





Index

. (dot), data hiding technique, 350, 372–373 169.254.x.x pattern, 314

ACCEPT action, 103 Accepting packets, 103 ACID (Analysis Console for Intrusion Detection), Acid Falz, profiling example, 548-551 Ack scans, 287 Active analysis analysis environment, 464-465 antidebugging tricks, 467-468 black box analysis, 465-466 debugging, 468-469 definition, 450 pros and cons, 451 sandboxing, 464-465 tracing, 466-467 Active attacks, 559-560, 560-561 Active fingerprinting versus passive, 317 Active reconnaissance, 563-565 Active users, analyzing, 358-359 Aesthetic jargon, 528 Aleph One, 4 Alerts IDS, 61-62, 71-73 ISLab example, 177-180

logging, 162-165

network forensics, 295-297 real-time monitoring and alerting, 79 Snort intrusion detection, 264–267 Swatch, 177-180 "An Evening with Bereford," 5 Analysis Console for Intrusion Detection (ACID), Analyzing data See computer forensics See data analysis

See network forensics See profiling Anomaly detection, 71-73 Antidebugging tricks, 467–468 Antonomasia, 68 Apache log example, Windows worms, 61 Application-level attacks, 567-568 APUHRP (Azusa Pacific University Honeynet Research Project) attack log, 578-591 attack summary, 589-591 attack timeline, 578-589 attacker profiles, 591-594 blackhats, 591-592

history of, 11 honeynet setup and configuration, 576-578 honeypot setup and configuration, 576 lessons learned, 593-594

carders, 592













APUHRP, continued BackOfficer Friendly, 21-22 overview, 575-576 Bad guys. See blackhats. Balas, Edward, 129 spammers, 592-593 Banners, 193 threat analysis, 591-593 Barnett, Ryan, 194 warez traders, 592 Architecture. See also data capture; data control. bash shell patch, 68 GenI honeynets, 49-50 Basic Honeypot Zone, 135 GenII honeynets, 96-97 Binary logging, 161–162 Arkin, Ofir, 316, 324 Black box analysis, 465-466 arp command, 415 Blackhats Art jargon, 528 definition, 507-509 ASCII SESSION log files, 263–264 future threats, 682-683 ASCII session logging, 162 profiling, 545-547 ASR Date: SMART, 340 Block pointers, 353-354 Assembly language programming, 483 bncs (bouncers), 600-601 Asymmetric routing, 217 Book reference jargon, 528 Books and publications. See also online resources. Attackers. See hackers. Attacks. See also exploits. "An Evening with Bereford," 5 active, 559-560, 560-561 assembly language programming, 483 analyzing "Bro: ... Detecting Network Intruders ...", 71 See computer forensics compiler theory, 483 See data analysis Computer Forensics: Incidence Response Essentials, See network forensics 329 See profiling The Cuckoo's Egg, 5 containing. See data control. decompilation, 484 detecting. See alerts; Snort. Digital Evidence and Computer Crime, 329 example scenario, 90-93 exploit coding, 484 Getting Physical with the Digital Investigation known, database of, 113-114 logging and monitoring Process, 366 Hacker's Dictionary, 507 See data acquisition See data capture "Honeynet Definitions, Requirements, and See log files Standards," 37 See logging "Honeypot Bandwidth Rate Limitation," 52 passive, 560 "Honeypots: Simple, Cost Effective Detection," reconstructing, 608-615 Honeypots: Tracking Hackers, 31 types of, 558-561 Attempted criminal acts, 244-246 "Honeypotting with VMware: ...", 194 Autopsy case setup, 367-369 "How to Write Snort Rules," 289 "ICMP Usage in Scanning," 316 Autopsy Forensic Browser, 337-340, 435-444 Auto-rooters, 56 "Identifying ICMP Hackery Tools," 324 Azusa Pacific University Honeynet Research Project Incidence Response and Computer Forensics, 329 (APUHRP). See APUHRP (Azusa Pacific Know Your Enemy, 10 University Honeynet Research Project). "Know Your Enemy: Motives," 7 "Know Your Enemy: Sebek ...", 129 "Monitoring VMware Honeypots," 194 Backdoors, 571-572 "Paranoid Penguin: Stealthful Sniffing ... and Backing up installed honeypots, 197-198 Logging," 69

















phrack magazine, 484 Practical UNIX and Internet Security, 4 program debugging, 484 programming theory, 484 Sleuth Kit Informer newsletter, 335 "Smashing the Stack for Fun and Profit," 4 "To Build a Honeypot," 6 "The Use of Honeynets ... Across Large ... Networks," 35 "What are MAC Times?", 376 boot log files, 395 Bootable Linux CDs, 360 Bootstrapping the honeywall, 153–156 Bouncers (bncs), 600-601 Brazilian Honeynet Project, 11 Brenton, Chris, 6 Bridge box, 99 Bridge utilities, 151 Bridging, 99-102, 150-151 Bro, 71 "Bro: ... Detecting Network Intruders ...", 71 Bro anomaly network IDS, 71–73 Broadcast pattern, 312 Browsing files, 436-437 Buffer overflow, 568 Bugs. See exploits. burndump, 468 burneye, 468

C

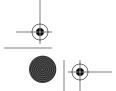
Carders, 592 Carrier, Brian, 435 Case studies. See examples. Casey, Eoghan, 329 Cause (ideology), hacker motivation, 514-516 Chain of Custody, 331 Challenge exercises. See also examples and case studies. Forensic Challenge, 9 history of, 8-9 Reverse Challenge, 9 Scan of the Month Challenge, 8 Scan of the Month Challenge 22, 54 Scan of the Month Challenge 28, 80 Scan of the Week Challenge, 8 Checkpoint Firewall-1, 51-52, 63 Cheswick, Bill, 5

Cluster chains, 406 Clusters, 406, 408 Command prompt, forensic analysis, 412-413 Communication jargon, 528 Compiler theory, 483 Compiler used, determining, 453 Computer forensics, basic. See also network forensics; profiling. ASR Date: SMART, 340 Autopsy Forensic Browser, 337–340 Chain of Custody, 331 data acquisition concepts, 342 data types, 344 dead, 342 guidelines, 342-343 live, 342 netcat tool, 344-345 OOV (Order of Volatility), 343 shutdown considerations, 344 techniques, 344-345 data handling, 331-332 description, 275-276 DFT (ProDiscover Forensics), 341 EnCase Forensic, 341 file system analysis tools, 335-337 FTK (Forensic Toolkit), 341 hardware considerations, 333-334 hash values, 331-332, 343 key concepts, 332-333 large file support, 334 legal issues, 329 Linux-based analysis, 334 Linux-based tools, 335-340 overview, 328-333 preserving the crime scene, 332 scientific method, 329-331 The Sleuth Kit, 335-337 Windows-based analysis, 340-341 Windows-based tools, 341 Computer Forensics: Incidence Response Essentials, Computer forensics, UNIX. See also Greek Honeynet Project; Solaris compromise.

