

INDEX

A

ACCEPT rules
 and DROP rule, 46
 for SSH connections, 23

ACCEPT target, 12

access directive, for fwknop server, 242

ACK scan, 64

ack Snort rule option, 158, 159

acknowledgment values, inclusion in iptables, 51

active response
 examples, 137–143
 configuration settings, 138–139
 FIN scan response, 141–142
 maliciously spoofing scan, 142–143
 Nmap version scan, 141
 SYN scan response, 139–140
 UDP scan response, 140–141

integrating with third-party tools, 143–147

 command-line interface, 143–144

 vs. intrusion detection, 131–133

 psad vs. fwsnort, 198–199

 trade-offs, 133–134

Address Resolution Protocol (ARP), 22

Advanced Encryption Standard (AES), 243

AfterGlow, 257, 262–263

Aleph One, 75

alert action
 in fwsnort, 157
 in Snort, 156

ALERT_ALL variable, in psad.conf file, 93

ALERTING_METHODS variable, in psad.conf file, 95

--algo bm argument, 70

--analysis-fields argument, for psad, 266

anomaly, problem defining, 216

application layer, 69
 abusing, 73–79
 buffer overflow exploits, 74–76
 gray matter hacking, 77–79
 Snort signatures, 74
 SQL injection attacks, 76–77

attack definitions, 72–73

encryption and application encodings, 79–80

responses, 80

string matching with iptables, 70–72

non-printable data match, 71–72

Applied Cryptography (Schneier), 229

ARP (Address Resolution Protocol), 22

asn1 keyword, in Snort, 171

asymmetric encryption, SPA with, 246–249

asymmetric-key cipher, 243

Atkins, Todd, 145

attacking IP addresses, psad display of top fifty, 126

attacks
 classes of, 133
 concealing with fragments and targeted TTLs, 43
 expectation of, 4
 psad for responding to, 134–137
 raw packet data for analysis, 3

- attacks, *continued*
 reducing surface, 213–214
 Snort rules for detecting, 113–119
 spoofing, 279–283
 connection tracking, 280–283
 visualizations, 263–277
 Nachi worm, 272–273
 of port scans, 264–267
 of port sweeps, 267–270
 SQL Slammer worm, 270–271
- authentication, 232
 tricking user into providing
 credentials, 77
- AUTH_MODE variable, for fwknop, 234
- authorization, 232
- AUTO_BLOCK_REGEX variable, 136, 199
- AUTO_BLOCK_TIMEOUT variable, 136, 138
- AUTO_IDS_DANGER_LEVEL variable, 136, 199
- automatically blocked IP addresses,
 psad display of, 127
- auto-response messages, from
 psad, 111
- AVG_IP_HEADER_LEN keyword, in
 /etc/fwsnort/fwsnort.conf
 file, 166
- AVG_TCP_HEADER_LEN keyword, in
 /etc/fwsnort/fwsnort.conf
 file, 166
- B**
- back reference, regular expression
 with, 145
- backdoor, 78–79
- backdoor server, in Dumador
 trojan, 186
- “Bancos Trojan” signature, 154
- bandwidth, saturation, 39
- Base64-encode, 243
- Bastille Linux project, 4, 81
- Bastille-NIDS, 82
- Beale, Jay, 82
- Bernstein, Daniel, 66
- BINDIR variable, 19
- BlackICE, 132
- blacklists, setup, 191
- Bleeding Snort project, 174
 “Bancos Trojan” signature, 154
 detection of attempts to truncate
 SQL query section, 76
- bleeding-all.rules file, 188
- blocked IP addresses, automatically,
 psad display of, 127
- blocking rules, changing, 144
- botnet, 199
- Bourne shell script
 fwsnort.sh script, 179–182
 for implementing iptables filtering
 policy, 20
- Boyer-Moore string search algorithm,
 70, 71, 160
- buffer overflow exploits, 74–76
- Bugtraq, 214
 ID 9057, 194
- byte_jump option, in Snort, 171
- byte_test option, in Snort, 171
- C**
- C applications, buffer overflow, 74–75
- C++ applications, buffer overflow,
 74–75
- California legislation, consumer
 notification of data theft, 214
- cd00r, 217
- CGI applications, as SQL injection
 attack target, 76
- chains, 10–11. *See also individual
 chain names*
- FORWARD, 11
 in default policy, 25–26
 listing current ruleset, 19
 LOG rule in, 50–51
 messages logged within, 102
- FWKNOP_INPUT, 245
- FWSNORT_FORWARD, 180, 189
- FWSNORT_FORWARD_ESTAB, 181, 195
- FWSNORT_INPUT, 180
- FWSNORT_OUTPUT, 180
- INPUT, 11
 in default policy, 22–24
 listing current ruleset, 19
 LOG rule in, 50–51
 messages logged within, 102

OUTPUT, 11
 in default policy, 24
 listing current ruleset, 19
 LOG rule in, 50–51
 messages logged within, 102
POSTROUTING, 11, 26
PREROUTING, 11, 26
 viewing list of, 143
character device, 17
Check Point, 143
CHECK_INTERVAL variable, in psad.conf file, 92
chown command, signature for overflow against, 75
client-side vulnerabilities, over TCP, 30
CMD_REGEX variable, in
 /etc/fwknop/access.conf file, 238–239
code reuse, in computer underground, 216
--comment match, 12
compiling kernel, 18
compromised systems, outbound connections from, 273–277
CONFIG_SYN_COOKIES, kernel compiled with, 66
connection resource exhaustion, as transport layer attack, 52
connection tracking, 280–283
connectionless protocol, 49–50
connection-oriented protocol, 49
content Snort option, 160
cookies, mishandling, 73
counthouruinq directive, 265
Crypt::CBC Perl module, 233
Crypt::Rijndael Perl module, 233
--CSV-fields argument, for psad, 261
--CSV-regex argument, for psad, 262

