectors 120
 - USB 112, 147–148, 165
- DISPLAY variable 744, 748
- displays (monitors) 794
- distance-vector routing protocols 338
- Distfile** 506–508
- Distributed Management Task Force (DMTF) 262
- distributions, Linux 6–9, 962
 - logos 10
 - popularity 962
- DIX Ethernet II 278
- DMA, tuning 130
- DMCA (Digital Millennium Copyright Act) 950
- dmesg** command 206
- dmesg** file 206
- DMTF (Distributed Management Task Force) 262
- DNAME DNS records 404
- DNS 377–386
 - see also* BIND
 - see also* domain names, DNS
 - see also* name servers
 - see also* resource records, DNS
 - see also* zones, DNS
 - adding a new machine 374–375
 - anycast routing 424
 - architecture 415–418
 - asynchronous notification of zone changes 388
 - authoritative servers 413, 416
 - caching 384–386
 - caching servers 413, 417
 - use with CIDR 400–401
 - client configuration 306
 - CNAME hack 400–401

DNS *continued*

- country code top-level domains 379
- cryptography in 387, 453–463
- database 378, 389–409
- delegation 383
- denial of service (DOS) attacks 397
- design 415–418
- doc** (domain obscenity control) 476–478
- domain names *see* domain names, DNS
- dynamic updates 312, 448–450
- EDNS0 protocol 389
- efficiency 384–386
- forward mapping 378, 382
- forward zone files 378
- fully qualified domain names 381
- gTLDs (generic top-level domains) 378–379
- history 375
- implementations 376–377
- in-addr.arpa domain 396
- internationalization 388
- IP addresses 374–375, 396–397
- ip6.arpa for reverse IPv6 mappings 404
- IPv6 support 404–405
- ISP domain registration 381
- lame delegations 469, 475–476
- load balancing 385
- lookups, **sendmail** 576
- master name server 413
- Microsoft and 464–466
- namespace 378, 381, 415
- negative answers 463
- negative caching 385
- nonauthoritative servers 413
- nonrecursive servers 413
- protocol 376, 386
- public key cryptography 456
- Punycode 388
- query recursion 425
- record types 391
- recursive servers 413
- referrals 414
- resolver configuration 418–420
- resolver library 414
- resolver testing 420
- resource records *see* resource records, DNS

DNS *continued*

- reverse mapping 378, 382, 396–397, 405, 444
- reverse zone files 378
- RFCs 375–376, 482
- root servers configuration file 383
- round-robin 723
- security 417, 424, 451–464
- server architecture 418
- server hints 414
- service switch file 306–307
- setup 415–418
- slave server 413
- SOA record serial number 393
- SOA record shell interfaces 415
- SOA record timeout values 393
- spam, eliminating 403
- SPF (Sender Policy Framework) pseudo-records 403
- split DNS 438
- stub servers 413
- stub zones 408–409
- subdomains 383
- TKEY 453–456
- top-level domains 378–379, 381
- traceroute** and 649
- TSIG (transaction signatures) 444, 453–456
- TTL harmonization 390
- us domain 380
- VeriSign Site Finder tool 429
- ZSK (zone-signing keys) 458
- DNSKEY DNS records 457–458
- DNSSEC 387, 456–463
- dnssec-keygen** 454, 458
- dnssec-signzone** 460–461
- doc** (domain obscenity control), DNS 476–478
- documentation
 - Linux 11–14
 - local 17, 930–934
 - sources 11–13
 - user 934
- Doering, Gert 856
- domain directive, DNS 420
- DOMAIN macro, **sendmail** 572
- domain names, DNS 378–383
 - case sensitivity 380
 - fully qualified 381
 - hierarchy 378
 - in-addr.arpa domain 396
 - internationalization 388
 - registration 371, 383

domain names, DNS *continued*

- rules 378–383
- second-level 383
- selecting 382
- squatting 380
- subdomains 383
- syntax 380
- top-level 378, 381
- trailing dot in 381
- domainname** 520
- domains, setting up NIS 517–520
- DontBlameSendmail option 603, 605
- DOS (denial of service) attacks 397, 511, 608, 817
- dot files 105–106
- DoubleClick.net 951
- dpkg** 237
- drivers** directory, kernel source tree 879
- drivers *see* device drivers
- DS DNS records 458, 460
- DSL networks 364–365
- DSR (data set ready) signal 852–853
- DTE (Data Terminal Equipment) interface 845–847
- DTR (data terminal ready) signal 853
- dual booting 30–31, 826
- dump** 123, 169–173
- /etc/dumpdates** file 170
- dumps *see* backups
- duplex, setting interface *see* **mii-tool**
- DVD Copy Control Association 950
- DVMRP protocol 343

E

- e2label** 127
- ECN TCP option 307
- EDITOR environment variable 103
- EFF (Electronic Frontier Foundation) 958, 969
- effective user IDs (EUIDs) 55
- EIGRP protocol 339, 342
- .emacs** file 105
- email
 - see also* MX DNS records
 - see also* Postfix
 - see also* **sendmail**
 - access agents 533
 - addresses 95, 535

- email *continued*
- aliases *see* aliases, email
 - architecture 539–544
 - backup servers, ISP 541
 - blacklists 594–595
 - bounced messages 569
 - clients 532
 - components 530–534
 - daemons 897
 - delivery agents 532
 - delivery status codes 593
 - denial of service (DOS) attacks 608
 - envelope 534
 - Exim 621–623
 - fallback MX 614
 - forgery 608–609
 - forwarding 549–550
 - headers 535–539
 - home mailbox 106, 542
 - IMAP protocol 533, 543
 - loops 546, 550
 - mailing lists 551–554
 - message stores 533
 - message structure 534–535
 - POP protocol 533, 543
 - privacy 610
 - proxies 540
 - queue directory 563–565
 - relaying 589–591
 - SASL 610
 - security 547, 603–610
 - server setup 540–541, 614
 - spam *see* spam
 - submission agents (MSA) 533–534
 - system administration tasks 530
 - system components 530–534
 - system design 539–544
 - to a disabled account 108
 - to files 547
 - to programs 547
 - transport agents 532
 - undeliverable messages 613
 - user agents 531
- emergency *see* disaster
- encryption *see* cryptography
- Engarde Linux 710
- encrypt** 778, 780
- environmental monitoring 798
- equipment racks 799
- error correction protocols 863–864
- ESMTP protocol 532
- /etc** directory 75
- Ethernet 351–359
- addresses 280
 - autonegotiation 302
 - broadcast domain 352
 - cables 278, 353–355
 - collisions 352, 649–650
 - congestion 356–357, 369
 - design issues 368–370
 - DIX II 278
 - evolution 352
 - frames *see* packets
 - framing standards 277
 - hardware addresses 280, 292
 - hubs/concentrators 356
 - packet encapsulation 276–277
 - routers 358–359
 - speed 352
 - speed, setting 303
 - switches 353, 356–358
 - topology 352
 - troubleshooting 366
 - UTP cables 353–355, 366
- EUIDs (effective user IDs) 55
- EULAs (End User License Agreements) 953
- EUROPEN 965
- event correlation 221
- events** daemon 894
- exec** system call 56
- executable maps, NFS automounter 499
- Exim mail system 621–623
- expect** 104, 348
- EXPN command 588
- exports** 52, 491
- /etc/exports** file 489–491
- EXPOSED_USER macro, **sendmail** 581, 584
- ext2fs filesystems 87, 120
- ext3fs filesystems 87, 120, 125
-
- ## F
-
- FAI 231
- fallback MX, email 614
- FAT filesystems 120
- fax mailer 573
- FC-AL (Fibre Channel Arbitrated Loop) 112
- fcntl** system call 486
- fcron** 157
- FDDI networks 361–362
- fdisk** 134–136, 140–141
- FEATURE macro, **sendmail** 574–585
- Fedora network configuration 308
- FHS (Filesystem Hierarchy Standard) 75
- Fibre Channel 112
- file attributes 81–88
- ACLs 88–92
 - change time 83
 - changing 81, 84–86
 - chattr** 87
 - on device files 84
 - directory search bit 82
 - displaying using **ls** 81–84
 - group ID number 83
 - inode number 84
 - link count 83
 - lsattr** 87
 - permission bits 81, 684
 - setuid/setgid bits 45, 82–83
 - sticky bit 82–83
 - supplemental 87
 - symbolic links 80
 - user ID number 83
- file statement, DNS 434
- filenames
- control characters in 77
 - encoding under Samba 830
 - length restrictions 72
 - pattern matching 10, 77
 - quoting 72
 - removing sneaky 77–78
 - shell globbing 10, 77
 - spaces in 72
- files
- see also* configuration files
 - see also* device files
 - see also* file attributes
 - see also* filenames
 - block device 77
 - character device 77
 - deleting 77
 - device 122
 - directory 77–78
 - hard links 78
 - links vs. original files 78
 - local domain sockets 77, 80
 - modes *see* file attributes
 - named pipes 77, 80
 - NFS locking 486
 - ownership of 44–46
 - permissions 81, 684
 - regular 77–78
 - removing temporary 154