ASR Date: SMART, 340

Autopsy Forensic Browser, 337-340

chkrootkit tool, 358













Computer forensics, continued hfind tool, 382 case studies. See Greek Honeynet Project; Solaris hidden files, 372-373 known bad files, databases of, 380-382 compromise. data acquisition MAC times, 376-380 active users, 358-359 data analysis, setup chkrootkit tool, 358 Autopsy case setup, 367–369 Coroner's Toolkit, 359 Linux setup, 369 dd tool, 360-361 preparation, 403 dead, 361-363 stating the problem, 369-371 device names, identifying, 358 Linux background disk spanning systems, 360 . (dot), data hiding technique, 350 fdisk tool, 364 block pointers, 353-354 hard disk data, 359-363 bootable CDs, 360 hard disk partitions, 363-366 data hiding, 350-351 hash values, 361 direct block pointers, 353-354 ils tool, 359 double indirect block pointers, 353-354 kstat tool, 358 file blocks, 352-353 live, 362–363 file deletion, 355-357 file fragments, 352-353 loopback devices, 363-366 losetup command, 363-366 file names, 355 lsof tool, 358 file systems, 351–357 mmls tool, 364-365 file type information, 355 network connections, 358-359 indirect block pointers, 353-354 nonvolatile data, 359–363 inodes, 353-355 OOV (Order of Volatility), 358 kernel modules, 349-350 open files, 358-359 start-up scripts, 348-349 store time information, 354-355 ps tool, 359 RAID systems, 360 swap space, 357 running processes, 358–359 triple indirect block pointers, 353-354 volatile data, 357-359 Linux-based tools, 335-340 data analysis, detailed Computer forensics, Windows configuration file analysis, 390-393 case study. See APUHRP (Azusa Pacific file content analysis, 384-389 University Honeynet Research Project). file extensions, 393-394 cluster chains, 406 file recovery, 396-397 clusters, 406, 408 file types, 393-394 data acquisition history files, 393 arp command, 415 keyword searching techniques, 398-402 command prompt, 412-413 lazarus tool, 397 Cygwin tool, 413 log files, 394-396 dd tool, 415, 417-420 overview, 383-384 drive enumeration, 416-417 start-up file analysis, 390-393 first data, 414 unallocated space, 396-397 fport tool, 415 hard disks, wiping clean, 416 data analysis, quick hits . (dot), data hiding technique, 372-373 memory information, 415 file activity timeline, 376-380 netcat tool, 421-422 file integrity verification, 373-376 netstat tool, 415 hash databases, 380-382 network information, 414-415













-



INDEX

nonnative Windows tools, 413 nonvolatile data, 415–420 output options, 420-422 process information, 414 PsInfo utility, 414 PsList utility, 414 raw image acquisition, 416-417 sterilizing media, 416 UnxUtils, 413 volatile data, 412–415 volume_dump program, 416 wipe program, 416 data analysis, detailed Autopsy Forensic Browser, 435-444 browsing files, 436–437 file activity time lines, 439-442 file categorizing, 438–439 grep command, 430-431 hex-based searches, 431 keyword searches, 437 keyword searching, 430–431 kregedit program, 434 MAC times, 439–442 memory searches, 431-433 ntreg tool, 435 recovering deleted files, 442-444 regedit32.exe program, 434 registry analysis, 433-435 The Sleuth Kit, 435–444 sorter command, 438 Sorter tool, 438 sorting files, 438–439 strings command, 430-431 data analysis, quick hits file deletion, 427-430, 442-444 IIS (Internet Information Server) log files, 426 Internet Explorer, 426-427 log files, 426 Recycle Bin, 427-430 data analysis, setup analysis environment, 422-423 mounting local image files, 423 mounting remote shares, 424 read-only restrictions, 424-425 Samba program, 425 viewing file system contents, 423-425 virtual hardware write blockers, 424-425

FAT file system, 406–408 FAT12 file system, 406-407 FAT16 file system, 406–407 FAT32 file system, 406 file names, 407-408, 410 file size limitations, 407, 408 file systems, 406-411 file timestamps, 409 meta-data, 407, 408-409 MFT (Master File Table), 408-409 nonresident MFT records, 409 NTFS file system, 408–411 reserved files, 410-411 resident MFT records, 409 sectors, 406 Windows-based forensic analysis, 340-341 Computer Fraud and Abuse Act, 239-246 "Computer trespasser" exception, 236 Confederated distributed honeynets, 211–212 Configuration file analysis, 390-393 Connect scans, 287 Connection blocking, 51–52 Connection limiting, 51 Connection Rate Limiting Mode (CRLM), setting, 152 Connection tracking, 105-106. See also stateful inspection. "Consent of a party" exception, 235-236 Contraband, 246-249 Copying data See computer forensics See data acquisition See data capture See data collection See log files See logging See network forensics Coroner's Toolkit, 359 Covering one's tracks, 572-574 Covert monitoring, 60 Crackers, definition, 507-509 Crimes by juveniles, 246 Criminal activity legal issues. See legal issues, criminal activity. risk of, 43 CRLM (Connection Rate Limiting Mode), setting, 152 cron log files, 395













The Cuckoo's Egg, 5 Cygwin tool, 413

D

Damage, limiting. See data control.