D

danger level, in psad email alert, 108
DANGER_LEVEL{n} variable, in psad.conf file, 91
data transmission rate, minimal, and port knocking, 224
DATA_COLLECT_MODE variable, in
 /etc/fwknop/access.conf file, 239

Data::Dumper Perl module, 127
DDoS (Distributed Denial of Service)
 attacks, 44, 83
 Trin00 tool for, 184–185
Debian package, installing psad as, 84
--debug switch, in psad, 128–129
default iptables policy
 FORWARD chain, 25–26
 INPUT chain, 22–24
 instantiating, 27
 Network Address Translation, 26–27
 OUTPUT chain, 24
 saving, 27–29
 script preamble, 20–21
 testing, 29–31
default-drop packet filter, 214
 making connection through, 217
defense in depth principle, 4, 82, 151, 216
Denial of Service (DoS) attack. *See*
 DoS (Denial of Service) attack
depth Snort option, 162
--destination (-d) match, 12
destination IP address
 in psad email alert, 109
 specifying in Snort, 157
destination NAT (DNAT) target, 26
directories, for psad install, 85
distance Snort option, 161, 162
Distributed Denial of Service (DDoS)
 attacks, 44, 83
 Trin00 tool for, 184–185
d'Itri, Marco, 89, 109
DNAT (destination NAT) target, 26
DNS cache-poisoning attack,
 detecting, 188–190
documentation, in psad.conf file, 90
DoS (Denial of Service) attack
 against knock server, 225
 LAND attack as, 116
 Naptha, 117
downloading
 latest version of psad, 83
 Metasploit framework, 205–206
 from mirror servers, 14
DROP rule, and ACCEPT rules, 46
DROP target, 12
 vs. REJECT target, 201–204

DShield Distributed IDS, 84
psad display of statistics, 127
reporting, 123–124
`DSHIELD_ALERT_INTERVAL` variable, 123
`DSHIELD_USER_ID` variable, 123
`dsiz` Snort option, 165–166
Dumador trojan, detecting, 186–188
dynamic action, in Snort, 156

E

Echo Reply packets, iptables policy
for accepting, 32
Elgamal cryptosystem, 246*n*
email alerts from psad, 108–110
on attempted Metasploit update,
210–211
`EMAIL_ADDRESSES` variable
for fwknop, 237, 245
in `psad.conf` file, 91
`EMAIL_ALERT_DANGER_LEVEL` variable, in
`psad.conf` file, 93
`EMAIL_LIMIT` variable, in `psad.conf`
file, 95
`ENABLE_AUTO_IDS` variable, in `psad.conf`
file, 94, 127, 135, 199
`ENABLE_AUTO_IDS_REGEX` variable, 136, 139
`ENABLE_CMD_EXEC` variable, in
`/etc/fwknop/access.conf`
file, 238
`ENABLE_DSHIELD_ALERTS` variable, in
`psad.conf` file, 94
`ENABLE_MD5_PERSISTENCE` variable, for
fwknop, 236
`ENABLE_PCAP_PROMISC` variable, for
fwknop, 235
`ENABLE_PERSISTANCE` variable, in
`psad.conf` file, 92, 109
`ENABLE_SPA_PACKET_AGING` variable, for
fwknop, 236
`ENABLE_TCP_SERVER` variable, for
fwknop, 237
`enc_knock.pl` script, 223
encryption, asymmetric, SPA with,
246–249
entry router, for virtual circuit, 254
`ESTABLISHED` state, 23

`/etc/fwknop/access.conf` file,
237–240
`CMD_REGEX` variable, 238–239
`DATA_COLLECT_MODE` variable, 239
`ENABLE_CMD_EXEC` variable, 238
example, 240–241
`FW_ACCESS_TIMEOUT` variable, 239
`GPG_DECRYPT_ID` variable, 240
`GPG_DECRYPT_PW` variable, 240
`GPG_REMOTE_ID` variable, 240
`KEY` variable, 239
`OPEN_PORTS` variable, 238
`PERMIT_CLIENT_PORTS` variable, 238
`REQUIRE_USERNAME` variable, 239
`SOURCE` variable, 238
`/etc/fwknop` directory, 233
`/etc/fwknop/fwknop.conf` file,
234–237
`AUTH_MODE` variable, 234
`EMAIL_ADDRESSES` variable, 237
`ENABLE_MD5_PERSISTENCE` variable, 236
`ENABLE_PCAP_PROMISC` variable, 235
`ENABLE_SPA_PACKET_AGING` variable, 236
`ENABLE_TCP_SERVER` variable, 237
`FIREWALL_TYPE` variable, 235
`GPG_DEFAULT_HOME_DIR` variable, 237
`IPT_AUTO_CHAIN1` variable, 235
`MAX_SPA_PACKET_AGE` variable, 236
`PCAP_FILTER` variable, 234–235
`PCAP_INFT` variable, 234
`PCAP_PKT_FILE` variable, 235
`REQUIRE_SOURCE_ADDRESS` variable,
236–237
`TCPSERV_PORT` variable, 237
`/etc/fwsnort/fwsnort.conf` file, 177
`WHITELIST` and `BLACKLIST`
variables, 191
`/etc/fwsnort/fwsnort.sh` script, 200
`/etc/hosts.deny` file, 134
`/etc/init.d/fwknop` initialization
script, 234
`/etc/psad/auto_dl` file, 96, 108
psad and, 143
`/etc/psad/ip_options` file, 97
`/etc/psad/pf.os` file, 97–98
`/etc/psad/psad.conf` file, 90–96
`ALERT_ALL` variable, 93
`ALERTING_METHODS` variable, 95