- files *continued*
 - servers, dedicated NFS 496
 - servers, system files 510
 - sharing with Samba 833
 - symbolic links 77, 80
 - types of 76–81
 - Filesystem Hierarchy Standard (FHS) 75
 - filesystems 70–71
 - see also* partitions
 - automatic mounting 127
 - backing up 160
 - BSD FFS 120
 - checking and repairing 25, 128, 131–133, 137
 - cleaning using **cron** 154–155
 - converting ext2fs to ext3fs 121
 - copying 178
 - creating 125–126, 136–138
 - damaged 131–133
 - disabling setuid execution 684
 - enabling ACLs 88
 - exporting NFS 489–492
 - ext2fs 87, 120, 125
 - ext3fs 87, 120
 - FAT 120
 - fuser** 74
 - inodes 126
 - journaling 121
 - labels 127
 - Linux 120–122
 - load balancing 805, 814
 - loopback 73
 - lost+found** directories 127, 133
 - lsdf** 74
 - mounting 73–74, 126–129, 835
 - mounting at boot time, NFS 495
 - naming conventions, NFS 487
 - organization 75
 - patching 133
 - quotas 486
 - reinitializing 69
 - ReiserFS 121
 - root 24, 32, 75, 124
 - sizing for backups 161
 - smbfs 835
 - superblocks 126
 - sysfs 872, 882
 - unmounting 73
 - filters, CUPS 771–772
 - find** 72, 155
 - finger** 98
 - FireWall-1 318
 - firewalls 701–708
 - host-based 318
 - ICMP blocking 645, 647–648
 - Linux IP tables 704–708
 - Netfilter 704–708
 - packet-filtering 701–702
 - proxy 703
 - stateful 703–704
 - traceroute** and 648
 - flock** system call 486
 - flow control, serial line 852–853
 - Fogel, Karl 253
 - Foomatic database 771, 782
 - fork** system call 56
 - formatting disks 123
 - .forward** file, email 549–550, 605
 - forward mapping, DNS 382
 - forwarders option, DNS 427
 - ForwardPath variable, **sendmail** 549
 - fragmentation, IP 279
 - frame relay networks 363
 - frames *see* packets
 - framing standards, Ethernet 277
 - Frampton, Steve 12
 - free** 811
 - Free Software Foundation (FSF) 965
 - free space, displaying 127
 - Free Standards Group 959
 - fsck** 25, 128, 131–133, 137
 - /etc/fstab** file 127–129, 132, 137, 495, 497, 836
 - FSUID process parameter 55
 - FTP
 - chrooted** 735
 - through firewalls 702–703
 - and HTTP, compared 735
 - permissions 736
 - security 684, 736
 - server setup 734–736
 - ftp** 900
 - ftpd** daemon 735, 900
 - /etc/ftpusers** file 736
 - fully qualified hostnames 381, 396
 - functions** script 208
 - fuser** 74
 - FYI documents 275
-
- G**
-
- gated** routing daemon 344, 901
 - /etc/gateways** file 344
 - GDI printers 783
 - gdm** 743
 - GECOS information 98
 - Geer, Dan 161
 - \$GENERATE directive, DNS 401, 406
 - generic top-level domains 379
 - genericstable feature, **sendmail** 579
 - getfac** 89
 - gethostbyname** routine 414, 516
 - gethostent** routine 819
 - getty** process 25, 855–858
 - gettydefs** file 858
 - Ghostscript 780
 - Ghostview 785
 - GIAC (Global Information Assurance Certification) 675
 - GIDs *see* group IDs
 - globbing, shell 10, 77
 - GNOME 758–759
 - see also* X Window System
 - GNU
 - Free Software Foundation (FSF) 965
 - Openwall GNU/*/Linux (Owl) 710
 - Public License (GPL) 962
 - Stow 266
 - Zebra routing package 344
 - greet_pause feature, **sendmail** 597
 - greylisting for spam 636
 - /etc/group** file 101–102
 - defining groups 45, 97
 - editing 104
 - for FTP servers 735
 - permissions 684
 - group IDs
 - see also* **/etc/group** file
 - globally unique 102
 - kernel and 104
 - in **ls** output 83
 - mapping to names 45
 - numbers 45
 - real, effective, and saved 45
 - saved 55
 - groups
 - see also* **/etc/group** file
 - default 97
 - effective 55
 - file attribute 83
 - numbers (GIDs) 45
 - passwords for 101
 - of a process 55
 - grub** 138

GRUB boot loader 26–28
 multiboot configuration 30
 options 883
 single-user mode 32
grub.conf file 27, 30, 883
grub-install 27
/etc/gshadow file 102
 guest user accounts 944
 Gutenprint project 771
gv 785

H

hald 899
halt 42
 halting the system 40–42
 Hamilton, Bruce 14
 hard carrier 852
 hard disks *see* disks
 hard links 78
 hardened Linux 710
 hardware
 see also disks
 see also Ethernet
 see also maintenance
 see also networks
 see also PC hardware
 air conditioning 796–798
 BIND requirements 421
 computer displays 794
 cooling systems 940
 decommissioning 791
 environment 796–798
 equipment racks 799
 hubs 356
 kernel adaptation 869
 labeling 933
 logs 791
 memory 23, 794–795, 804
 power supplies 798
 probing 23
 purchasing 782–787, 916–917
 routers 358–359
 static electricity 793
 switches 353, 356–358, 360
 temperature monitoring 798
 tools 800
 USB *see* USB
 warranties 793
 wiring 366–368, 934
 Hayes command language 864
 Hazel, Philip 621
hdparm 129–131

header checking, **sendmail** 595–596
 Hesiod 390
 home directories 75
 creating 105
 location 75
 logging in to 98
 missing 98
 removing 107
/home partition 125
host 474
/etc/host.conf file 307
hostname command 299
/etc/hostname file 310
 hostnames
 fully qualified 396
 mapping to IP addresses 281, 298
/etc/hosts file 281, 298–299, 420
/etc/hosts.allow file 691–692
/etc/hosts.deny file 691–692
/etc/hosts.equiv file 685, 898
 hot-plugging kernel modules 882–883
 hot-swappable drives 112, 116, 145
 Hotz, Steve 473
 HPAGE_SIZE kernel parameter 809
 HTTP
 CUPS and 769
 protocol 720–722
 server *see* web hosting
httpd *see* web hosting
httpd.conf file 726–732
 hubs, Ethernet 356
 HUP signal 58–59
hwconf file 37
 HylaFAX 573

I

I/O schedulers 815–816
 ICANN (Internet Corporation for Assigned Names and Numbers) 273, 289, 371, 383
 ICMP 275
 firewall blocking 645, 647–648
 netstat output 653
 packets 707
 ping and 645
 redirects 295, 317
 sequence numbers 646
 tracroute and 648
 TTL and 647
 IDE 112–114
 accessing more than 1024 cylinders 112
 altering disk parameters 129–131
 device names 873
 DMA, tuning 130
 history 112–113
 performance tuning 130
 vs. SCSI 118
 IDENT protocol 609
 IEEE 802.* standards 278, 352, 356, 358–359
 IETF (Internet Engineering Task Force) 273
ifconfig 299–302
 adding routes using 304, 335
 PPP and 321
 subnet masks and 283
 virtual addresses and 728
ifdown 309, 311
ifup 40, 309, 311, 327
 IGMP (Internet Group Management Protocol) 281
 IGRP (Interior Gateway Routing Protocol) 339, 342
 IIS web server 827
 IMAP (Internet Message Access Protocol) 533, 543, 897
imspd 897
in.fingerd 901
in.rlogind 898
in.rshd 898
in.telnetd 898
in.ftptd 899
 in-addr.arpa domain 396
 \$INCLUDE directive, DNS 406
 :include: directive, for email aliases 546
 include statement, DNS 423
 incremental backups 170
 indirect maps, NFS automounter 499
inetd 885, 887–888, 890–893
/etc/inetd.conf file 890–892
init process 22–23, 56, 855–857, 886–887
 bootstrapping and 25
 logins and 886
 run levels and 33–36, 42, 886
 startup scripts and 32, 38, 40
 zombie processes and 56, 61
/etc/init.d directory 34–35, 38, 40
initlog 207

/etc/inittab file 34, 855–857, 886
 inodes 84, 126
insmod 880–882
 installation, Linux *see* Linux installation
 INT signal 58–59
 integrity monitoring 692
/etc/interfaces file 311
 interfaces, network *see* networks
 International Organization for Standardization (ISO) 354
 Internet
 dial-up connections *see* PPP protocol
 Cache Protocol (ICP) 733
 Control Message Protocol *see* ICMP
 Corporation for Assigned Names and Numbers (ICANN) 289
 Engineering Task Force (IETF) 273
 governance 273–275
 history 272–274
 Network Information Center (InterNIC) 288
 Official Protocol Standards 274
 protocol security (IPsec) 709
 protocol *see* IP
 registries 289
 RFC series 274–275
 Society (ISOC) 273
 standards and documentation 274–275
 system administration resources 13
 Systems Consortium (ISC) 12, 312
 Worm 669
 InterNIC (Internet Network Information Center) 288
 intrusion detection, **samhain** 692–693
 IOS (Cisco router OS) 346–348
iosstat 813
 IP 275
 see also IP addresses
 see also IPv6
 see also routing
 directed broadcast 317
 fragmentation 279
 masquerading *see* NAT

IP *continued*
 packet forwarding 303, 316
 source routing 317
 spoofing 317–318
 TOS (type-of-service) bits 330
 IP addresses 279–293
 see also IPv6
 allocation 288–289
 broadcast 281
 CIDR (Classless Inter-Domain Routing) 283, 286–288
 classes 282
 hostnames and 281, 298
 loopback interface 282, 294, 302, 397
 multicast 281–282
 netmasks 282–285
 ports 281
 PPP 322
 private 289–291, 409, 416, 438, 465
 shortage of 285–286
 subnetting 282–285
 unicast 292
ipcalc 284
 IPsec (Internet Protocol security) 709, 949
iptables 319, 704–708
 IPv6 286, 291–293
 DNS support 387, 404–405
 vs. CIDR 286
 ISC (Internet Systems Consortium) 312, 376
 ISDN networks 364
 IS-IS protocol 339, 343
 ISO (International Organization for Standardization) 354
 ISO/IEC 17799 standard 675
 ISOC (Internet Society) 273
 ISPs
 AOL 954
 domain registration 381
 IP address allocation 289–293
/etc/issue file 856
 ITIL (Information Technology Interface Library) 960

J

Jacobson, Van 273, 320, 329, 647, 656
 JFS filesystem 122

jobs, scheduling 887
 John the Ripper 690
 journaling filesystems 121
 jukeboxes, tape media 167

K

kacpid daemon 894
 Kahn, Bob 273
 Kalt, Christophe 266
kblockd daemon 894
 KDE 758–759
 see also X Window System
 Konqueror 789
 Print Manager 773
 printing under 788–790
kdm 743
 Kerberos 464, 695–696
kermit 864
 kernel 868–869
 ARP cache 296
 boot time options 29, 883
 building 876–878
 .config file, customizing 877–878
 configuration 873–874
 daemons 893
 device drivers 79, 868–870
 hot-plug blacklist 883
 hot-plugging modules 882–883
 HPAGE_SIZE 809
 initialization 23
 loadable modules 880–882
 location 75
 logging 206–208, 894
 network security variables 319
 options 874, 876–878
 panics 131, 133
 saved group IDs 55
 source tree 876–877, 879
 swappiness parameter 811
 threads 23
 TOS-based packet sorting 330
 tuning 314–316, 614, 874
kernel directory 877
 KEY DNS records 455, 458
.key DNSSEC key file, DNS 454
 key statement, DNS 430
 keymap file, corrupted 37
 keys, generating BIND 458
 keys, SSH 697