Data acquisition, basics

See also computer forensics

See also data capture

See also data collection

See also log files

See also logging

See also network forensics

concepts, 342

data types, 344

dead, 342

guidelines, 342-343

live, 342

netcat tool, 344-345

OOV (Order of Volatility), 343

shutdown considerations, 344

techniques, 344–345

Data acquisition, UNIX

active users, 358–359

chkrootkit tool, 358

Coroner's Toolkit, 359

dd tool, 360-361

dead, 361-363

device names, identifying, 358

disk spanning systems, 360

fdisk tool, 364

hard disk data, 359-363

hard disk partitions, 363-366

hash values, 361

ils tool, 359

kstat tool, 358

live, 362-363

loopback devices, 363-366

losetup command, 363-366

lsof tool, 358

mmls tool, 364-365

network connections, 358-359

nonvolatile data, 359-363

OOV (Order of Volatility), 358

open files, 358-359

ps tool, 359

RAID systems, 360

running processes, 358-359

volatile data, 357-359

Data acquisition, Windows

arp command, 415

command prompt, 412-413

Cygwin tool, 413

dd tool, 415, 417-420

drive enumeration, 416-417

first data, 414

fport tool, 415

hard disks, wiping clean, 416

memory information, 415

netcat tool, 421-422

netstat tool, 415

network information, 414–415

nonnative Windows tools, 413

nonvolatile data, 415-420

output options, 420-422

process information, 414

PsInfo utility, 414

PsList utility, 414

raw image acquisition, 416-417

sterilizing media, 416

UnxUtils, 413

volatile data, 412–415

volume_dump program, 416

wipe program, 416

Data analysis. See also computer forensics; network

forensics; profiling.

layers

computer forensics, 275-276

network forensics, 273–275

reverse engineering, 276-279

types of data

ASCII SESSION logs, 263–264

firewall logs, 257-259

keystroke logs, 269-272

network binary logs, 259-262

Snort intrusion detection alerts,

264-267

Data capturesystem logs, 268-269

See also data acquisition

See also data collection

See also log files

See also logging

See also Sebek

See also Snort

definition, 36

description, 39

encryption, 39





















GenI example, 83-85, 88-89 IDSs (intrusion detection systems), 124–128 guidelines for, 40 intrusion detection, 125 Data capture, firewalls network traffic sniffing, 125 Checkpoint Firewall-1, 63 overview, 120-122 overview, 98-99 example, 83-85 GenI honeynets, 63-64 tools Linux IPTables Firewall, 63 keystroke logger, 129-132 network transaction recording, 63-64 Sebek, 129-132 OpenBSD PF Firewall, 63 system logs, 132-133 Data capture, GenI honeynets Data collection, 40–41. See also data acquisition; anomaly detection, 71-73 data capture; distributed honeynets. auto-rooters, 56 Data control Bro anomaly network IDS, 71-73 definition, 36 covert monitoring, 60 description, 37-38 disk images, 54-55 Data control, GenI honeynets DoS (denial of service) traffic, 57 connection blocking, 51 encryption, 58-59 connection limiting, 51 flooding, 58-59 examples honeynet attackers, 57 setting up, 79-83 host activity recording, 59-61, 65-70 technologies, 52-53 IDS alerts, 61–62, 71–73 testing, 88-89 inbound activity, 56–57 firewalls keystroke logging, 68 Checkpoint Firewall-1, 51–52 layered, 53-55, 62-63 configuring, 49 malicious software, 57 connection blocking, 51–52 multiple intruders, 58 example, 79-83 mystery traffic, 57 versus gateways, 48-49 network traffic recording, 58-59, 64-65 IPTables Firewall, 51, 52 network transaction recording, 55-58, 63-64 Linux IPTables Firewall, 51 outbound activity, 57-58 OpenBSD PF Firewall, 51-52 previous owner traffic, 57 rc.firewall, 51-52 repeat visitors, 56-57 guidelines for, 38-39 script kiddies, 56 setup example, 79-83, 88-89 session tracking, 71-73 technology choices, 51-52 setup example, 83-85, 88-89 Data control, GenII honeynets spam, 57 bridge box, 99 bridging, 99 system software, 58 tcpdump, 64-65 bridging gateways, 99-102 technology categories, 55-62 description, 118-120 technology choices, 63-73 Ethernet frames, definition, 99 tools, 53 firewalls traffic dumps, 59 honeywalls, 99-102, 109-118 worms, 56 IPTables, 102–106 forwarding Ethernet frames, 99-102 Data capture, GenII honeynets layers honeywalls firewall logging, 122-124 implementing, 99-102 managing, 101-102 flow diagram, 121 honeypots, 128-133 revealing, 100













Data control, continued Data hiding, 350–351 honeywalls, data control modes Data sanitization, 222 control layers, 109 Databases CRLM (Connection Rate Limiting Mode), hash values, 375, 380-382 known attacks, 113-114 110 - 113IPS layer, 109 log files. See HSC (Honeynet Security Console); limiting connection rates, 110-113 log files, centralizing. malicious packets, dropping, 110, 113-116 Solaris Fingerprint Database, 375 malicious packets, replacing, 110, 116-118 dd tool, 360-361, 415, 417-420 network gateway layer, 109 de Haas, Job, 10 PDM (Packet Drop Mode), 110, 113–116 Dead data acquisition, 342, 361-363 PRM (Packet Replace Mode), 110, 116–118 Debugging IPTables, 102–106 See also computer forensics netfilter, 102 See also data capture network filtering, 102-106 See also log files packets See also logging accepting, 103 See also network forensics acting on, 102-106 See also profiling forwarding, 99-102 antidebugging tricks, 468 hiding, 130 books and publications, 484 logging, 103 Deception Toolkit, 28 malicious, dropping, 110, 113-116 Decompilation malicious, replacing, 110, 116-118 books and publications, 484 example, 474-481 queuing, 103 rejecting, 103, 108-109 order of, 463-464 from Sebek clients, 130 techniques, 459-463 selecting, 102-106 Decoy networks. See honeynets. TARGETS, 102-106 Deleted files packets, filtering with forensic analysis, 355-357, 427-430, 442-444 honeywalls, 99-102 recovering, 442-444 IPTables, 102-106, 106-109 Deleting directories, 60 Snort-Inline, 106-109 Denial of service (DoS). See DoS (denial of service). rules Deploying exploits, 536 IPTables, 104-106 Derogatory jargon, 526 pseudo-rules, 118-120 Detecting attacks. See alerts; Snort. Snort-Inline, 107-109, 116 Detecting honeynets, 42, 193 STP (spanning tree protocol), 99-102 Device names, identifying, 358 Data control modes, GenII honeynets DFT (ProDiscover Forensics), 341 control layers, 109 Digital Evidence and Computer Crime, 329 CRLM (Connection Rate Limiting Mode), Dike, Jeff, 185 110-113 Direct block pointers, 353-354 IPS layer, 109 Directories, deleting, 60 limiting connection rates, 110–113 Disabling the honeynet, risk of, 43 malicious packets, dropping, 110, 113-116 Disassembler, fooling, 457–458 malicious packets, replacing, 110, 116-118 Disassembly, 456-458, 473 network gateway layer, 109 Discovering exploits, 536-538 Disk spanning systems, forensic analysis, 360 PDM (Packet Drop Mode), 110, 113-116 PRM (Packet Replace Mode), 110, 116-118 Disks. See hard disks.