AUTO_BLOCK_REGEX variable, 136
AUTO_BLOCK_TIMEOUT variable, 136, 138
AUTO_IDS_DANGER_LEVEL variable,
 136, 137
CHECK_INTERVAL variable, 92
DANGER_LEVEL{*n*} variable, 91
DSHIELD_ALERT_INTERVAL variable, 123
DSHIELD_USER_ID variable, 123
EMAIL_ADDRESSES variable, 91
EMAIL_ALERT_DANGER_LEVEL variable, 93
EMAIL_LIMIT variable, 95
ENABLE_AUTO_IDS variable, 94, 127, 135
ENABLE_AUTO_IDS_REGEX variable,
 136, 139
ENABLE_DSHIELD_ALERTS variable, 94
ENABLE_PERSISTANCE variable, 92
EXTERNAL_NET variable, 91
FW_MSG_SEARCH variable, 95–96
HOME_NET variable, 91
IGNORE_LOG_PREFIXES variable, 95
IGNORE_PORTS variable, 94
IGNORE_PROTOCOLS variable, 95
IMPORT_OLD_SCANS variable, 94
IPTABLES_BLOCK_METHOD variable, 136
IPT_AUTO_CHAIN{*n*} variables, 137, 139
MIN_DANGER_LEVEL variable, 93
PORT_RANGE_SCAN_THRESHOLD variable,
 92–93
SCAN_TIMEOUT variable, 92
SHOW_ALL_SIGNATURES variable, 93
SNORT_SID_STR variable, 93
STATUS_IP_THRESHOLD variable, 126
STATUS_PORTS_THRESHOLD variable, 127
SYSLOG_DAEMON variable, 92
TCPWRAPPERS_BLOCK_METHOD
 variable, 136
/etc/psad/signatures file, 96, 114
/etc/psad/snort_rule_dl file, 97
Ethernet sniffer, 4
 for extracting user and password
 information, 79
exit router, for virtual circuit, 254
exploit code, 75
EXTERNAL_NET variable
 for fwsnort, 177
 in psad.conf file, 91

F

false negatives, 134
false positives, 3
 hiding attacks in, 279
 in intrusion detection systems, 134
Filesystem Hierarchy Standard
 (FHS), 85
filter table, 11
filtering response, in network layer, 45
FIN scans
 detection with psad, 105–106
 and Netfilter connection
 tracking, 105
 response, 141–142
 of TCP ports, 58
FireWall KNoCK OPerator (fwknop).
 See fwknop (FireWall KNoCK
 OPerator)
firewall logs, reasons for analyzing, 72
Firewall Snort. *See* fwsnort (Firewall
 Snort)
firewalls
 and intrusion detection systems, 82
 and intrusion prevention
 system, 150
 rules, and router ACLs, 67
 technology trends, 1
FIREWALL_TYPE variable, for fwknop, 235
flags Snort option, 162–163
flexresp detection plug-in, in Snort, 65
flexresp2 detection plug-in, in
 Snort, 65
flexresponse detection plug-in, resp
 option, 169
flexresponse2 detection plug-in, resp
 option, 169
flooding target, with ICMP Echo
 Response Packets, 43
flow Snort option, 166–168
flowbits option, in Snort, 171
--Flush argument, 144
forensics mode, in psad, 128, 266
FORWARD chain, 11
 in default policy, 25–26
 listing current ruleset, 19
 LOG rule in, 50–51
 messages logged within, 102

frag3 preprocessor, 151
fragbits option, in Snort, 172
fragments, concealing attack with, 43
fragroute tool, 42
FsSniffer backdoor, 79
Full-disclosure, 214
--fw-block-ip argument, 144
--fw-list argument, 143
--fw-rm-block-ip argument, 144
`FW_ACCESS_TIMEOUT` variable, in
 `/etc/fwknop/access.conf`
 file, 239
`fwcheck_psad` script, 86
`fwdxtra` file, log messages from, 102
fwknop (FireWall KNoCK OPerator),
 2, 231
 configuration, 234–241
 `/etc/fwknop/access.conf` file,
 237–240
 `/etc/fwknop/fwknop.conf` file,
 234–237
 deploying, 243–255
 GnuPG keys
 exchange, 246–249
 running with, 248–249
 installing, 232–234
 OpenSSH integration patch,
 252–253
 rules and iptables policy rules, 246
 SPA packet format, 241–243
`FWKNOP_INPUT` chain, 245
`fwknop_serv` daemon, 254
`FW_MSG_SEARCH` variable, in `psad.conf`
 file, 95–96
`fwsnort` (Firewall Snort), 2, 119, 149
 active response vs. psad, 198–199
 attack detection with, 195–196
 restricting psad responses, 199
 command-line options, 182–183
 configuration file, 177–179
 DROP vs. REJECT targets, 201–204
 example attacks, 184–190
 DNS cache-poisoning attack,
 188–190
 Dumador Trojan, 186–188
 Linux shellcode traffic
 detection, 185–186
Trin00 DDoS tool detection,
 184–185
installing, 173–175
iptables signature policy in, 152
output, 176
reasons to run, 150–152
 defense in depth principle, 151
 inline responses, 152
 intrusion detection and net-
 work layer defragmentation,
 151–152
 lightweight footprint, 152
running, 175–183
Snort rules interpretation, 155–172
for stopping Metasploit updates,
 208–211
tying detection to psad operations,
 194–198
whitelists and blacklists setup, 191
`FWSNORT_FORWARD` chain, 180, 189
`FWSNORT_FORWARD_ESTAB` chain, 181, 195
`FWSNORT_INPUT` chain, 180
`FWSNORT_OUTPUT` chain, 180
`fswsnort.log` file, 177
`fwsnort.sh` script, 177
 example, 285–290
 structure, 179–182
 activating chains with jump
 rules, 182
 signature inspection and log
 generation, 181–182
 TCP connection states and
 chains, 180–182
Fyodor’s Top 100 Network Security
Tools list, 204

G

`getlogin()` function (Perl), 241
`getpwuid()` function (Perl), 241
GnuPG, 243
 key exchange for fwknop, 246–249
 signature, 232
 verifying, 83
`GnuPG::Interface` Perl module, 233
`Gnuplot`, 257, 260–262
 graphing directives, 260–261
 plot of port scan, 264
--gnuplot argument, for psad, 260, 261