- kghostview** 788
 Kickstart 226–229
kill 60, 818
 KILL signal 58–60
killall 60, 203
 Kim, Gene 617
 Kirch, Olaf 12
kjournald daemon 894
klogd daemon 207, 894
 Knoppix 6, 232
 Kolstad, Rob 617
 Konqueror 789
 Kotsikonas, Anastasios 553
kprinter 788–789
 Kristensen, Peter 266
ks.cfg file 227–229
ksftirqd daemon 894
kswapd daemon 810, 894
 Kudzu 37
-
- L**
-
- lame delegations, DNS 469, 475–476
 LAMP platform 719
 LANs 351
 ATM 362
 Ethernet 351–359
 FDDI 361–362
lastlog file 206
 LBA (Logical Block Addressing) 112
 LCFG (large-scale configuration system) 261
 LDAP (Lightweight Directory Access Protocol) 520–526
 attribute names 522
 documentation 523–524
 OpenLDAP 523
 security 526
 setup 524–525
 structure of data 521
 use with **sendmail** 547, 555–557, 580–581
 user IDs and 97
 uses of 522–523
 ldap_routing feature, **sendmail** 556, 580–581
 LDP (Linux Documentation Project) 11
 leadership 907
 Leffler, Sam 573
- legal issues 949–958
 appropriate use policies (AUPs) 954
 call records and web logs 952
 copyrights 950
 cryptography 949
 EULAs (End User License Agreements) 953
 liability for data 954
 pornography 954
 privacy 951
 software licenses 955
 Libes, Don 104
 licenses, software 955
lilo 28–29, 31, 138
 LILO boot loader 28–29
 configuring 883
 multiboot configuration 31
 single-user mode 32
/etc/lilo.conf file 28, 31, 883
limit shell builtin 818
 link layer, networks 277–279
 links, hard 78–80, 83
 link-state routing protocols 339
 Linux
 culture 961, 963
 distributions 6–9, 962
 documentation 11–14
 Documentation Project (LDP) 11
 history 5
 installation *see* Linux installation
 International (LI) 964
 mailing lists 967
 popularity 962
 Professional Institute (LPI) 964, 967
 resources 964–968
 security flaws 670
 standards 958–960
 Test Project 963
 vendor logos 10
 vs. UNIX 4
/usr/src/linux directory 876
 Linux installation 224–232
 see also system administration
 see also system configuration
 automating from a master system 232
 automating with AutoYaST 230–231
 automating with **cdebconf** 231
- Linux installation *continued*
 automating with **cdebootstrap** 231
 automating with **debian-installer** 231
 automating with FAI 231
 automating with Kickstart 226–229
 automating with **system-config-kickstart** 231
 ks.cfg file 227–229
 netbooting 224–226
 PXE protocol 225–226
 PXELINUX 225
 system-config-netboot 226
 TFTP protocol 225
 LinuxWorld conference 966
 listen-on option, DNS 426
listmanager 554
 ListProc 553
 LISTSERV Lite 554
 Liu, Cricket 423
 LMTP protocol 625
ln 78, 80
 load average, **sendmail** 613
 load averages 808
 load balancing
 disks and filesystems 805, 814
 DNS 385
 servers 805
 web server 722–724
 loadable modules 880–882
 LOC DNS records 401
 local delivery agents, **sendmail** 533
 local domain sockets 77, 80
/usr/local hierarchy 255–260
 compilation 258–259
 distribution 259
 organizing 256–257
 testing 257–258
 LOCAL_* macros, **sendmail** 586
 local_lmtp feature, **sendmail** 585
 local_procmail feature, **sendmail** 585
 localhost 282
 localhost zone configuration example, BIND 439
local-host-names file 574
locate 15, 771
lockd daemon 486
lockf system call 486
/var/log directory 204

log files 209–220
see also logging
see also syslog
 analyzing and searching 220–221
 for Apache 727
 archiving 204
 lists of 205, 218
 for logins and logouts 206
 monitoring 220–221
 replacing while in use 203
 rotating 156, 202, 208–209
 to system console 218
 web hosting 727

/dev/log socket 210

logcheck 220

logger 217–218

logging
see also log files
see also syslog
 for BIND 411, 432, 446, 466–471
 boot-time 206–208
 to central server 214, 216
 for **cron** 151
 for CUPS 781
 hardware failures 791
 kernel 206–208
 for **sendmail** 619–621
 for **sudo** 49
 through syslog 218–220
 to system console 218

logging in from Windows 821–822

logging statement, DNS 432, 466

logical unit numbers, SCSI 117

logical volume management *see* LVM

login command 46, 856

.login file 105

login process 855

login *see* user accounts

/etc/login.defs file 98, 100

logos, vendor 10

logrotate 208–209
/etc/logrotate.conf file 208
/etc/logrotate.d directory 208

logwatch 221

loopback
 address, BIND 437
 filesystem 73
 interface 282, 294, 302, 397

LOPSA 965

lost+found directories 127, 133

low-level formatting, disks 123

lpd daemon 894

lpd-errs file 215

lpinfo 772

ls 45, 77, 81–84

lsattr 87

lsmod 881

lsnf 74, 494

LTO backup tapes 167

lvcreate 144

lvextend 146

LVM 139, 143–147
 creating 143–144
 resizing 146–147

lwresd 897

M

m4 566–570, 586

MAC addresses 280, 292

Mackerras, Paul 508

macros, **sendmail** 570–574

magic cookies, NFS 486

magic cookies, X Windows 746

mail *see* email

mail.local delivery agent 533, 585, 605

MAIL_HUB macro, **sendmail** 583, 600

MAILER macro, **sendmail** 573–574

mailers 573
 cyrus 573
 discard 596
 error 591, 596
 fax 573
 local 573
 pop 573
 qpage 574

mailertable feature, **sendmail** 578

mailing list software 551–554
listmanager 554
 ListProc 553
 LISTSERV Lite 554
 Mailman 553
 Majordomo 552
 SmartList 554

mailing lists 546, 551–554, 967

mailq 619

.mailrc file 105

mailstats 615

main.cf file 626

maintenance 791–800
see also hardware
 contracts 792–793
 environment 796–798
 equipment racks 799

maintenance *continued*
 power 798
 preventive 795–796
 Uninterruptible Power Supply (UPS) 799

major device numbers 79, 870–872

Majordomo 552–553, 605

makedbm 512

MAKEDEV script 79, 872

makemap 576–577

man pages 11–13

management 907–915

management standards, networks 658

Manheimer, Ken 553

MANs 351

many-answers option, DNS 425

map files, NFS automounter 499–500

masks in ACLs 90

MASQUERADE_AS macro, **sendmail** 581–583, 616

masquerading, **sendmail** 581–583

master boot record (MBR) 26

master name server, DNS 413

master server, NIS 511–513, 517–518

master.cf file 623

masters statement, DNS 432, 434

match-clients clause, DNS 438

max-cache-size option, DNS 426

MaxDaemonChildren option, **sendmail** 608

MaxMessageSize option, **sendmail** 608

MaxRcptPerMessage option, **sendmail** 608

MBR (master boot record) 26

McKusick, Kirk 120

MDA (mail delivery agent) 532

mdadm RAID management utility 141–143, 145

mdrecoveryd daemon 894

/proc/mdstat file 142, 145

media, backup 163–169
see also tapes
 CD and DVD 164
 jukeboxes 167
 labeling 159
 life of 163
 magnetic 164
 optical 164
 summary of types 168
 verifying 162

- memory
 - buffering 40
 - effect on performance 804, 806
 - kernel initialization and 23
 - management 809–811
 - modules 794–795
 - paging 809–814, 818
 - RAM disks 815
 - usage, analyzing 811–813
 - virtual (VM) 810–811
 - message of the day 856, 954
 - message stores 533
 - /var/log/messages** file 207, 215
 - Metcalf, Bob 351
 - mgetty** process 855–858
 - Microsoft Windows *see* Windows
 - mii-tool** 303
 - Miller, Todd 49
 - militering, **sendmail** 597
 - MIME (Multipurpose Internet Mail Extensions) 531, 601
 - /etc/cups/mime.convs** file 772
 - /etc/cups/mime.types** file 771
 - Minar, Nelson 902
 - mingetty** process 855–858
 - mini DIN-8 connectors 847
 - minicom** 864
 - minor device numbers 79, 870–872
 - mkdir** 78
 - mk2fs** 125, 136–137
 - mkfs** 69
 - mkknod** 79–80, 871
 - mkpasswd** 104
 - MKS Toolkit 827
 - mkswap** 138
 - Mockapetris, Paul 375
 - model** file 771
 - modems 852, 862–864
 - modprobe** 881
 - /etc/modprobe.conf** file 881
 - MODULE_DEVICE_TABLE macro 880
 - Mondo Rescue 197
 - monitoring log files 220–221
 - monitors 794
 - Moore’s Law 273
 - Morris, Robert, Jr. 669
 - MOSPF protocol 343
 - /etc/motd** file 856, 954
 - Motion Picture Association of America 950
 - mount** 73, 126–128
 - enabling filesystem ACLs 88
 - NFS filesystems 492–495
 - mount point, filesystem 73
 - mount.smbfs** 836
 - mountd** daemon 489
 - mounting filesystems *see* filesystems, mounting
 - mpstat** 808
 - /var/spool/mqueue** directory 563, 619
 - mreport** program 620
 - MRTG (Multi-Router Traffic Grapher) 664
 - MSA (mail submission agent) 533
 - mt** 178
 - MTA (mail transport agent) 532
 - MTU (maximum transfer unit) 278–279, 361
 - mtx** 179
 - MUA (mail user agent) 531
 - multibooting 30–31
 - multicast addresses 281–282
 - multiprocessor machines, analyzing performance 808
 - Multipurpose Internet Mail Extensions (MIME) 531, 601
 - multiuser mode 25
 - MX DNS records 397–399
 - MySQL 180–182, 377, 719, 936
-
- N**
-
- Nagios SNMP monitoring tool 665
 - name servers
 - see also* DNS
 - see also* BIND
 - see also* **named**
 - authoritative 413, 416
 - caching 384–386, 417
 - caching-only 413
 - delegation 383
 - dynamic updates 448–450
 - forwarding 427
 - hints 414
 - keep-running script 417
 - lame delegations 469, 475–476
 - master 413
 - negative caching 385
 - nonauthoritative 413
 - name servers *continued*
 - recursion 413, 425
 - resolver 414, 418–420
 - slave 413
 - stub 413
 - switch file 479
 - zone delegation 407–409
 - zone serial numbers 447
 - named** 412, 446
 - see also* BIND
 - see also* DNS
 - see also* name servers
 - acl statement 430
 - ACLs 429, 451–453
 - allow-recursion option 425
 - allow-update clause 433, 450
 - avoid-v4-udp-ports option 427
 - blackhole option 428
 - bogus directive 431
 - chrooted** 451, 453
 - command-line interface *see* **named, rndc**
 - compiling with OpenSSL 458
 - configuration 420–446
 - configuration examples 439–446
 - confining with **chroot** 453
 - controls statement 436–438
 - datasize option 426
 - debugging 466–478
 - delegation-only option 386, 429
 - directory statement 424
 - domain directive 420
 - error messages 469
 - file statement 434
 - forwarders option 427
 - forwarding zone, configuring 436
 - \$GENERATE directive 401, 406
 - hardware requirements 421
 - \$INCLUDE directive 406
 - include statement 423
 - init** scripts 446
 - ISC configuration example 444
 - keep-running script 417
 - key statement 430
 - listen-on option 426
 - localhost zone configuration example 439
 - logging 411, 446, 466–471