Dot (.), data hiding technique, 350, 372-373 Distributed honeynets See also data collection Double indirect block pointers, 353-354 See also GenI honeynets Drive enumeration, 416-417 See also GenII honeynets DROP action, 103 See also honeynets drop action, 108-109 See also virtual honeynets Dynamic linking, 453 confederated model, 211-212 creating a honeynet gateway, 210-211 Ε data loss, 223 Ego, hacker motivation, 513-514 data sanitization, 222 Elevation of privileges attack, 570 definition, 208 Embedded strings, identifying, 453 deployment drawbacks, 212 EnCase Forensic, 341 deployment options, 211–212 Encrypted blackhat connections, 122 federal model, 212 Encryption future of, 680 and data capture, 39, 58-59 honeypot farms distributed honeynets, 223 asymmetric routing, 217 packets, and network forensics, 304 configuring the Ethernet, 222 Enemy. See hackers. definition, 212 Entertainment, hacker motivation, 512-513 example, 218-222 Entrance to social group, hacker motivation, 516-517 hot-zoning, 213-214 Entrapment, 249–250 IP tunnels, 216, 219-220 Erasing latency problem, 215–216 hard disks, 416 NAT (Network Address Translation), 218, 221 the victim machine, 86 packet mangling, 217-218, 220-221 Ethereal sniffer, 289 policy-based routing, 217, 220 Ethernet configuring for honeypot farms, 222 pros and cons, 214 protecting production hosts, 213-214 frames, definition, 99 sample diagram, 213 packets, forwarding, 99-102 Eventlog to syslog utility, 140-141 setting up, 216-218 technology choices, 216-218 Examples and case studies. See also challenge VLANs (virtual LANS), 217 exercises; GenI honeynets, setup example. honeywall CD-ROM, 210-211 Apache log, Windows worms, 61 issues, 222-223 GenII honeynet deployment. See ISLab example, physical distribution, 208-212 GenII deployment. RTT (Round Trip Time), 215 high-interaction honeypots, 25-27 session encryption, 223 Honeyd, 23-25 size issues, 223 honeynet deployment. See ISLab example, GenII time synchronization, 222-223 deployment. time zone synchronization, 41 honeypot farms, 218-222 Dittrich, David, 9, 10 HSC (Honeynet Security Console), 497-500 DNS reverse lookup pattern, 313 low-interaction honeypots, 23-25 DoS (denial of service) monitoring network users, legal issues, 231-235 attack analysis, 659-663 passive fingerprinting, 318-324 description, 571 profiling, 548-556 legal issues, 240-242 reverse engineering. See Honeynet Reverse tool detection, 654-658 Challenge. Snort, network forensics, 295-298 traffic, capturing, 57











Ethernet, continued	online resources, 484
Snort-based IDSs (intrusion detection systems),	risk analysis, 541–542
126–128	source code auditing, 532
Symantec Decoy Server, 25–27	vulnerability, 531–534
system log, statd attack, 60–61	·
UNIX forensics. See Greek Honeynet Project;	F
Solaris compromise.	False negatives, 19
Windows forensics. See APUHRP (Azusa Pacific	False positives, 19, 124
University Honeynet Research Project).	Farmer, Dan, 9, 335, 376
Executable file formats, identifying, 452	FAT file system, 406–408
Exploits. See also attacks.	FAT12 file system, 406–407
analyzing	FAT16 file system, 406–407
See computer forensics	FAT32 file system, 406
See data analysis	fdisk tool, 364
See network forensics	Federal distributed honeynets, 212
See profiling	File blocks, forensic analysis, 352–353
birth, 534–536	File extension analysis, 393–394
books and publications, 484	File names
common steps	FAT, 407–408
active reconnaissance, 563–565	forensic analysis, 355
application-level attacks, 567–568	NTFS, 410
backdoors, 571–572	File systems
buffer overflow, 568	analysis tools, 335–337
covering one's tracks, 572–574	contents, viewing, 423–425
DoS (denial of service), 571	forensic analysis, 351–357
elevation of privileges, 570	UML (User-Mode Linux), 201
exploiting standardized installation	Windows, 406–411
procedures, 569	Files
gaining access, 566	activity timeline analysis, 376-380, 439-442
misconfiguration attacks, 570	browsing, 436–437
operating system attacks, 566–567	categorizing, 438–439
sample program attacks, 569	content analysis, 384–389
scripts, 569	deleted, forensic analysis, 355–357, 427–430
trojans, 571–572	442-444
containing. See data control.	deleted, recovering, 442-444
corrupting, 540–541	integrity verification, 373–376
death, 541	recovering, 396–397
definition, 531	size limitations, 407–408
deploying, 536	sorting, 438–439
detecting. See alerts; Snort.	timestamps, 409
discovering, 536–538	type analysis, 355, 393–394
example, 638–644	Filtering
life cycle, 538–539	packets with
logging and monitoring	honeywalls, 99–102
See data acquisition	IPTables, 102–106, 106–109
See data capture	Snort-Inline, 106–109
See log files	Snort output, 291
See logging	FIN scans, 287
	•