--gnuplot-file-prefix argument, for psad, 262
--gnuplot-graph-style argument, for psad, 262
`PGP_DECRYPT_ID` variable, in /etc/fwknop/access.conf file, 240
`PGP_DECRYPT_PW` variable, in /etc/fwknop/access.conf file, 240
`PGP_DEFAULT_HOME_DIR` variable, for fwknop, 237
`PGP_REMOTE_ID` variable, in /etc/fwknop/access.conf file, 240
graphs
 external source addresses vs. destination ports vs. packet counts, 268
 external sources vs. number of unique local destinations, 267
link graph
 from AfterGlow, 262, 269–270
 of Nachi worm packets, 274
 of outbound connections from honeynet, 276, 277
MySQL 3306 port sweep, 269
number of packets to ports per minute, 258
number of SYN packets to ports per hour, 259
point graph of outbound connections from honeynet, 275
Slammer worm packet counts
 by the hour, 271
 by the minute, 272
source IP addresses vs. number of unique ports, 264
time vs. unique ports, 266
value of, 259
 for visualizing security data, 257
gray matter hacking, 77–79
grep command, to view Netfilter configuration, 16
gzip encoding, web browser support for, 80

H

hacking, gray matter, 77–79
half-open (TCP SYN) scans, 56–57
 detection with psad, 103–105
header abuses
 as network layer attacks, 39
 as transport layer attacks, 53
--hex-string argument, 72
`HOME_NET` variable
 for fwsnort, 177
 in psad.conf file, 91
Honeynet Project, 257–258, 263
 system on open Internet, 273–277
host discovery, 39
hping utility, 31, 32, 41
 to spoof Snort content fields, 167
HTTP, and short-lived SPA sessions, 228–229
HTTP Cross-Site Cooking, 73

|

ICMP (Internet Control Message Protocol)
list of all message types, 163
packets in port knocking sequence, 219
Port Unreachable message, 31, 60, 67, 107
testing iptables policy over, 32
ICMP Echo Response Packets
flooding target with, 43
length of, 165
`icmp_id` Snort rule option, 158
`icmp_seq` Snort rule option, 158
`icode` Snort option, 163
`id` Snort rule option, 158
iDefense, 214
IDS (intrusion detection system)
 and firewalls, 2, 82, 150
 and RST generation, 65
searching data for sequences of malicious bytes, 70
signature-based, implications, 215–216
target-based, and network layer defragmentation, 151–152

IGMP (Internet Group Management Protocol)
attacks, 44
DoS, 39

`IGNORE_LOG_PREFIXES` variable, in
psad.conf file, 95

`IGNORE_PORTS` variable, in psad.conf
file, 94

`IGNORE_PROTOCOLS` variable, in psad.conf
file, 95

`IMPORT_OLD_SCANS` variable, in psad.conf
file, 94

`--in-interface (-i)` match, 12

`IN=` string, 88

`--include-type` option, for fwsnort, 183

informational syslog message, from
psad, 110–111

initial sequence numbers,
randomization of, 61

initialization scripts, for psad, 85

inline device, 82

`INPUT` chain, 11
in default policy, 22–24
listing current ruleset, 19
`LOG` rule in, 50–51
messages logged within, 102

installing
 `fwnop`, 232–234
 `fwsnort`, 173–175
 `iptables`, 12–14
 `iptables Userland Binaries`, 19–20
 kernel, 18
 psad, 83–85

instantiating, default `iptables`
 policy, 27

Internet Control Message Protocol
(ICMP). *See* ICMP (Internet
Control Message Protocol)

Internet Group Management
Protocol (IGMP). *See* IGMP
(Internet Group Management
Protocol)

Internet, open, Honeynet Project
 system on, 273–277

Internet Security Systems, 132

`INT_NET` variable, defining in
`iptables.sh` script, 22

intrusion detection system (IDS).
See IDS (intrusion detection
system)

intrusion prevention system (IPS).
See IPS (intrusion prevention
system)

`INVALID` state, 23

IP
 address
 psad mapping to integers for
 Gnuplot graph, 265
 psad to automatically block, 136
 time for blocking rules
 against, 140

communications, dropping all
 packets, 22

fragmentation, 41–42

header
 length of, 165
 logging, 36–38
 spoofing, 40–41, 47
 with Perl, 41

ipEye port scanner, 115
 detecting, 115

`ip_options` file, for psad, 97

`ipopts` Snort option, 164–165

`ip_proto` Snort option, 166

IPS (intrusion prevention system), 3,
 82, 150
 and firewalls, 150
 and lightweight system usage
 footprint, 152
 Snort as, 168
 and worms, 61

`IPT_AUTO_CHAIN{n}` variables, 137, 139

`--ipt-drop` option, for fwsnort, 182, 195

`--ipt-flush` option, for fwsnort, 183

`--ipt-list` option, for fwsnort, 183

`--ipt-reject` argument, for
 fwsnort, 208

`--ipt-reject` option, for fwsnort,
 183, 195

`iptables`, 2, 9–10
 attack visualizations, 263–277
 blocking rules, syslog message
 showing creation and
 destruction, 111

building rules file in human-readable format, 27
decoding TCP options from logs, 122–123
default policy, 20–32
 FORWARD chain, 25–26
 INPUT chain, 22–24
 instantiating, 27
 Network Address Translation, 26–27
 OUTPUT chain, 24
policy requirements, 20–21
saving, 27–29
script preamble, 20–21
testing, 29–31
for detecting attacks, 2–4
emulation in Snort, 156
features, 10
installing, 12–14
installing Userland Binaries, 19–20
log messages, 10
 from SYN scan, 55
log prefix, 196
packet filtering with, 10–12
persistent blocking rules when session is shut down, 209
policy configuration in psad, 86–88
and regular expressions, 161
Snort rule options unsupported by, 171–172
string match expression, 70
for supplementing intrusion detection infrastructures, 3
translating Snort rules into rules for, 2
visualizing logs, 257
 AfterGlow, 262–263
 Gnuplot, 260–262
 seeing the unusual, 258–260
iptables-restore command, 27–29
iptables-save command, 27–29
IPTABLES variable, defining in
 iptables.sh script, 22
IPTABLES_BLOCK_METHOD variable, 136
IPTables::ChainMgr Perl module, 233
IPTables::Parse Perl module, 88, 173, 174, 233

iptables.sh script, 20
 preamble, 22
IPT_AUTO_CHAIN1 variable, for fwknop, 235
ipt.save file, 28
IRC client, for backdoor, 78
isdataat option, in Snort, 172
itype Snort option, 163