named *continued*

logging statement 432, 466
 many-answers option 425
 master server, configuring 433
 masters statement 432, 434
 match-clients clause 438
 max-cache-size option 426
/etc/named.conf file 421–446,
 450–451, 470, 480–481
named.run file 471
named-checkconf 421, 455, 478
named-checkzone 421, 478
 notify option 424
 options statement 423–429
 \$ORIGIN directive 406
 provide-ixfr option 448
 query-source option 426
 recursion option 425
 recursive-clients option 426
 request-ixfr option 448
rndc 436–438, 447, 471–473
 root server hints 435
root.cache file 435
 rrset-order statement 428
 search directive 419
 server statement 431, 448
 slave server, configuring 434
 sortlist option 428
 starting 448
 statements, list of 422
 stub zones, configuring 434
 testing 466–478
 topology statement 428
 transfers-in option 425
 transfer-source option 426,
 445
 transfers-out option 425
 transfers-per-ns option 425
 trusted-keys statement 430
 \$TTL directive 390, 394, 406
 TTL options 428
 update-policy clause 450
 updating zone files 447–450
 versions 411, 424
 view statement 438
 zone commands 405–407
 zone serial numbers 447
 zone statement 432–436
 zone-statistics option 433
 named pipes 77, 80
/etc/named.conf file 421–446, 450–
 451, 470, 480–481
named.run file 471

named_dump.db file 472
named-checkconf 421, 455, 478
named-checkzone 421, 478
 namespace, DNS 378
 naming conventions
 device files 872
 shared filesystems 487
nanny script 446
 NAT 290–291, 319
 National Science Foundation (NSF)
 381
ncftp 510
ndbm library 169
neigh directory 315
 Nemeth, Evi 679
 Nessus 690
 NetBIOS 828, 896
 netbooting 224–226
 Netfilter 704–708
/etc/netgroup file 517
 netgroups, NIS 517
 netmasks 282–285
 NeTraverse 826
 NET-SNMP 661–664
netstat 649–654
 displaying interface names 300
 examining the routing table 294
 examples 335–337
 interfaces 649
 monitoring connections 651
 network statistics 649–654
 and NFS UDP overflows 492
 open ports 652
 routing table 652
 Network Appliance, Inc. 496
 network configuration 298, 307–
 311
 Debian and Ubuntu 310
 Red Hat and Fedora 308
 SUSE 309
 Network Information Service *see*
 NIS
 Network Solutions, Inc. 381
 Network Time Protocol (NTP) 902
 network unreachable error 304
 network wiring 934
 building 366–368
 cable analyzer 366
 cable choices 352–355, 366
 for offices 367
 maintenance and documenta-
 tion 370
 Wireshark network sniffer 366

networks

see also Ethernet
see also IP addresses
see also network configuration
see also network wiring
see also routing
see also TCP/IP
 adding a machine to a LAN 297–
 307
 address translation *see* NAT
 addresses 279–293
 administrative databases 504,
 511
 ARP (Address Resolution Proto-
 col) 296–297
 ATM 362–363
 broadcast storms 301, 357
 CIDR (Classless Inter-Domain
 Routing) 286–287
 connecting and expanding 355–
 359
 connecting with PPP 321
 daemons 900–901
 debugging with **mii-tool** 302–
 303
 default route 293–294, 305, 329,
 336
 design issues 368–370
 DHCP (Dynamic Host Configu-
 ration Protocol) 311–314
 firewalls 318, 701–708
 interface activity reports 654
 interface configuration 299–302
 load balancing 385, 805
 loopback 282, 294, 302, 397
 management issues 370–371,
 643
 management protocols 657–661
 management standards 658
 monitoring 650–651
 MTUs 278–279, 361
 NAT 290–291, 319
 netmasks 282–285
 packets *see* packets
 PAT 319
ping and 645–647
 port scanning 688–690
 ports 281
 PPP 320–330
 redundancy 941
 routing tables 652
 scanner, Nessus 690
 security *see* security

- networks *continued*
 - statistics 649–654
 - subnetting 282–285
 - troubleshooting 366, 644–654
 - tuning 314–316
 - virtual private networks *see* VPNs
 - VLANs 357
 - wireless 278, 359–361
 - network-scripts** directory 38
 - newaliases** 551
 - newgrp** 102
 - NFS (Network File System) 484–500
 - all_squash option 488, 491
 - anongid option 488, 491
 - anonuid option 488, 491
 - buffer sizes 494
 - client 492–495
 - common options 491
 - configuration, server 489–492
 - cookies 486
 - daemons 895–896
 - dedicated file servers 496
 - disk quotas 486
 - and **dump** 170
 - exporting filesystems 489–492
 - file locking 486
 - firewalls and 488
 - and the **fstab** file 127
 - hard vs. soft mounts 493
 - insecure option 491, 495
 - mount** 492–495
 - mounting filesystems at boot time 495
 - naming conventions 487
 - no_root_squash option 488, 491
 - nobody account 51, 488
 - protocol versions 484
 - root access 488
 - RPC and 485
 - secure option 491, 495
 - secure_locks option 491
 - security 487–489, 495, 686
 - statistics 495
 - subtree_check option 491
 - TCP vs. UDP 485
 - tuning 494
 - using to export email 542
 - nfsd** daemon 489, 492, 494
 - nfsstat** 495
 - nice** 61–62, 818
 - nice value 55
 - NIS (Network Information Service) 511–520
 - architecture 512–514
 - commands 514
 - configuring clients 519
 - configuring servers 518
 - database files 511–512
 - files to share 503
 - LDAP vs. 525
 - map files 512
 - master server 511–513, 517–518
 - netgroups 517
 - query procedure 513
 - security 685–686
 - setting access control options 519
 - setting up a domain 517–520
 - slave servers 512–514, 517
 - nmap** 688–690
 - nmbd** 829, 896
 - nocanonify feature, **sendmail** 576
 - nohup** 59
 - notify option, DNS 424
 - NS DNS records 395, 407
 - nscd** daemon 504, 897
 - /etc/nscd.conf** file 505, 897
 - NSEC DNS records 463
 - NSF (National Science Foundation) 381
 - NSFNET 272
 - /etc/nsswitch.conf** file 307, 515, 562
 - nsupdate** 449
 - NTP (Network Time Protocol) 902
 - /etc/ntp.conf** file 902
 - ntpd** 902–903
 - ntpdate** 902
 - null modem serial cable 846–847
 - nullclient feature, **sendmail** 584–585
 - NXT DNS records 458
-
- O**
-
- Oetiker, Tobias 262, 664
 - office wiring 367
 - off-site backup storage 161
 - Oja, Joanna 11
 - one-time passwords 698
 - open relaying, email 589
 - OpenLDAP 523, 555
 - openlog** routine 218–220
 - OpenOffice.org 826
 - Openwall GNU/*/Linux (Owl) 710
 - operating system installation *see* Linux installation
 - opprofile** 817
 - options statement, DNS 423–429
 - \$ORIGIN directive, DNS 406
 - orphaned processes 56, 61, 63
 - OSI layers 276
 - OSPF protocol 339, 342–343
 - OSTYPE macro, **sendmail** 570–572
-
- P**
-
- Pack Management Project 266
 - package management 234–247
 - alien** conversion tool 235
 - automating 244–246
 - .deb** format 235
 - dpkg**/APT 235, 237, 241–246
 - Red Hat Network 240
 - repositories 239–240
 - RPM format 235
 - rpm/yum** 235–238, 246–247
 - packages *see* software packages
 - packets
 - see also* networks
 - dropped 646
 - encapsulation 276–277
 - filtering 677, 701
 - forwarding 335–337
 - handling with Netfilter 704–708
 - ICMP 707
 - round trip time 646
 - sniffers 366, 655–657
 - tracing 647–649
 - pages, memory 809–811
 - paging 129, 809–814, 818
 - Painter, Mark 376
 - PAM (Pluggable Authentication Modules) 681–682
 - paper sizes for printers 777–778
 - paperconfig** 778
 - PAPERSIZE environment variable 778
 - /etc/papersize** file 778
 - Parain, Will 261
 - partitions 124–125, 134–138
 - see also* filesystems
 - load balancing 814
 - resizing with LVM 146–147
 - root 124
 - setting up 134–136
 - swap 124, 129, 138

passwd command 46, 96, 104
/etc/passwd file 93–99
 editing 96, 103
 for FTP servers 735
 group ID numbers 83
 permissions 684
 security 678–681, 684
 user ID numbers 45, 83

passwords
 aging 680
 boot loader 673
 cracking 690
 encryption 94, 96, 830
 FTP 735
 group 101
 initial 104
 one-time 698
 root 47
 Samba 830
 security 47, 678–681
 selection 47, 104, 679–680
 shadow 94, 99–100, 678
 strength 682, 690

PAT (Port Address Translation)
 319

PATA *see* IDE

patches, software 677

patents

EU patent policy 957
 software 957–958
 U.S. patent office 957

pathnames 48, 72

PC hardware

see also hardware
 BIOSes 25
 boot device priority 26
 bootstrapping 25
 delete character 859
 device drivers 870
 multibooting 30–31
 vs. UNIX hardware 25