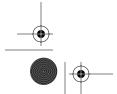


Fingerprinting
UML (User-Mode Linux), 200
virtual honeynets, 185
VMware GSX Server, 193
Fingerprints, default, 204
FIRE, 360
Firewall log files
centralizing, 487–489
description, 257–259
example, 598–600
Firewall logging
GenII honeynets, 122–124
ISLab example, 153
Firewall SQL Import Script (FISQ), 488
Firewalls
data capture
Checkpoint Firewall-1, 63
example, 83–85
Linux IPTables Firewall, 63
network transaction recording, 63–64
OpenBSD PF Firewall, 63
data control
Checkpoint Firewall-1, 51–52
configuring, 49
connection blocking, 51–52
example, 79–83
versus gateways, 48–49
IPTables Firewall, 51, 52
Linux IPTables Firewall, 51
OpenBSD PF Firewall, 51–52
rc.firewall, 51–52
definition, 17
GenI honeynets
Checkpoint Firewall-1, 51–52
configuring, 49
connection blocking, 51–52
versus gateways, 48–49
IPTables Firewall, 51, 52
Linux IPTables Firewall, 51
OpenBSD PF Firewall, 51–52
rc.firewall, 51–52
GenII honeynets, 99–106, 109–118
hardening, 80
history of, 4
TIS Firewall Toolkit, 4
FISQ (Firewall SQL Import Script), 488
Flooding, 58–59
Forensic Challenge 9

Forensic Toolkit (FTK), 341 Forensics. See computer forensics; network forensics. Forwarding packets, 99-102 Founding members, 6, 7-8 Fourth Amendment issues, 226–227 fport tool, 415 Frames, definition, 99 FTK (Forensic Toolkit), 341 Future of honeynets advanced threats, 681 blackhat response, 682-683 distributed honeynets, 680 insider threats, 681-682 law enforcement applications, 682 use and acceptance, 682 Fyodor's Nmap Security Scanner, 316 Garfinkel, Simson, 4 Garner, George dd tool, 415, 417-420

volume_dump program, 416 wipe tool, 416 Gateways versus firewalls, 48-49 Gathering information. See information gathering. GenI honeynets See also distributed honeynets See also GenII honeynets See also honeynets See also virtual honeynets architecture, 49-50 See also data capture, GenI See also data control, GenI history of, 7-8 uses for, 44 attack scenario, 90-93 erasing the victim machine, 86 firewall machine, data capture, 83-85

GenI honeynets, setup example attack scenario, 90–93 erasing the victim machine, 86 firewall machine, data capture, 83–85 firewall machine, data control, 79–83 firewall machine, hardening, 80 hardware requirements, 76–78 honeynet machine, 85–88 Internet, connecting to, 89 Internet connection hardware, 77–78 Linux operating system, 78 networking, 88–89











GenI honeynets, <i>continued</i> overview, 73–76 passwordless authentication, 80 process summary, 76 sniffer, deploying on the firewall, 80 sniffing the honeynet, 83–85 Snort network IDS, 78–79 software requirements, 78–79 stealth interface, 83–85 Swatch, 79 systems hardware, 76–77 utilities, 79 victim machine, 85–88 GenII honeynets	ptrace vulnerability reconstructing the Sebek logs, 606–60 Snort alerts, 600–6 Snort session files, SSL vulnerability, 6 system logs, 607 history of, 11 honeynet setup and coverview, 595–596 post-attack analysis, 6 Greenwich Mean Time (40, 41 grep command, 430–43
See also distributed honeynets	grep communa, 130 13
See also GenI honeynets	Н
See also honeynets	Hacker wargames sites,
See also virtual honeynets	Hackers. See also profilir
architecture, 96-97. See also data capture, GenII;	bad guys. See blackha
data control, GenII.	blackhats, definition,
deployment example. See ISLab example, GenII	carders, 592
deployment.	crackers, definition, 5
encrypted blackhat connections, 122	definition, 507–509
history of, 10	good guys. See whiteh
improvements over GenI, 95–96, 122, 128–129	grayhats, definition, 5
overview, 98–99	Jargon File, 509, 526–
uses for, 44–45	motivation
Getting Physical with the Digital Investigation	cause (ideology), 5
Process, 366 Glazer, J.D., 6Gettysburg, Civil War battle, 5	ego, 513–514 entertainment, 512
GMT (Greenwich Mean Time), synchronizing to,	entrance to social g
40, 41	hacktivism, 514
Good guys. See whitehats.	MEECES (Money, 1
Grannick, Jennifer, 8	Entrance, Stat
Grayhats, definition, 508	MICE (Money, Ide
Greek Honeynet Project. See also Solaris	509
compromise.	money, 510-512
event summary, 633–634	status, 517–519
forensic procedure	script kiddies, 562
attack follow-through, 607–621	social structure
blackhat activity, 615–621	aesthetic jargon, 52
bncs (bouncers), 600-601	art jargon, 528
evidence collection, 598–607	book reference jarg
examining downloaded packages, 624–629	characteristics of, 5
firewall logs, 598–600	communication jar
identifying exploits, 621–624	derogatory jargon,
indication of activity, 597–598	external influences
locating the attack session, 608–615	history jargon, 527

Inerability, 623-624 ucting the attack session, 608-615 gs, 606–607 erts, 600-601 ssion files, 602-606 erability, 622–623 gs, 607 etup and configuration, 596–597 95-596 analysis, 629-633 ean Time (GMT), synchronizing to, d, 430–431 mes sites, 484 also profiling. ee blackhats. lefinition, 507-509 finition, 507-509 507-509 See whitehats. efinition, 508 509, 526-530 eology), 514–516 -514 ment, 512-513 to social group, 516–517 m, 514 (Money, Entertainment, Ego, Cause, rance, Status), 509-510 Money, Ideology, Compromise, Ego), 10-512 7-519 les, 562 ture jargon, 528 n, 528 erence jargon, 528 ristics of, 521–522 ication jargon, 528 ry jargon, 526 influences, 524–525