J

jump rules, to activate fwsnort chains, 182

K

kernel compilation
 with CONFIG_SYN_COOKIES, 66
 and installing, 18
kernel configuration, 14–17
 Netfilter compilation options, 15–16
 Core Netfilter configuration, 15
 IP: Netfilter configuration, 15–16
 saving file, 16
Kernel Rebuild Guide, 13
kernel source code, 13
KERNEL_DIR variable, 19
Kernel-HOWTO, 13
kernel.org webserver, load increase on, 14
key exchange, for asymmetric ciphers, 246
KEY variable, in
 /etc/fwknop/access.conf file, 239
keylogger, in Dumador trojan, 186
kill() system call, to check for currently running process, 87
klogd (kernel logging daemon), 88
kmsgsd daemon, 84, 85
 purpose, 86
Knuth-Morris-Pratt string-searching algorithm, 71
Krzywinski, Martin, 217

L

LAND attack, 116
legitimate traffic, 136
LEN field
 SYN scan vs. `connect()` scan, 104
 for UDP in iptables log message, 52
length match, for iptables, 165
`LIBDIR` variable, 19
libpcap, 218
link graph
 from AfterGlow, 262, 269–270
 of Nachi worm packets, 274
 of outbound connections from
 honeynet, 276, 277
Linux kernel
 configuration and compilation, 13
 IGMP attacks, 44
`/linux/net/ipv4/netfilter/`
 `ipt-REJECT.c` file, 204
Linux shellcode traffic detection,
 185–186
Loadable Kernel Module (LKM),
 Netfilter subsystems as, 16–17
log action
 in fwsnort, 156
 in Snort, 156
log messages, 30
`LOG` target, 12, 35, 50, 158
--log-tcp-options argument,
 50–51, 122
logging
 headers with iptables, 35–38
 ICMP, 38
 IP header, 36–38
 IP options, 37–38
 SYN packet, 104
 TCP headers, 50–51
 UDP headers, 52
 UDP packets, 42
logging prefixes, psad display of, 127
Loose Source Route (`lssr`) option,
 testing for, 165
Lowe, Kwan, 13
`lynx` command, 200

M

MAC address, filtering IP packets
 based on extension, 22
MadHat, 231
`make config` command, 14
`make menuconfig` command, 14
`make xconfig` command, 14
`mangle` table, 11
Marty, Raffael, 262
matches, in iptables rule, 12
--max-rtt-timeout option, 101
Maximum Segment Size (MSS)
 value, 57
`MAX_SPA_PACKET_AGE` variable, for
 fwknop, 236
MD5 sum, verifying, 83
Metasploit Project, 204–211
 2.6 updates, 206
 busting updates with fwsnort and
 psad, 208–211
 downloading and updating
 framework, 205–206
 signature development, 206–207
Microsoft
 JPEG vulnerability, 30
 operating systems, 215
`MIN_DANGER_LEVEL` variable, in `psad.conf`
 file, 93
mirror servers, downloading from, 14
mode, for SPA packet for fwknop
 server, 242
MS03-026 vulnerability, 272
`msfupdate` script, 206
MSS (Maximum Segment Size)
 value, 57
multicast addresses, packets for, TTL
 value, 42

N

Nachi worm, 272–273
 link graph, 274
named pipe, 85n
Naptha denial of service attack, 117
NAT (Network Address Translation)
 addresses, and piggy-backing, 228
 in default iptables policy, 26–27
 vs. IP spoofing, 40

nat table, 11
National Institutes of Standards and Technology (NIST), 221
Ncurses interface, 14
Netcat, running TCP server on, 170
Netfilter, 9–10
 compilation options, 13
 viewing, 16
subsystems, security
 vulnerabilities, 17
`Net::IPv4Addr` Perl module, 173, 174, 233
`Net::Pcap` Perl module, 233
`Net::RawIP` Perl module, 219, 233, 251
network, default diagram, 21
Network Address Translation (NAT).
 See NAT (Network Address Translation)
Network Anomaly Detection Systems, 216
network layer
 abusing, 39–44
 DDoS attacks, 44
 IP fragmentation, 41–42
 IP spoofing, 40–41
 Linux kernel IGMP attacks, 44
 Nmap ICMP ping, 39–40
 Smurf attack, 43
 attack definitions, 38–39
 defragmentation, intrusion detection and, 151–152
 logging headers with iptables, 35–38
 responses, 45–47
 combining response across layers, 46–47
 filtering response, 45
 thresholding response, 45–46
Network Packet Filtering Framework, 14
network stack exploits, as network layer attacks, 39
`NF_DROP` macro, 204
NIST (National Institutes of Standards and Technology), 221

Nmap
 active fingerprinting with, 120
 command attempt signature, 153–154
 ICMP ping, 39–40
 for port scans, 100–101
 decoy option, 54
 and round trip times, 101
 scanner, 54
 for testing iptables policy, 31
 use of raw socket, 56
 version scan, 141
 --no-addresses option, for fwsnort, 183
 --no-ipt-sync option, for fwsnort, 183
 --no-rdns option, 109
 non-printable data match, in iptables search, 71–72
 NSA SELinux distribution, 5
NULL scans
 detection with psad, 105–106
 of TCP ports, 58