PCL printer language 763, 766

PDF 764, 766

pdftops 772

performance 803–819
 BIND 478
 CPU 806–809, 813
 disk 806, 813–815
 factors affecting 806–807
 improving 803–806
 kernel tuning for email 614
 load averages 808

performance *continued*
 measuring and monitoring 664,
 807
 memory 68, 804, 806, 811–813
 network, TOS bits 330
 NFS 494
nice 61
 partitioning disks to improve
 124
 PPP 321
 using RAID to improve 139
 SDCS Secure Syslog 210
sendmail 611–615
 Squid web cache 733–734
 st_atime flag 87
syncing log files 213
 troubleshooting 817–819
 tuning IDE drives 130
 web server 722–724, 727

performance analysis tools

free 811
iostat 813
mpstat 808
oprofile 817
procinfo 812
sar 816
top 809
uptime 808
vmstat 807

Perl 14, 150, 719, 722, 827, 923

in administrative scripts 4
 example scripts 525
 generating passwords 524
 insecure example 672
 module sources 662
 null password check 679
 and **swatch** 220
 and syslog 219
 user ID check 681
 wrapping **cron** jobs 511

permissions

chmod and 84
 file 81, 684
 important 684
sendmail 604–605
umask and 86

personnel management 908–910

PGP (Pretty Good Privacy) 610, 696

Phonetics Sensaphone 798

PIDs 54

PIM protocol 343

ping 317, 645–647

pipes, named 77, 80

piracy 955

PIX firewall box 318

PJL printer language 765

.plan file 901

platters, disks 119

Pluggable Authentication Modules
 (PAM) 681–682

poff command 330

policy

agreements 107, 946–948
 backups 939
 documents 943–948
 enforcement 953
 logging 201
 Postfix policy daemons 636
 security 945–946

pon command 330

POP (Post Office Protocol) 533, 543,
 828, 897

pop mailer 573

popd 897

pornography 954

portmap daemon 488, 888, 893

ports, network 281

numbers 893

privileged 281, 689, 702

scanning 688–690

well known 688, 702

ports, serial 844–847

POSIX 683, 959

APIs under Windows 827

root account capabilities 46

Post Office Protocol (POP) 533, 543,
 828, 897

postconf Postfix configuration tool
 627

Postel, Jon 273

Postfix 623–638

access control 632–634, 638

amavisd virus filter 637

architecture 623

authentication 634

black hole lists 635

chrooted 625

command-line utilities 625

configuring 626–634

content filtering 636

debugging 637–639

greylisting 636

local delivery 629

lookup tables 627

- Postfix *continued*
- policy daemons 636
 - queue manager 624
 - receiving email 624
 - security 625
 - sending email 625
 - spam control 634–637
 - virtual domains 630–632
 - virus filtering 637
- PostScript 763, 766
- power management 798
- power supplies, emergency 940
- poweroff** 42
- /etc/cups/ppd** file 771
- PPD printer description files 770–771
- PPIDs 54
- /etc/ppp** directory 323
- PPP protocol 320–330
- commands, list of 324
 - configuration 323–330
- pppd** daemon 323, 325, 327, 329
- pppstats** 329
- pr** 780
- Practical Extraction and Report Language *see* Perl
- Pre-boot eXecution Environment (PXE) 225–226, 899
- Preston, W. Curtis 198
- Pretty Good Privacy (PGP) 610, 696–697
- printers
- see also* printing
 - accounting 787
 - cartridges 786
 - drivers 765
 - languages 763–766
 - network 773, 784
 - PPD printer description files 770–771
 - purchasing 782–787
 - security 787
 - selection 782–785
 - serial and parallel 784
 - USB 774, 781
 - WinPrinters 783
- printing
- see also* CUPS
 - see also* printers
 - banner pages 784–785
 - daemons 894
 - Foomatic database 771, 782
 - Gutenprint project 771
 - history 761–762
- printing *continued*
- KDE Print Manager 773
 - Konqueror and 789
 - paper sizes 777–778
 - PPD printer description files 770–771
 - previewers 785
 - sharing printers using Samba 836–839
 - software 779
 - under KDE 788–790
 - using **kprinter** 789
 - Windows driver installation 838–839
 - XHTML 764
- priority, processes 55, 61–62
- privacy 951
- .private** DNSSEC key file 454
- private IP addresses 289–291, 409, 416, 438, 465
- privileged ports 281, 689, 702
- /proc** filesystem 65–66, 314–316, 872, 874
- processes 53
- changing ownership credentials 45
 - changing user and group IDs 46
 - control terminal 56
 - EGID (effective group ID) 55
 - EUID (effective user ID) 55
 - execution states 60–61
 - FSUID parameter 55
 - GID (group ID) 55
 - identities: real, effective, and saved 45
 - IDs 54
 - monitoring 62–65
 - orphaned 56, 61, 63
 - owner 45, 54
 - PPID (parent PID) 54
 - priority 55, 61–62
 - runaway 67–69
 - scheduling 45
 - sending signals to 60
 - spontaneous 23
 - standard I/O channels 56
 - stopping and starting 61
 - UID (user ID) 54
 - zombie 56, 61, 63, 886
- procinfo** 812–813, 818
- procmail** 533, 585, 636
- /etc/profile** file 106
- /etc/profile.d** directory 106
- profiler, system 817
- programs, finding 15
- Project Athena 741
- .project** file 901
- promiscuous relaying, **sendmail** 589
- provide-ixfr option, DNS 448
- proxies, service 703
- proxies, web servers 733
- ps** 62–64, 809, 817
- pseudo-devices 871
- pseudo-users 97
- PTR DNS records 396, 444
- /dev/pts** directory 75
- public key cryptography 456, 697
- Punycode 388
- purchasing hardware 782–787, 916–917
- PuTTY 821
- pvcreate** LVM utility 143
- PXE (Pre-boot eXecution Environment) 225–226, 899
- PXELINUX 225
- Python 4, 15–16, 523, 923
-
- ## Q
-
- qmgr** 625
- qpage mailer 574
- qpopper** email server 543
- qshape** 638
- quad A DNS records 404
- query-source option, DNS 426
- queue groups, **sendmail** 611–612
- queue runners, **sendmail** 613
- QUIT signal 58–59
- quotas, disk 486
-
- ## R
-
- racks, equipment 799
- RAID 139–147, 805, 894
- raidtools** 141
- RAM disks 815
- /dev/ram0** and **/dev/ram1** files 815
- rc** scripts *see* startup scripts
- rc.local** script 36
- rcmd** 898
- rcp** 685, 898
- RCPT command, SMTP 588
- RCS 249–251
- rcsdiff** 250

- rdesktop** 825
- rdist** 505–508
- RDP (Remote Desktop Protocol) 824
- rdump** 171
- real-time scheduling 56
- RealVNC 824
- reboot** 42
- rebooting 40–41
- recursion option, DNS 425
- recursive-clients option, DNS 426
- Red Hat network configuration 308
- Red Hat Network, software repository 240
- redirect feature, **sendmail** 575
- REFUSE_LA option, **sendmail** 608
- registration of domain names *see* domain names, registration
- regular files 77–78
- Reiser, Hans 121
- ReiserFS filesystem 121
- /etc/mail/relay-domains** file 589
- Remote Desktop Protocol (RDP) 824
- Remote Procedure Call *see* RPC
- renice** 61–62, 818
- repositories, software 239, 266
- request-ixfr option, DNS 448
- reset** 862
- resize_reiserfs** 147
- resizing disk partitions 146–147
- /etc/resolv.conf** file 418–420
- resolver library, DNS 414
- resource records, DNS 389–405
 - A 396, 407
 - A6 404
 - AAAA 404
 - CNAME 399
 - DNAME 404
 - DNSKEY 457–458
 - DS 458, 460
 - format 389
 - glue 407–409
 - KEY 455, 458
 - LOC 401
 - MX 397–399
 - NS 407
 - NSEC 458, 460, 463
 - NXT 458
 - PTR 396, 444
 - quad A 404
 - RRSIG 457–458, 460, 463
 - SIG 458
 - SOA 392–395, 447
- resource records, DNS *continued*
 - special characters in 389
 - SRV 402–403, 464
 - time to live 390
 - trailing dot in names 389
 - TXT 403, 424
 - WKS 403
- restore** 173–176, 939
- reverse mapping, DNS 382, 396–397, 405, 444
- revision control 248–255
 - CVS 251–253
 - RCS 249–251
 - Subversion 253–255
- RFCs
 - BCP documents 275
 - DNS-related 375–376, 482
 - email-related 532, 640
 - FYI documents 275
 - LDAP-related 523
 - NFS-related 500
 - overview 274–275
 - private address space 289–291
 - SNMP-related 667
 - STD documents 275
 - subnetting 285
- RHN, repository package 240
- .rhosts** file 685, 898
- Riggle, David 376
- RIP protocol 339, 341–344
- RIP-2 protocol 341
- RJ-11 connectors 862
- RJ-45 connectors 355, 849
- rlog** 250
- rlogin** 685
- rm** 77, 79
- rmdir** 78
- rmmod** 881
- rncd** 436–438, 447, 471–473
 - /etc/rncd.conf** file 437
 - /etc/rncd.key** file 437
- rncd-confgen** 437
- root account 44, 46, 681
 - accessing 48–51
 - accessing via NFS 488
 - operations 46
 - passwords 47
 - POSIX capabilities 46
 - restricting access 685
 - squashing, NFS 488
 - /etc/sudoers** file 49–50
 - user ID 46
- root filesystem 24, 32, 75
- rootkits 688, 951
- Rossi, Markku 778
- rotating log files 156, 202, 208–209
- route** command 294, 303–305, 309, 900
- routed** daemon 341, 343–344, 900
- Router Discovery Protocol 343
- routers 358–359
- routing 293–295, 334–348
 - autonomous systems 340
 - BGP protocol 339
 - CIDR (Classless Inter-Domain Routing) 283–288
 - Cisco routers 346–348
 - cost metrics 340
 - daemons and protocols 337–344
 - default route 293–294, 305, 329, 336
 - distance-vector protocols 338, 342
 - EIGRP protocol 342
 - exterior gateway protocols 340
 - ICMP redirects 295, 317, 337
 - IGRP protocol 342
 - interior gateway protocols 341–343
 - IS-IS protocol 343
 - link-state protocols 339
 - netmasks 282–285
 - OSPF protocol 339, 342–343
 - packet forwarding 303, 316, 335–337
 - PPP 322
 - protocols 341–343
 - RIP protocol 339, 341–344
 - sendmail** 583
 - static routes 294, 303–305
 - static vs. dynamic routing 344–345
 - strategy 344–345
 - subnetting 282–285
 - tables 293–295, 335–337, 652
 - unreachable networks 304
 - with multiple ISPs 340
 - XORP (eXtensible Open Router Platform) 344
 - Zebra package 344
- Rowland, Craig 220
- RPC (Remote Procedure Call)
 - managing port assignments 888
 - mapping service numbers to ports 893
 - NFS and 485
 - portmap** and 893