humor jargon, 527 HNRouter, 148 jargon, thematic categories, 526-530 Honeyd, 23-25, 317 magic/religion jargon, 527 Honeynet Administration Zone, 136 "Honeynet Definitions, Requirements, and mapping the structure, 525–530 measure jargon, 528 Standards," 37 meritocracy, 522-524 Honeynet Project, history of metasyntactic jargon, 528 business plan, 12-15 popular reference jargon, 527 challenge exercises, 8-9 recreation jargon, 528 communication, 14-15 self-reference jargon, 527 founding members, 6, 7–8 social control jargon, 527 group size, 12-13 social function jargon, 528 Honeynet Research Alliance, 10-12 status jargon, 527 before honeynets, 4–5 studying the community, 520-521 honeynets, advent of, 7-8 symbol jargon, 528 honeynets, GenI, 7-8 technical jargon, 526 honeynets, GenII, 10 spammers, 592-593 honeypots, advent of, 6-7 warez traders, 592 keeping it fun, 13 whitehats, definition, 507-509 management strategy, 12-15 Hacktivism, hacker motivation, 514 military influence, 4-5 Hard disks multitasking, 13-14 security community support, 10–12 erasing, 416 forensic analysis, 359–363 tools and technique development, 11–12 forensic images, 359-363 Honeynet Project Tools page, 52 images, capturing, 54-55 Honeynet Research Alliance, 10-12 partitions, forensic analysis, 363-366 Honeynet Reverse Challenge. See also reverse wiping clean, 416 engineering. Hardened Honeypot Zone, 135 analysis, 474-481 decompilation, 474-481 Hash Keeper, 375 Hash values disassembly, 473 databases of, 375, 380-382 history of, 9 information gathering, 470-473 examples of, 343 online resources, 361 overview, 469-470 uses for, 331-332 Honeynet Security Console (HSC), 497-500. See verifying file integrity, 374 also log files. Heiser, Jay, 329 Honeynets Hexadecimal data display, 293-294 architecture, 35-41 hfind tool, 382 benefits of, 34-35 Hidden files, finding, 372-373 central data collection. See distributed honeynets. Hiding components, 136-138 packets, 130 containing attacks. See data control. UML kernel data, 200 detection by intruders. See fingerprinting; latency High-interaction honeypots, 25–27 problem. High-level language characteristics, identifying, future of 454-456 advanced threats, 681 High-level language used, identifying, 453 blackhat response, 682-683 History files, 393 distributed honeynets, 680 insider threats, 681-682 History jargon, 527















Honeynets, continued	definition, 17–18
law enforcement applications, 682	detecting attacks, 29
use and acceptance, 682	false negatives, 19
history of, 7–8	false positives, 19, 124
logging. See data capture; log files; logging.	high interaction, 25–27
monitoring. See data capture.	history of, 6–7
monitoring several at once. See data collection;	infrastructure, 18
distributed honeynets.	and IPv6, 20
multiple on a single computer. See virtual	ISLab example
honeynets.	configuration, 139
multiple OSs on a single computer. See virtual	eventlog to syslog utility, 140–141
honeynets.	keystroke logging, 141–148
risks	remote syslog server, 146–148
criminal activity, 43	Sebek, 141–146
customization, 44	Syslogd, 139–140, 146–148
detection of the honeynet, 42	system events logging, 139–141
disabling the honeynet, 43	layers, GenII honeynets, 128–133
harm to a system, 42	low interaction, 21–25, 26–27
human monitoring, 43	preventing attacks, 28
mitigating, 43–44	pros and cons, 19–21
violation, 43	as research tools, 30
time zone synchronization, 40	responding to attacks, 29-30
types of. See distributed honeynets; GenI	risks, 20–21
honeynets; GenII honeynets; virtual	Specter, 21–22
honeynets.	types of, 21–27
"Honeypot Bandwidth Rate Limitation," 52	uses of, 27–30
Honeypot farms	"Honeypots: Simple, Cost Effective Detection," 30
asymmetric routing, 217	Honeypots: Tracking Hackers, 31
configuring the Ethernet, 222	"Honeypotting with VMware:", 194
definition, 212	Honeytokens, 18
example, 218–222	Honeywall CD-ROM, 210–211
hot-zoning, 213–214	Honeywalls
IP tunnels, 216, 219–220	definition, 36
latency problem, 215–216	filtering packets, 99–102
NAT (Network Address Translation), 218, 221	kernel configuration, 713-715
packet mangling, 217-218, 220-221	Honeywalls, GenII honeynets
policy-based routing, 217, 220	data control modes
pros and cons, 214	control layers, 109
protecting production hosts, 213-214	CRLM (Connection Rate Limiting Mode),
sample diagram, 213	110–113
setting up, 216–218	IPS layer, 109
technology choices, 216-218	limiting connection rates, 110–113
VLANs (virtual LANS), 217	malicious packets, dropping, 110, 113-116
HoneyPot Proc FS (hppfs), 200	malicious packets, replacing, 110, 116-118
Honeypots	network gateway layer, 109
backing up, 197–198	PDM (Packet Drop Mode), 110, 113–116
BackOfficer Friendly, 21–22	PRM (Packet Replace Mode), 110, 116-118
Deception Toolkit, 28	firewalls, 99–102, 109–118





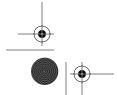








implementing, 99–102 IDS alerts, 61-62, 71-73 IPTables, 102-106 IDS logs, centralizing, 489–490 managing, 101-102 IDSs (intrusion detection systems), 17, 124–128 IIS (Internet Information Server) log files, 426 revealing, 100 Honeywalls, ISLab example ils tool, 359 alerting, 177-180 Inbound activity, monitoring, 56-57 alerts logging, 162-165 Incidence Response and Computer Forensics, 329 ASCII session logging, 162 Indirect block pointers, 353-354 binary logging, 161–162 Information gathering bootstrapping the honeywall, 153–156 attackers. See profiling. bridge utilities, 151 attacks bridging capability, 150–151 See computer forensics CRLM (Connection Rate Limiting Mode), See data acquisition setting, 152 See data capture data capture, Sebek, 169-176 See data collection data capture, Snort, 161-169 See log files firewall logging, 153 See logging installing and configuring, 152-156 See network forensics IPTable updates, 151–152 description, 452-456 PDM (Packet Drop Mode), disabling, 153 example, 470-473 PRM (Packet Replace Mode), disabling, 153 Information security. See data control. remote management decisions, 153 Information security, history of. See Honeynet Sebek traffic, 153 Project, history of. sniffing network traffic, 161–165 inodes, forensic analysis, 353-355 Snort log size, 161–165 Internet connection hardware, 77-78 Snort-Inline data control, 156–162 Internet connections, 89, 138 Swatch, 177–180 Internet Explorer, forensic analysis, 426–427 tools and utilities, 150–152 Internet Information Server (IIS) log files, 426 Host activity recording, 59-61, 65-70 Internet resources. See online resources. Host system, definition, 184 Intruders. See hackers. Hot-zoning, 213-214 Intrusion detection. See alerts; Snort. "How to Write Snort Rules," 289 Intrusion detection systems (IDSs), 17, 124–128 hppfs (HoneyPot Proc FS), 200 Intrusions, legal issues, 242-243 HSC (Honeynet Security Console), 497-500. See IP headers, 283-285 IP Stack simulation, 317 also log files. Humor jargon, 527 IP tunnels, 216, 219-220 Hybrid virtual honeynets, 188-189 ippersonality patch, 317 **IPTables** connection tracking, 105-106 ICMP Echo Request Data Payload Content, 322 filtering packets, 102-106, 106-109 ICMP Echo Request Datagram Size, 322 GenII honeynets, 102-106 ICMP Echo Request Timestamp, 322 packet filtering, 102-105 ICMP Identification Number Used, 322 rules, 104-106 stateful inspection, 105-106 ICMP packet signatures, 322 ICMP Sequence Numbers, 322 updates, 151-152 "ICMP Usage in Scanning," 316 IPTables Firewall "Identifying ICMP Hackery Tools," 324 data control, 51, 52 Ideology (cause), hacker motivation, 514-516 script code, 685-702