0

obscurity, security and, 229–230
offset Snort option, 161–162
Onion Router (Tor), 254
OpenBSD TCP stack, 61
`OPEN_PORTS` variable, in
 `/etc/fwknop/access.conf` file, 238
OpenSSH
 integration patch, for fwknop, 252–253
 project, 215
OPSEC API, 143
`OPT` field, SYN scan vs. connect() scan, 105
OS fingerprinting, 120–123
 active fingerprinting with Nmap, 120
 combining with port knocking, 231
 passive fingerprinting with p0f, 121–123
OSI Reference Model, 4
--out-interface (-o) match, 12
OUT= string, 88
outbound connections, from compromised systems, 273–277

- OUTPUT chain, 11
in default policy, 24
listing current ruleset, 19
LOG rule in, 50–51
messages logged within, 102
- P**
- p0f project
OS database from, psad use of, 97
passive fingerprinting with, 121–123
- packet
filtering, with iptables, 10–12
MD5 sum, and fwknop client, 242
payload, for Snort rule, 165
- PAM ICQ module, 132
- pass action, 156
- password
Ethernet sniffer for extracting, 79
theft by Bancos Trojan, 154
- Paxson, Vern, 43
- PCAP_FILTER variable, for fwknop, 234–235
- PCAP_INFT variable, for fwknop, 234
- PCAP_PKT_FILE variable, for fwknop, 235
- pcre option, in Snort, 172
- Perl
IP spoofing with, 41
for main psad daemon, 84
psad requirements for modules, 84
regular expressions, applying to
arbitrary logfiles, 145
- Perl Compatible Regular
Expressions, 172
- PERMIT_CLIENT_PORTS variable, in
`/etc/fwknop/access.conf`
file, 238
- pf.os file, for psad, 97–98
- PGPNet connection attempt
signature, 154–155
- phishing attacks, 73, 77
- Phrack*, 17
- PID file, 87
- piggy-backing, and NAT
addresses, 228
- ping command
to measure round-trip time, 101
timestamp option, 37
- plot directive (Gnuplot), 261
- port knocking, 217–225
architectural limitations, 223–225
knock sequence busting with
spoofed packets, 225
knock sequences and port scans,
224–225
minimal data transmission
rate, 224
sequence replay problem,
223–224
- combining with OS
fingerprinting, 231
- encrypted sequences, 221–223
- shared sequences, 218–221
- SPA for addressing limitations,
227–228
- thwarting Nmap and target identi-
fication phase, 218
- Port Scan Attack Detector. *See* psad
(Port Scan Attack Detector)
- port scans
detection with psad, 100–107
FIN, XMAS, and NULL scans,
105–106
TCP connect() scan, 101–103
TCP SYN (half-open) scans,
103–105
UDP scans, 106–107
knock sequences and, 224–225
matching to vulnerable services,
53–54
- psad detection of, 83
of TCP ports, 54–59
connect() scans, 54–55
FIN, XMAS, and NULL scans, 58
TCP ACK scans, 58
TCP idle scans, 59–60
TCP SYN (half-open) scans,
56–57
UDP scans, 60
visualizations, 264–267
- port sweeps, 61
visualizations, 267–270
- portkey, 217
- PORT_RANGE_SCAN_THRESHOLD variable, in
`psad.conf` file, 92–93
- PortSentry, 82

POSTROUTING chain in nat table, 11, 26
PREROUTING chain in nat table, 11, 26
privacy, 69
private key, 243
process ID, of psad daemons, 86
process status information, psad
 report on, 126
programming bugs, and application
 layer attacks, 73
--protocol (-p) match, 12
psad (Port Scan Attack Detector),
 2, 81
active response
 configuration settings, 138–139
 vs. fwsnort, 198–199
 integrating with third-party
 tools, 143–147
alerts and reporting with, 108–111,
 196–197
 email alerts, 108–110
 syslog reporting, 110–111
attack detection with Snort rules
 ipEye port scanner, 115
 LAND attack, 116
 Naptha denial of service
 attack, 117
 source routing attempts, 118
 TCP port 0 traffic, 116
 Windows Messenger pop-up
 spam, 118–119
 zero TTL traffic, 117
combining with Gnuplot, 261–262
configuration, 90–98
 /etc/psad/auto_dl, 96
 /etc/psad/ip_options, 97
 /etc/psad/pf.os, 97–98
 /etc/psad/psad.conf, 90–96
 /etc/psad/signatures, 96
 /etc/psad/snort_rule_dl, 97
 variables, 135–137
daemon process uniqueness, 86
--debug switch, 128–129
emulating p0f with, 122
features, 83
forensics mode, 128, 266
--fw-list argument, 143
--gnuplot mode, 260
history, 81–82
installing, 83–85
intrusion detection vs. active
 response, 131–133
iptables policy configuration,
 86–88
number of packets monitored
 by, 102
OS fingerprinting, 120–123
 active fingerprinting with
 Nmap, 120
 passive fingerprinting with p0f,
 121–123
port scan detection with, 100–107
 FIN, XMAS, and NULL scans,
 105–106
 TCP connect() scan, 101–103
 TCP SYN (half-open) scans,
 103–105
 UDP scans, 106–107
responding to attacks, 134–137
--sig-update argument, 119
signature updates, 119–120
starting and stopping, 85–86
--Status, 140
for stopping Metasploit updates,
 208–211
support for email submission of
 scan data to DShield, 123

R

`rand()` function (Perl), 241
raw sockets, 56
 Nmap use of, 56
`raw` table, 11
RealSecure, 132
reconnaissance against network, 42
Record Route option, detecting, 165
redundancy, 2
regular expressions
 applying to arbitrary logfiles, 145
 with back reference, 145
 and iptables, 161
`REJECT` target, 12, 64, 169, 170
 vs. `DROP` target, 201–204
`--reject-with icmp-port-unreachable`
 argument, 67
RELATED state, 23
remote operating system finger-
 printing, 97
 `p0f` for, 121
 passively, 83
replace Snort option, 168–169
replay attack, 223
 detecting and stopping, 249–251
 SPA solution for, 227
`REQUIRE_SOURCE_ADDRESS` variable, for
 `fwnop`, 236–237
`REQUIRE_USERNAME` variable, in
 `/etc/fwnop/access.conf`
 file, 239
Reset (RST) packet, 62
 and intrusion detection systems, 65
 vs. RST/ACK packet, 63–65
Reset/Acknowledgment (RST/ACK)
 packet, 62–63
 vs. RST packet, 63–65
resource exhaustion, and application
 layer attacks, 73
`resp` Snort option, 169
`--restrict-intf` option, for fwsnort, 183
`RETURN` target, 12
RFC (Request for Comments)
 791 on IP, 36
 792 on ICMP, 38
 793 on TCP, 50, 63
 Rijndael cipher, 217, 221, 243