- rpc.bootparamd** daemon 899
 - rpc.lockd** daemon 895
 - rpc.mountd** daemon 489, 895
 - rpc.nfsd** daemon 489, 895
 - rpc.rquotad** daemon 896
 - rpc.statd** daemon 895
 - rpc.ypxfrd** daemon 896
 - rpciod** daemon 896
 - rpm** 235–237
 - RPM software package format 235
 - rquotad** daemon 486
 - RRDTool graphing tool 664
 - rrestore** 175
 - rrset-order statement, DNS 428
 - RRSIG DNS records 457–458, 460, 463
 - RS-232 standard 844–847, 853
 - RS-232 to USB adapters 865
 - rsh** 898
 - rsync** 197, 508–511, 900
 - rsyncd** daemon 900
 - rsyncd.secrets** file 510
 - RTS (request to send) signal 853
 - run levels 856
 - changing 887
 - init** and 33–36, 42, 856, 886
 - RunAsUser **sendmail** user account 603
 - runaway processes 67–69
 - running Linux programs from Windows 822–823
 - Russinovich, Mark 951
 - rxvt** 827
-
- S
-
- S/MIME 610
 - SafeFileEnvironment option, **sendmail** 606
 - SAGE guild 965–966, 968
 - SAIT tapes 166
 - Samba 828–841
 - see also* Windows
 - CIFS 828
 - command-line file transfer program 835
 - configuration 829
 - daemons 829, 895–896
 - debugging 840–841
 - display active connections and locked files 840
 - file and printer server daemon 896
 - Samba *continued*
 - file sharing 833
 - filename encoding 830
 - group shares 833
 - installation 829–830
 - listing configuration options 830
 - log files 840
 - Network Neighborhood browsing 831
 - password encryption 830
 - printer sharing 836–839
 - security 829
 - setting up passwords 830
 - sharing files 828
 - user authentication 832
 - UTF-8 encoding 830
 - WINS server 831
 - samhain 692–693
 - SAN (Storage Area Network) servers 496
 - SANE 965
 - SANS Institute 675, 713, 965, 968
 - sar** 654, 816
 - Sarbanes-Oxley Act (SOX) 675, 956, 960
 - SASL (Simple Authentication and Security Layer) 610
 - SATA (Serial ATA) 112, 114
 - savelog** 209
 - Sawyer, Michael 473
 - /sbin** directory 75
 - SCA (Single Connector Attachment) plug 116
 - schedulers, I/O 815–816
 - scheduling classes 56
 - scheduling commands 150–157
 - SCO 951
 - scp** 697
 - SCSI 112, 114–118
 - BIOS 134
 - connectors 115–117
 - device names 873
 - fast and wide 115
 - installing 134
 - troubleshooting 118
 - vs. IDE 118
 - scsi_eh_N** daemon 894
 - SDSC Secure Syslog 210
 - search directive, DNS 419
 - search path 15
 - SEC (Simple Event Correlator) 221
 - sectors and tracks, disks 120
 - secure** file 206
 - secure terminals 685
 - /etc/securetty** file 685
 - security
 - account hygiene 93
 - Application Security Checklist* 676
 - auth.log** file 206
 - backups 161, 686
 - BIND 417, 424, 451–464
 - certifications 673–675
 - CISA (Certified Information Systems Auditor) 675
 - CISSP (Certified Information Systems Security Professional) 674
 - vs. convenience 673
 - denial of service (DOS) attacks 397, 511, 608, 817
 - device files 684
 - directed broadcast 317
 - DNS 417, 424, 451–464
 - DNSSEC 387, 456–463
 - DOS attack via syslog 213
 - email 588
 - email to programs 547, 605–606
 - file permissions 684
 - firewalls 701–708
 - firewalls, host-based 318
 - flaws in Linux 670
 - FTP 684, 736
 - GIAC (Global Information Assurance Certification) 675
 - of **group** file 684
 - handling attacks 710–712
 - hardened Linux 710
 - hints 678
 - hot-plug blacklist 883
 - ICMP redirects 295, 317
 - identifying open ports 652
 - information sources 712–715
 - intrusion detection 692–693
 - IP forwarding 316
 - IP spoofing 317–318
 - iptables** 704–708
 - Kerberos 695–696
 - kernel network variables 319
 - LDAP and 526
 - log files 201, 214
 - login names, uniqueness 95
 - monitoring 17, 677–678, 688, 692, 704
 - of **named** 451, 453
 - network 316–319
 - NFS 487–489, 495, 686

- security *continued*
- NIS 519, 685–686
 - overview 669–670
 - packet sniffers 655–657
 - PAM (Pluggable Authentication Modules) 681–682
 - of **passwd** file 678–681, 684
 - of passwords 47, 94, 96, 679–680, 690
 - policy 945–946
 - port scanning 688–690
 - of Postfix 625
 - of PPP 323
 - of printers 787
 - remote event logging 685
 - reporting break-ins 712
 - restricting root access 685
 - .rhosts** file 685
 - root account 48, 681
 - rootkits 688, 951
 - running **su** 48
 - Samba 829
 - SDSC Secure Syslog 210
 - search path 48
 - secure** file 206
 - /etc/securetty** file 685
 - SELinux 693–694
 - of **sendmail** 558, 588–598, 603–610, 686
 - setuid programs 683–684
 - /etc/shadow** file 678–681
 - shadow passwords 94, 99–100, 678
 - SNMP 660
 - social engineering 671
 - software patches 677
 - source routing 317
 - SSH 685, 697–698
 - SSL 730–732
 - standards 675–676
 - stunnel** 699–701
 - syslog 214
 - terminals 685
 - tools 688–701
 - Trojan horses 687
 - TSIG (transaction signatures) 444, 453–456
 - viruses 686–687
 - of VPNs (virtual private networks) 318, 708–710
 - of wireless networks 360
 - X Window System 744–748, 823
 - SecurityFocus.com 713
 - segmentation violations 58
- SEGV signal 58
- SELinux 693–694
- Sender ID 599
- Sender Policy Framework (SPF) 403, 599
- sendmail** 530, 897
- see also* email
 - see also* spam
 - access database 591–594
 - acting as MSA/MTA 534
 - aliases *see* aliases, email
 - authentication and encryption 603–610
 - chrooted** 607
 - command line flags 562
 - configuration 559–561, 565–587, 590–598
 - configuration examples 599–603
 - configuration options 586–587
 - controlling forgery 609
 - debugging 558, 566, 615–621
 - delivery agents 533
 - delivery modes 611
 - documentation 566
 - email to a disabled account 108
 - envelope splitting 611–612
 - headers 535–539, 595–596
 - history 557
 - Installation and Operation Guide* 639
 - installing 559–562
 - logging 619–621
 - m4** and 566–570, 586
 - masquerading 581–583
 - militering 597
 - MX backup sites 565
 - ownership, files 603–604
 - performance 611–615
 - permissions 604–605
 - privacy options 606–607
 - queue groups 611–612
 - queue runners 613
 - queues 563–565, 611–613, 619
 - rate and connection limits 596
 - relaying 589–591
 - security 558, 588–598, 603–610, 686
 - and the service switch file 562
 - slamming 597
 - using SMTP to debug 618
 - spam control features 588–598
 - startup script 38
 - statistics 615
- sendmail** *continued*
- tables and databases 576–580
 - verbose delivery 617–618
 - versions 557
 - virtusertable feature 579–580
 - Sendmail, Inc. 530, 610
 - sendmail.cf** file 559, 563, 565
 - sendmail.cw** file 574
 - sendmail.st** file 615
 - SEPP 266
 - serial
 - breakout boxes 865
 - cables *see* serial cables
 - connectors *see* serial connectors
 - device drivers 872
 - device files 853–855
 - devices, software configuration 855
 - drivers, special characters 859–862
 - interface, DCE vs. DTE 845–847
 - line, debugging 864
 - line, flow control 852–853
 - ports *see* serial ports
 - terminals, configuring 855–859
 - Serial ATA (SATA) 112, 114
 - serial cables
 - length limits 853
 - null modem 846–847
 - straight-through 846–847
 - Yost RJ-45 standard 850–852
 - serial connectors
 - DB-25 844–847
 - DB-9 848
 - mini DIN-8 847
 - RJ-11 862
 - RJ-45 849
 - serial ports 844–847
 - flow control 852–853
 - hard/soft carrier 852
 - parameters, setting 854–855
 - resetting 862
 - setting options 860–862
 - server statement, DNS 431, 448
 - servers
 - Apache *see* web hosting
 - DNS/BIND 412–414
 - email backup 541
 - FTP 734–736
 - HTTP 724
 - Kerberos Windows and DNS 464
 - load balancing 385, 805
 - master NIS 511–513, 517–518