IPv6	Internet connections, 138
and honeypots, 20	Public Internet Zone, 135
traffic analysis, 666–670	topology, 133–136, 137
tunnel setup, 670–674	1 0.
IRC chats	J
capturing, 305	Jargon, thematic categories, 526–530
extracting from tcpdump files, 305	Jargon File
profiling from, 551–556	definition, 509
traffic examination, 652–654, 663–666	thematic analysis, 526-530
ISLab example, GenII deployment	Journal of Digital Evidence, 366
Basic Honeypot Zone, 135	-
Hardened Honeypot Zone, 135	K
HNRouter, 148	Kernel modules, forensic analysis, 349-350
Honeynet Administration Zone, 136	Keystroke logging
honeynet components, 136-138	centralizing, 494-496
honeypots	forensic analysis, 269–272
configuration, 139	ISLab example, 141–148
eventlog to syslog utility, 140-141	UML (User-Mode Linux), 199
keystroke logging, 141–148	vulnerability, 68
remote syslog server, 146–148	Keyword searching techniques, 398–402
Sebek, 141–146	Knoppix, 360
Syslogd, 139–140, 146–148	Knoppix STD, 360
system events logging, 139–141	Know Your Enemy, 10
honeywall	"Know Your Enemy: Motives," 7
alerting, 177–180	"Know Your Enemy: Sebek", 129
alerts logging, 162–165	Known bad files, databases of, 380–382
ASCII session logging, 162	Known Goods, 375
binary logging, 161–162	kregedit program, 434
bootstrapping the honeywall, 153–156	Kruse, Warren, 329
bridge utilities, 151	kstat tool, 358
bridging capability, 150–151	Kurtz, George, 8
CRLM (Connection Rate Limiting Mode),	
setting, 152	L
data capture, Sebek, 169–176	Large file support, 334
data capture, Snort, 161–169	lastlog log files, 395
firewall logging, 153	Latency problem, 215–216
installing and configuring, 152–156	Law enforcement involvement, 247–248
IPTable updates, 151–152	Laws. See also legal issues.
PDM (Packet Drop Mode), disabling, 153	outside the U.S., 238
PRM (Packet Replace Mode), disabling, 153 remote management decisions, 153	Pen Register, Trap and Trace Devices statute 236–238
Sebek traffic, 153	U.S. Constitution issues, 226–227
sniffing network traffic, 161–165	U.S. contracts and policies, 238
Snort log size, 161–165	U.S. statute issues, 227–238
Snort-Inline data control, 156–162	USA Patriot Act, 236
Swatch, 177–180	Wiretap Act, 228–236
tools and utilities, 150-152	Layered data capture, 53-55, 62-63



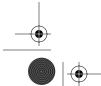








Layers, data analysis Linux. See also computer forensics, UNIX. computer forensics, 275–276 bootable CDs, 360 case study. See Greek Honeynet Project. network forensics, 273–275 reverse engineering, 276-279 IPTables Firewall, 51, 63 setup for forensic analysis, 369 Lazarus tool, 397 Legal issues Linux-based forensic analysis, 334 computer forensics, 329 Linux-based forensic analysis tools, 335-340 Live data acquisition, 342, 362-363 criminal activity attempted criminal acts, 244-246 LOG action, 103 Computer Fraud and Abuse Act, 239–246 Log files. See also HSC (Honeynet Security contraband, 246 Console); monitoring; Sebek. crimes by juveniles, 246 ASCII SESSION, 263-264 DoS (denial of service) attacks, 240-242 boot, 395 entrapment, 249-250 centralizing informing victims, 248-249 firewall logs, 487–489 intrusions, 242-243 IDS logs, 489–490 law enforcement involvement, 247-248 keystroke logs, 494–496 liability to others, 250-251 overview, 486 malicious code, 240-242 system logs, 492-494 network crimes, 239-246 tcpdump logs, 490-492 protected computer, definition, 239 cron, 395 protecting other systems, 248 firewall, 257-259, 598-600 protocols for dealing with, 246-249 forensic analysis, 394-396, 426 IIS (Internet Information Server), 426 threatening computer damage, 244 keystroke, 269-272 trafficking in passwords, 244 unauthorized access, 243 lastlog, 395 monitoring network users maillog, 395 "computer trespasser" exception, 236 messages, 395 real-time monitoring and alerting, 79network "consent of a party" exception, 235-236 examples, 231-235 binary, 259-262 Fourth Amendment issues, 226–227 Sebek, 606-607 laws outside the U.S., 238 secure, 395 Pen Register, Trap and Trace Devices statute, Snort intrusion detection alerts, 264–267 236-238 system, 268-269, 607 privacy laws. See Pen Register, Trap and Trace system logs, 607 Devices statute; Wiretap Act. wtmp/wtmpx, 395 "provider protection" exception, 229-231 xferlog, 395 reasonable expectation of privacy, 227 Logging. See also monitoring. search warrants, 226-227 alerts, 162-165 U.S. Constitution issues, 226-227 ASCII sessions, 162, 168 attacks. See data capture; log files; logging. U.S. contracts and policies, 238 U.S. statute issues, 227-238 binary, 161-162, 167 USA Patriot Act, 236 firewalls, 122-124, 153 Wiretap Act, 228–236 honeynets. See data capture; log files; logging. Levy, Elias, 8 keystrokes centralizing, 494-496 Liability to others, 250–251 forensic analysis, 269-272 Limiting damage. See data control.