`rmmod` command, 16
rootkits, 17
route blackholing, 45
router ACLs, 67
`rpc` option, in Snort, 172
RPM for Linux distribution, install-
 ing psad as, 84
RST (Reset) packet, 62
 and intrusion detection systems, 65
 vs. RST/ACK packet, 63–65
RST/ACK (Reset/Acknowledgment)
 packet, 62–63
 vs. RST packet, 63–65
Ruby, 205
rules in iptables policy, 10
running process, current, `kill()`
 system call to check, 87

S

`sameip`
 packet header test, 116
 Snort rule option, 158
 for LAND attack detection, 159
saving
 default iptables policy, 27–29
 kernel configuration file, 16
scan match messages, from psad, 111
Scan34 Honeynet challenge, 258, 263
scanned port, states for, 54
scanned TCP and UDP ports, psad
 display of, 127
`SCAN_TIMEOUT` variable, in `psad.conf`
 file, 92
Schneier, Bruce, *Applied Cryptog-
raphy*, 229
scripts, 146–147
Sdbot trojan, 78
secure computing, challenge of, 1
security
 for compiling as LKM vs. compil-
 ing directly into kernel, 16
 Metasploit Project and, 204
 and minimal compilation, 17–18
 obscurity and, 229–230
`seq` Snort rule option, 158, 159
server authentication method, for
 `fwnop` server, 242

set terminal directive (Gnuplot), 261
set title directive (Gnuplot), 261
set xdata time directive (Gnuplot), 261
set xrange directive (Gnuplot), 261
shared port-knocking sequences,
 218–221
SHOW_ALL_SIGNATURES variable, in
 psad.conf file, 93
signature
 format, in p0f, 121–122
 match messages, from psad, 111
 matches, psad display of top
 fifty, 126
 translation, examples, 153–155
 updates, in psad, 119–120
signature-based intrusion detection,
 implications, 215–216
Single Packet Authorization (SPA),
 217, 226–229
addressing limitations of port
 knocking, 227–228
architectural limitations, 228–229
with asymmetric encryption,
 246–249
ciphertext data length associated
 with message, 247
for fwknop, 231
network, 227
over Tor, 254–255
packet format for fwknop, 241–243
spoofing packet source address,
 251–252
Slammer worm, 61
 visualizations to detect, 270–271
Smurf attack, 43
SNAT (source NAT) target, 26
Snort, 4
 actions and alerts, 157
 flexresp and flexresp2 detection
 plug-ins, 65
 rule interpretation by fwsnort,
 155–172
 translating Snort rules header,
 155–157
 rule options in iptables
 explicit matching and filtering
 support, 160
 unsupported, 171–172
rule translation
 into iptables rules, 2
 options, iptables packet logging,
 157–159
rules for attack detection, 113–119
 fwsnort for translating into
 iptables rules, 149
 ipEye port scanner, 115
 LAND attack, 116
 Naptha denial of service
 attack, 117
 source routing attempts, 118
 TCP port 0 traffic, 116
 Windows Messenger pop-up
 spam, 118–119
 zero TTL traffic, 117
signature ruleset, 44
stateless attacks against, 167
--snort-conf option, for fwsnort, 183
Snort HTTP preprocessor, 80
Snort rule IDs
 ID 275, 117
 ID 524, 116
 ID 527, 116
 ID 622, for ipEye scanner
 detection, 115
 ID 1321, 117
 ID 2281, 194, 198
--snort-sid option, for fwsnort, 183
Snort signatures, 74
 ruleset availability, 174
 shellcode.rules file in, 185
snort2iptables shell script, 149*n*
snort_rule_dl file, for psad, 97
SNORT_SID_STR variable, in psad.conf
 file, 93, 196
snortspoof.pl script (Perl), 280–282
Snot tool, 167
Song, Dug, 42
source code, for projects, 5
source IP address
 in psad email alert, 109
 specifying in Snort, 157
 spoofing, 41
source NAT (SNAT) target, 26

source routing attempts, 118
--source (-s) match, 12
SOURCE variable, in
 `/etc/fwknop/access.conf`
 file, 238
SPA (Single Packet Authorization).
 See Single Packet Authorization (SPA)
spam, 118–119
spoofed attack, monitoring by
 IDS, 214
spoofed packets, 40
 knock sequence busting with, 225
 TCP ACK, 167
SQL injection attacks, 76–77
SQL Slammer worm, 61
 visualizations to detect, 270–271
SSL, Metasploit update use of, 207
Stacheldraht DDoS agent, 44
stack-based buffer overflows, 74
starting psad, 85–86
--state ESTABLISHED argument, 71
--state match, 12
stateful firewall
 determining if port is filtered by, 58
 iptables as, 167
stateless attacks, against Snort, 167
STATUS_IP_THRESHOLD variable, 126
STATUS_PORTS_THRESHOLD variable, 127
Stearns, William, 149n
Stick tool, 167
stopping psad, 85–86
stream preprocessor, 167
 stream4, 280
 stream5, 283
Strict Source Route option,
 detecting, 165
--string match, 12
string match expression, in
 iptables, 70
Subversion source control system, 205
SucKIT rootkit, 17
Swatch utility, 145
symmetric-key cipher, 243
SYN/ACK packet in TCP
 handshake, 55
 unsolicited, 56
SYN cookies, 66
SYN packet in TCP handshake, 55
SYN scan response, 139–140
SysAdmin magazine, 217
syslog
 configuration in psad, 88–89
 fwknop server messages to, 249
 hostname in psad email alert, 109
 reporting in psad, 110–111
 writing log data to, 35
syslog-*ng* daemon, 88–89
syslogd daemon, 88
SYSLOG_DAEMON variable, in `psad.conf`
 file, 92