- servers *continued*
 - name *see* BIND, DNS, and **named**
 - network printer 773
 - NFS 489–492, 496
 - NIS slave 512–514, 517
 - Squid 733–734
 - Storage Area Network (SAN) 496
 - system files 510
 - TUX 727
 - VNC 824
 - web proxy 733
 - web *see* web hosting
 - WINS 831
 - X Window System for Windows 823, 827
- service proxy firewalls 703
- service switch file 306–307, 562
- service.switch** file 562
- /etc/services** file 281, 702, 892–893
- setfacl** 89, 91
- setrlimit** system call 818
- setserial** 854
- setuid/setgid file attribute 45, 82–83, 683–684
- /etc/shadow** file 99–100, 678–681, 856
- shadow passwords 94, 99–100, 678
- Shapiro, Gregory 610
- share (Samba) 828
- shell
 - filename globbing 10, 77
 - login 98
 - search path 48
 - startup files 105
- SHELL variable 861
- /etc/shells** file 98, 108
- showmount** 492
- shutdown** 41–42, 215
- shutting the system down 40–42
- SIG DNS records 458
- signals 57–60
 - see also* individual signal names
 - caught, blocked, or ignored 57
 - CONT 61, 68
 - KILL 59–60
 - list of important 58
 - sending to a process 60
 - STOP 61, 68
 - TERM 59–60
 - tracing 66
 - TSTP 61
- Simple Network Management Protocol *see* SNMP
- single-user mode
 - booting to 24, 32
 - bypassing 24
 - entering 31
 - manual booting 22, 24
 - remounting the root filesystem 24, 32
- size, file attribute 84
- skel** directory 106
- slamming, controlling in **sendmail** 597
- slapd** daemon 523, 555
- slave servers, NIS 512–514, 517
- SLIP 320
- slurpd** daemon 523
- SMART_HOST macro, **sendmail** 583, 600
- SmartList 554
- SMB protocol *see* Samba
- smb.conf** file 829–831, 836, 840
- smbclient** 835
- smbcontrol** 840
- smbd** daemon 829, 896
- smbfs filesystem 835
- smbpasswd** 830
- smbstatus** 840
- SMP (symmetric multiprocessing) 808
- smrsh** email delivery agent 533, 585, 605–606
- SMTP protocol 532, 618, 625, 827
- smtpd** 897
- smtpd/smtpfwdd** 540
- smurf attacks 317
- SNMP 658–667, 900
 - agents 661–662
 - using Cacti 664
 - CiscoWorks and 667
 - community string 660
 - data collection 664
 - data organization 659–660
 - MIBs (Management Information Bases) 659–660
 - using Nagios 665
 - NET-SNMP 661–664
 - OIDs (object identifiers) 659–660
 - RMON MIB 661
 - tools 663–666
 - traps 660
- snmpd** daemon 662, 900
- snmpd.conf** file 662
- snmpwalk** 663
- SOA DNS records 392–395, 447
- socket** system call 80
- sockets, local domain 80
- soft carrier 852
- soft links 80
- software
 - see also* software package tools
 - see also* software packages
 - configuration errors 673
 - development 919–924
 - engineering principles 923–924
 - licenses 955
 - management tools 266
 - patches 677
 - patents 957–958
 - piracy 955
 - printing 779
 - recommended 266
 - sharing over NFS 263
 - vulnerabilities 672
- software package tools
 - see also* package management
 - see also* software
 - see also* software packages
 - alien** 235
 - APT 241–246
 - apt-ftparchive** 244
 - apt-get** 241–246
 - apt-proxy** 244
 - dpkg** 237
 - high level 237–247
 - RHN (Red Hat Network) 240
 - rpm** 235–237
 - /etc/apt/sources.list** file 242–243
 - yum** 246
- software packages
 - see also* software
 - see also* software package tools
 - dependencies 265
 - installers 234
 - list of 267
 - localizations 255–260
 - management 234–247
 - namespaces 264
 - repositories 239
 - revision control 248–255
 - RPM format 235
- software RAID 139
- Sony rootkits 951
- sortlist option, DNS 428
- source routing 317
- /etc/apt/sources.list** file 242–243

- SOX (Sarbanes-Oxley Act) 675, 956, 960
- spam
- amavisd** virus filter 637
 - blacklists 594–595, 598
 - danger of replying to 588, 598
 - eliminating using DNS 403
 - email header checking 595–596
 - fighting 598–599
 - greylisting 636
 - mobile spammers 598
 - Postfix 634–637
 - relaying 589–591
 - Sender ID 599
 - sendmail** control features 588–598
 - Spam Cop 598
 - SpamAssassin 598
 - SPF 403, 599
 - web resources for fighting 598
 - Spam Cop 598
 - SpamAssassin 598
- speed, setting for a network interface *see* **mii-tool**
- SPF (Sender Policy Framework) 403, 599
- split DNS 438–439, 441–444
- squatting, domain 380
- Squid web cache 733–734, 955
- SRV DNS records 402–403, 464
- SSH 697–698
- forwarding for X 747–748
 - security 685
 - Windows clients 821
 - X forwarding 823
- ssh** 697
- sshd** daemon 697, 898
- /etc/sshd_config** file 698, 823
- SSL 730–732
- stackers, tape media 167
- Stafford, Stephen 11
- standards 958–960
- COBIT (Control Objectives for Information and related Technology) 960
 - data center 800
 - Ethernet 277, 352
 - FHS (Filesystem Hierarchy Standard) 75
 - IEEE 802.* 278, 352, 356, 358–359
 - Internet 274–275
 - ISO/IEC 27001 675
- standards *continued*
- ITIL (Information Technology Interface Library) 960
 - Linux 958–960
 - LSB (Linux Standard Base) 959
 - network management 658
 - POSIX 959
 - security 675–676
 - Windows email and web compliance 827
- star** 197
- StarOffice 826
- startup files 105–106
- startup scripts 32–40
- bootstrapping 32–40
 - CUPS 773, 780
 - examples 34, 38
 - init** and 22, 32, 38, 40
 - /etc/init.d** directory 34–35, 38, 40
 - NFS server 489
 - sendmail** 38
- startx** 743
- statd** daemon 486
- stateful inspection firewalls 703
- static electricity 793
- static routes 294, 303–305
- statistics
- BIND 473
 - CPU 808
 - network 649–654
 - NFS 495
 - performance 816
 - reporting 816
 - sendmail** 615
- STD documents 275
- sticky bit 82–83
- STOP signal 58, 61, 68
- Stow, GNU 266
- STP cables 844
- strace** 66
- straight-through serial cables 846–847
- stty** 852, 860–862
- tunnel** 699–701
- su** 48
- subdomains, DNS 383
- submission agents, email (MSA) 533
- submit.cf** file 559, 566
- subnet masks *see* networks, net-masks
- subnetting 282–285
- Subversion 253–255
- sudo** 48–51, 97, 206
- sudo.log** file 206
- /etc/sudoers** file 49–50
- superblocks 126
- superuser *see* root account
- SUSE network configuration 309
- svn** 254
- svnserv** daemon, Subversion 253
- svnserv.conf** file 254
- swap space 124, 129, 138, 812, 814
- swapon** 128, 138, 812, 814
- swatch** 220
- switch file 420, 479
- switches 353, 356–358, 360
- Swpkg 266
- symbolic links 77, 80
- symmetric multiprocessing (SMP) 808
- sync** command 42
- sync** system call 42, 126
- synchronization of clocks 902
- synchronizing files
- copying 505
 - rdist** 505–508
 - rsync** 508–510
 - wget/ftp/expect** 510–511
- /proc/sys** directory 874
- /sys** directory 872
- /etc/sysconfig** directory 37–38, 309
- sysctl** 874
- /etc/sysctl.conf** file 316, 874
- sysfs virtual filesystem 872, 882
- syslog 209–220
- see also* log files
 - see also* logging
 - actions 213
 - alternatives 209
 - architecture 210
 - central server 214, 216
 - configuration examples 214–217
 - configuring 210–213
 - debugging 217–218
 - and DNS logging 466–471
 - DOS attack via 213
 - example using Perl 220
 - facility names 212
 - libraries 218–220
 - output 216
 - programming interface 218–220
 - remote logging 685
 - restarting 210
 - security 214

- syslog *continued*
 - setup 214
 - severity levels 212
 - software that uses 218
 - /etc/syslog.conf** file 204, 210–216
 - syslogd** daemon 203, 210–213, 901
 - time stamps 211
 - syslog** routine 210, 218
 - /etc/syslog.conf** file 204, 210–216, 620
 - syslogd** daemon 203, 210–213, 901
 - system-ng** 209
 - system administration 18
 - see also* hardware
 - see also* security
 - see also* system administration
 - group responsibilities
 - automation 922–924
 - checklists 943
 - configuring multiple machines 502
 - development 919–924
 - disaster recovery 163, 938–943
 - documentation 930–934
 - emergency power supplies 940
 - essential tasks 16–18
 - Internet resources 13
 - keeping users happy 904–906
 - legal issues 949–958
 - list of email tasks 530
 - local scripts 922–924
 - management 907–915
 - operations 924–926
 - orgs and conferences 964–967
 - personality syndrome 18
 - policy agreements 948
 - purchasing hardware 782–787, 916–917
 - role of 915–919
 - SOX (Sarbanes-Oxley Act) 956
 - support 927–930
 - survey results 968
 - testing solutions 910
 - toolbox 800, 922–923
 - trouble ticketing and tracking 935–938
 - system administration roles
 - administration 915–919
 - development 919–924
 - management 906–915
 - operations 924–927
 - support 927–930
 - system configuration 255–263
 - see also* hardware
 - see also* Linux installation
 - see also* system administration
 - Arusha Project 261
 - cfengine** 260
 - CIM (Common Information Model) 262
 - LCFG (large-scale configuration system) 261
 - management 260–263
 - Template Tree 2 262
 - system-config-kickstart** 231
 - system-config-netboot** 226
-
- ## T
-
- talk** 900
 - talkd** daemon 900
 - Tanenbaum, Andrew S. 5
 - tape drives, device names 873
 - tapes, backup
 - see also* media, backup
 - 4mm 166
 - 8mm 166
 - AIT 166
 - blocking factor 177
 - copying 178
 - DDS/DAT 166
 - device files 171
 - DLT/S-DLT 166
 - library, robotic 179
 - LTO 167
 - positioning 178
 - SAIT 166
 - stackers 167
 - VXA/VXA-X 167
 - tar** 177–178
 - target number, SCSI 117
 - TCP
 - connection states 651
 - vs. UDP for NFS 485
 - wrappers 887
 - TCP/IP 271, 275–281
 - CIDR (Classless Inter-Domain Routing) 283, 286–288
 - fancy options (SACK, ECN) 307
 - fragmentation 279, 646
 - history 272
 - IPsec 949
 - IPv6 286, 291–293
 - loopback interface 282, 294, 302, 397
 - TCP/IP continued*
 - NAT 290–291, 319
 - netmasks 282–285
 - network model 276
 - packet encapsulation 276–277
 - ports 281
 - protocol suite 275–276
 - subnetting 282–285
 - TOS bits 330
 - tcpd** daemon 887
 - tcpdump** 656
 - tcpflow** 657
 - telinit** 32, 42, 857, 887
 - telnet** 346
 - TELNET protocol 898
 - Tel-splice connector 852
 - Template Tree 2, system configuration 262
 - temporary files, removing 154
 - Tera Term Pro 821
 - TERM environment variable 859, 861
 - TERM signal 58–60
 - /etc/termcap** file 858–859
 - Terminal Server service, Windows 825
 - terminals 855–859
 - capability databases 858–859
 - control 56
 - secure 685
 - setting options 860–862
 - special characters 859–862
 - unwedging 862
 - terminators, SCSI 117
 - /etc/terminfo** file 858
 - Terry, Douglas 376
 - testing, system 257
 - testparm** 830
 - Texinfo 11
 - TFTP 312, 899
 - tftp** 347
 - Thomas, Eric 554
 - threads, kernel 23
 - TIA (Telecommunications Industry Association) 354
 - TightVNC 824
 - time synchronization 902–903
 - tip** 864
 - TLS *see* SSL
 - TLT/S-DLT tapes 166
 - /tmp** directory 75
 - /tmp** partition 125
 - tools, hardware 800
 - top** 65, 809, 817