T

tables in iptables, 11
target-based intrusion detection,
 and network layer
 defragmentation, 151–152
targets for iptables, 12
TCP (Transmission Control
 Protocol), 49
ACK scans of ports, 58
building iptables rule applied to
 traffic, 157
connect() scan
 detection with psad, 101–103
 vs. SYN scan, 103
connection states, and fwsnort
 chains, 180–182
decoding options from iptables
 logs, 122–123
detecting attacks in
 connections, 133
flags, 197
header length, 165
idle scans, 59–60
logging headers, 50–51
port 0 traffic, 116
ports, psad display of scanned, 127
RST (Reset) packet, 62
 and intrusion detection
 systems, 65
 vs. RST/ACK packet, 63–65

sequence
 inclusion in iptables, 51
 prediction attacks, 61–62
SYN (half-open) scans, 56–57
 detection with psad, 103–105
testing iptables policy, 29–31
three-way handshake, 55
for Tor transport, 254
translated Snort rule applied to
 traffic, 185
tcpdump, 4, 207
 to capture SPA packet to file, 249
TCP/IP suite, as attack target, 100
tcpreplay, 249
`TCPSERV_PORT` variable, for fwknop, 237
tcpwrappers, 134
`TCPWRAPPERS_BLOCK_METHOD` variable, 136
technical references, 5
terminal interface, 14
testing, default iptables policy, 29–31
three-way handshake, 55, 167
thresholding response, in network
 layer, 45–46
timer, rules expiring based on, 143
timestamp, for fwknop server, 241
Time-to-Live (TTL). *See* TTL
 (Time-to-Live)
Tor anonymizing network, 198
 SPA over, 254–255
TOS (Type Of Service) bits, Snort to
 inspect, 164
tos Snort option, 164
traceroute program, 42
traffic analysis, 254
Transmission Control Protocol
 (TCP). *See* TCP (Trans-
 mission Control Protocol)
transport layer, 49
 abusing, 53–62
 port scans, 53–60
 port sweeps, 61
 SYN floods, 62
 TCP sequence prediction
 attacks, 61–62
 attack definitions, 52–53
 logging headers with iptables,
 50–52
responses, 62–67
 TCP, 62–66
 for terminating connection, 62
 UDP, 66–67
transport stack exploits, 53
Trin00 tool, 184–185
trust, exploiting, 77
trust relationships, and application
 layer attacks, 73
TTL (Time-to-Live)
 concealing attack with targeted, 43
 low values, 42
TTL field, SYN scan vs. connect()
 scan, 104
ttl Snort option, 163–164
Tumbler, 217
tumbler project, 232
Type-Length-Value (TLV)
 encoding, 122
Type Of Service (TOS) bits, Snort to
 inspect, 164

U

UDP (User Datagram Protocol),
 49–50
checksum-crafting script, 220
header length, 165
ICMP for response, 66–67
iptables filtering against ports,
 31–32
logging headers, 52
packet logging by iptables, 42
port scans, 60
psad display of scanned ports, 127
scans
 detection with psad, 106–107
 response, 140–141
spoofed attack, 283
ulog project, 157n
Unix filesystem directory structure,
 directory purpose, 85
`Unix::Syslog` Perl module, 233
unsolicited SYN/ACK packet, 56
`uricontent` Snort option, 160–161
URL-encoded data, decoding in real
 time, 80

- US Advanced Encryption Standard, 221
- User Datagram Protocol (UDP). *See* UDP (User Datagram Protocol)
- user information, Ethernet sniffer for extracting, 79
- username, for fwknop command execution, 241
- /usr/bin/fwknop program, 233
- /usr/bin/fwknop_serv, 233
- /usr/lib/fwknop directory, 233
- /usr/lib/fwsnort directory, 174
- /usr/sbin/fwknopd daemon, 233
- /usr/sbin/knopmd daemon, 233
- /usr/sbin/knoptm daemon, 233
- /usr/sbin/knopwatchd daemon, 233–234
- V**
- /var/lib/psad/psadfifo named pipe, 103
- /var/log/auth.log file, monitoring for authentication failure, 146
- /var/log/messages file, 101
- /var/log/psad directory, 124
- /var/log/psad/scan_hash.pid file, 127
- /var/run/psad/auto_ipt.sock Unix domain socket, 146
- variables, in psad.conf file, 90. *See also individual variable names*
- verbose/debug mode, in psad, 128–129
- virtual circuit, 254
- Vuln-dev mailing lists, 214
- vulnerabilities in software, increase in discovery, 214
- W**
- Ward, Brian, 13
- Watkins, Peter, 81, 82
- Watson, Paul A., 61
- WEB-PHP Setup.php access attack, 194–198, 199–201
- webserver, CGI applications as SQL injection attack target, 76
- website for book, 5
- whitelists, 133
- setup, 191
- whois client
- database information in psad email alert, 109–110
- in psad, 89–90
- Wikipedia, 194
- wildcards, in Snort header, and variable resolution, 156
- WINDOW field, SYN scan vs. connect() scan, 104
- window Snort rule option, 158, 159
- Windows Messenger pop-up spam, 118–119
- Wireshark, 4, 220
- within Snort option, 162
- Witty worm of 2004, 132
- worms, 61
- X**
- X Windows interface, 14
- XMAS scans
- detection with psad, 105–106
- of TCP ports, 58
- Xprobe, 120
- Z**
- Zalewski, Michal, 121
- Zenoss, 152
- zero TTL traffic, 117
- zero-day attack problem, 214–216
- zombie, 44
- zombie host, 59