top-level domains 379, 381
 topology statement, DNS 428
 Torvalds, Linus 5
traceroute 647–649
 tracks and sectors, disks 120
 transfers-in option, DNS 425
 transfer-source option, DNS 426, 445
 transfers-out option, DNS 425
 transfers-per-ns option, DNS 425
 transport agents, email 532
 Tridgell, Andrew 508, 828
 Troan, Erik 208
 Trojan horses 687
 Trojnara, Michal 699
 trouble ticketing and tracking 935–938
 troubleshooting
 Bacula 195–196
 BIND 466–478
 CUPS 780–782
 named 466–478
 network hardware, cable analyzers 366
 network hardware, sniffers 366
 network hardware, T-BERD line analyzer 366
 network printing 781
 networks 366, 644–654
 networks with **mii-tool** 302–303
 Postfix 637–639
 printers 780–782
 RAID 144–145
 runaway processes 67–69
 Samba 840–841
 SCSI 118
 sendmail 615–621
 serial line 864–865
 sluggish system 817–819
 syslog 217–218
 wedged terminal 862
 X Window System 754–757
 Xorg X server 754–757
 trusted-keys statement, DNS 430
 TrustedUser **sendmail** user account 603
 Ts'o, Theodore 120
tset 861–862
 TSIG (transaction signatures) 444, 453–456
 Tsigotis, Panos 887

TSM (Tivoli Storage Manager) 197
 TSTP signal 58, 61
 TTL (time to live), packets 647
 \$TTL directive, DNS 390, 394, 406
 TTL for DNS resource records 390
tune2fs 121, 132
 tuning
 IDE disks 130
 the kernel 314–316, 874
 network parameters 314–316
 NFS 494
 TUX server 727
 Tweedie, Stephen 120
 TXT DNS records 403, 424
 typographic conventions 9–10

U

U (rack unit) 791
 Ubuntu network configuration 310
udev 79
 udev system 872
udev.conf directory 872
udev 872, 899
 UDP (User Datagram Protocol) 271, 275, 485
 UIDs *see* user IDs
 Ultr@VNC project 824
 Ultra SCSI *see* SCSI
umask 86, 105
umount 73, 129, 494
uname 881
 undeliverable messages, **sendmail** 613
 unicast addresses 292
 Uninterruptible Power Supply (UPS) 799
 UNIX vs. Linux 4
unlink system call 80
 unshielded twisted pair *see* UTP cables
 unsolicited commercial email *see* spam
 update-policy clause, DNS 450
update-rc.d 40
 updating zone files, DNS 447–450
 upgrades 176–177
uptime 808, 818
 URLs 720–721
 us domain 380
 USB 865–866
 device identification 869
 disks 112, 147–148, 165
 printers 774, 781
 RS-232 adapters 865
 in place of SCSI 115
 supported devices 784
 use_cw_file feature, **sendmail** 574
 USENIX association 965–966, 968
 user accounts
 adding 102–107, 109
 aliases, global (email) 95
 authentication under Samba 832
 bin 51
 daemon 51
 deleting 110
 disabling 108
 email home machine 106
 ftp 735
 GECOS information 98
 guest 944
 home directories 75, 98, 105
 hygiene 93
 ID number *see* user IDs
 login process 46
 login shell 98
 modifying 109
 names 94–95
 nobody (NFS) 51, 488
 passwords 104
 pseudo-users 51
 removing 107
 root *see* root account
 sendmail use of 603
 shared 680
 site-wide management 944
 startup files 105
 superuser *see* root account
 user agents, email 531
 User Datagram Protocol *see* UDP
 user IDs 45, 54–55, 96–97, 104
useradd 102, 109
userdel 110
usermod 99, 109
 usernames *see* user accounts, names
 users
 see also user accounts
 documentation 934
 keeping them happy 904–906
 policy agreements 946–948
/usr directory 75
 UTP cables 353–355, 366, 844

V

V.90 modem standard 863
 van den Berg, Stephen R. 554, 585
/var filesystem 75, 125
 variables, initializing in startup files 105
 vendor logos 10
 vendors we like 371–372
 Venema, Wietse 623, 856
 VeriSign Site Finder tool 429
 Veritas, backup tool 198
 VERSIONID macro, **sendmail** 570
 VFS (Virtual File System) 120
vgcreate LVM utility 143
vgdisplay LVM utility 143, 146
vgscan LVM utility 143
 Viega, John 553
 view statement, DNS 438
.vimrc file 105
vipw 103
 virtual domains, Postfix 630–632
 Virtual File System (VFS) 120
 virtual hosts, web 727–730
 virtual memory (VM) 124, 129, 810–811
 Virtual Network Computing *see* VNC protocol
 virtual network interfaces 300
 virtual private networks *see* VPNs
 virtual terminals and X 754–755
 VirtualHost clause, Apache 729
 virtusertable feature, **sendmail** 579–580
 viruses 686–687
visudo 50
 Vixie, Paul 150, 376
 Vixie-**cron** *see* **cron** daemon
 VLANs 357
vmlinuz file 29, 75
vmstat 807–808, 818
 VMware 825
 VNC protocol 824
vnserver 824
 VPNs (virtual private networks) 318, 328, 708–710
 IPsec tunnels 709
 SSH tunnels 709
 VRFY command 588
 VT100 terminal 858
 VXA/VXA-X backup tapes 167

W

wait system call 57
 Wall, Larry 388
 WANs 351
 Ward, Grady 47
WarGames 669
 warranties 793
 Warsaw, Barry 553
 Wassenaar, Eric 474
 Watchguard Firebox 319
 WBEM (Web-Based Enterprise Management) standard 658
 web *see* World Wide Web
 Web 2.0 719
 web hosting 719–734
 Apache 724–732
 Apache configuration 726–732
 Apache installation 724–726
 caching server 733–734
 certificates 731–732
 CGI scripting 722
 httpd 901
 IIS (Windows) 827
 load balancing 385, 722–724
 log files 727
 performance 722–724
 proxy server 733–734
 Squid cache 733–734
 SSL 730–732
 static content 727
 TUX 727
 virtual interfaces 727–730
 Weeks, Alex 11
 well-known ports 688, 702
 Wheeler, David A. 55
whereis 15
which 15
 white pages 901
 Win4Lin 826
 WINCH signal 58–59
 Windows
 see also Samba
 accessing remote desktops 822–825
 ACLs 833
 automounter 834
 backups 197
 DFS (Distributed File System) 834
 dual booting 826
 email and web standards compliance 827

Windows *continued*

FAT filesystems 120
 IMAP 828
 Kerberos server and DNS 464
 logging in from 821–822
 mounting Windows filesystems 835
 multibooting with LINUX 30–31
 Network Neighborhood browsing using Samba 831
 POP (Post Office Protocol) 828
 printing 838–839
 RDP (Remote Desktop Protocol) 824
 running Linux programs from 822–823
 running under VMware 825
 running Windows programs under Linux 825
 sharing files 828
 SMTP 827
 SSH clients 821
 Terminal Server service 825
 UNIX software running on 827
 VNC servers 824
 Wine project 825
 X forwarding 823
 X Window System servers 823, 827
xterm for 827
 Wine project 825
 Winmodems 863
 WinPrinters 783
 WINS server, Samba 831
 WinSCP 822
 wireless networks *see* networks, wireless
 Wireshark packet sniffer 366, 657
 wiring *see* network wiring
 Wirzenius, Lars 11
 WKS DNS records 403
 workstations, diskless 898
 World Wide Web
 see also web hosting
 browsers 720
 HTTP protocol 720–722
 URLs 720
 wrapper scripts for localization 265
wtmp file 206
 WU-FTPD 900
wvdial 325
 WWW *see* World Wide Web

X

X display manager 743–744
 X Window System
 see also **Xorg** X server
 architecture 742
 client authentication 745–746
 desktop environments 757–759
 DISPLAY environment variable 744, 748
 display manager 743–744
 history 741–742
 killing the X server 755
 magic cookies 746
 running an application 744–748
 security 744–748
 security under Windows 823
 SSH and 747–748
 startup files 105
 terminal window 859
 troubleshooting 754–757
 virtual terminals 754–755
 Windows servers 823, 827
 X forwarding 823
 X server output 755–756
/etc/X11 directory 743
 X11 *see* X Window System
xargs 72
xauth 746
.Xclients file 105
.Xdefaults file 105
xdm directory 743
xdm program 743
xdpyinfo 756
xdvi 785
 XFS filesystem 122
xhost 745–746
 XHTML 764
xinetd 887–890
 configuring 888–890
 ftpd and 735
 /etc/services file 892–893
 /etc/xinetd.conf file 888–890
/etc/xinetd.conf file 888
/etc/xinetd.d directory 888
xinit 743
.xinitrc file 105
xntpd 62
 XON/XOFF 852–853
Xorg X server 748–754
 configuring 748–754
 debugging 754–757
 logging 755–757

xdpyinfo 756
/etc/X11/xorg.conf file 749–754
xorgconfig 749
/etc/X11/xorg.conf file 749–754
xorgconfig 749
 XORP (eXtensible Open Router Platform) 344
Xsession 743
~/.xsession file 105, 743
xtab file 489, 895
xterm console emulator 827

Y

Yellow Pages *see* NIS
 Ylönen, Tatu 697
 Yost serial wiring system 850–852
 Yost, Dave 850
/var/yp file 512
yp* commands 513–518
/etc/yp.conf file 512
ypbind daemon 896
ypserv daemon 896
ypxfr 896
yum 246

Z

Zebra routing package 344
 Zhou, Songnian 376
 Zimmermann, Philip 696
 zombie processes 56, 61, 63, 886
 zone statement, DNS 432–436
 zones, DNS 388, 412
 commands 405–407
 files 389
 incremental transfers 388, 429
 IXFRs 447
 linkage 407–409
 signed, creating 458
 transfers 413, 425, 447–448
 updating files 447–450
 zone-statistics option, DNS 433