Logging. continued ISLab example, 141–148 UML (User-Mode Linux), 199 vulnerability, 68 packets, 103 "Paranoid Penguin: Stealthful Sniffing ... and Logging," 69 system events, 139-141 TTY, 199 Loopback devices, 363-366 losetup command, 363-366 Low-interaction honeypots, 21–25, 26–27 lsof tool, 358

M MAC times, 376-380, 439-442 Magic/religion jargon, 527 maillog log files, 395 Malicious code, 57, 240-242 Malicious packets, 110, 113-118 Mandia, Kevin, 329 Manuals. See books and publications. Master File Table (MFT), 408-409 McMillen, Rob, 152 Measure jargon, 528 MEECES (Money, Entertainment, Ego, Cause, Entrance, Status), 509-510 Memory information, forensic analysis, 415 Mendel, Dion, 9 Meritocracy, hacker community, 522-524 messages log files, 395 Meta-data, 407, 408-409 Metasyntactic jargon, 528 Mexico Honeynet Project, 11 MFT (Master File Table), 408-409 MICE (Money, Ideology, Compromise, Ego), 509 Military influence on Honeynet Project, 4-5 Misaligned code, 457-458 Misconfiguration attacks, 570 Mitnick, Kevin, 64 mmls tool, 364-365 Money, Entertainment, Ego, Cause, Entrance, Status (MEECES), 509-510 Money, hacker motivation, 510-512 Money, Ideology, Compromise, Ego (MICE), 509 Monitoring. See also log files; logging. covert, 60 honeynet attackers, 57

See data capture See data collection See log files See logging malicious software, 57 multiple intruders, 58 mystery traffic, 57 network users, legal issues. See legal issues, monitoring network users. outbound activity, 57-58 previous owner traffic, 57 real-time monitoring and alerting, 79 repeat visitors, 56-57 risks, 43 script kiddies, 56 spam, 57 system software, 58 worms, 56 "Monitoring VMware Honeypots," 194 Mounting local image files, 423 remote shares, 424 Multiple dimensional arrays, 455 Multiple intruders, monitoring, 58 Mystery traffic, monitoring, 57

N

honeynets

NAT (Network Address Translation), 218, 221 National Institute of Standards and Technology (NIST), 375 National Software Reference Library (NSRL), 375 netcat tool, 344-345, 421-422 netfilter, 102 netstat tool, 415 Network Address Translation (NAT), 218, 221 Network forensics. See also computer forensics; profiling. description, 273-275 limitation, 304 packet encryption, 304 protocols, nonstandard, 307-311 protocols, standard, 283 uses for, 282 Network forensics, example alerts, 295-297 attack follow-through, 304-305

capturing IRC chats, 305-307



















log analysis, 297–298		
rootkit reconstruction, 303-304		
session reconstruction, 298–304		
Network forensics, Snort		
command line options, 291		
example, 295–298		
filtering output, 291		
hexadecimal data display, 293–294		
"How to Write Snort Rules," 289		
output message details, 290–291		
packets, capturing, 292–293		
packets, inspecting, 293–294		
rootkit reconstruction, 303–304		
session reconstruction, 294–295, 298–30		
traffic analysis, 289–295		
verbose option, 290–291		
Network forensics, traffic analysis		
169.254.x.x pattern, 314		
Ack scans, 287		
broadcast pattern, 312		
capture and analysis, 288–295		
common patterns, 311–324		
connect scans, 287		
DNS reverse lookup pattern, 313		
Ethereal sniffer, 289		
FIN scans, 287 IP headers, 283–285		
open ports, determining, 287		
passive fingerprinting		
versus active, 317		
description, 316–317		
ICMP example, 320–324		
ICMP packet signatures, 322		
p0f tool, 324		
pros and cons, 317		
TCP example, 318–320		
port scans, identifying, 287		
proxy scanning pattern, 313–314		
SYN scans, 287		
TCP headers, 285–286, 288		
tcpdump, 289		
traceroute pattern, 314–316		
Networks. See also network forensics.		
binary log files, 259–262		
configuration summary, 709–711		
connections, forensic analysis, 358–359		
crimes, 239–246		
decov. See honevnets.		

intrusion detection tools. See Snort. traffic analysis. See network forensics, traffic analysis. traffic capture tools. See tcpdump. traffic recording, 58-59, 64-65 traffic sniffing, 125 transaction recording, 55-58, 63-64 ngrep tool, 63 ngrep-like tool, 70 NIST (National Institute of Standards and Technology), 375 Nonresident MFT records, 409 Nonstandard protocols, network forensics, 307-311 Nonvolatile data acquisition UNIX forensics, 359-363 Windows forensics, 415–420 NSRL (National Software Reference Library), 375 NTFS file system, 408-411 ntreg tool, 435 0

filtering, 102-106

169.254.x.x pattern, 314 Online resources. See also books and publications. ACID (Analysis Console for Intrusion Detection), 489 antidebugging tricks, 468 ASR Date: SMART, 340 Autopsy Forensic Browser, 339 bash shell patch, 68 Bro, 71 "Bro: ... Detecting Network Intruders ...", 71 burndump, 468 burneye, 468 chkrootkit tool, 358 computer crime laws, 239 computer crime prosecutions, 239 Computer Fraud and Abuse Act, 239 Coroner's Toolkit, 359 Cygwin tool, 413 data capture tools, 53 dd tool, 415 DFT (ProDiscover Forensics), 341 EnCase Forensic, 341 exploit coding, 484 FIRE, 360 FISQ (Firewall SQL Import Script), 488

FTK (Forensic Toolkit), 341













Online resources, continued Fyodor's Nmap Security Scanner, 316 Getting Physical with the Digital Investigation Process, 366 hacker wargames sites, 484 hash databases, 382 Hash Keeper, 375 hash value databases, 375 hash values, 361 Honeyd, 317 Honeynet Project Tools page, 52 "How to Write Snort Rules," 289 HSC (Honeynet Security Console), 497 "ICMP Usage in Scanning," 316 "Identifying ICMP Hackery Tools," 324 IP Stack simulation, 317 ippersonality patch, 317 IPTables, 102 IRC chat capture, 305 Journal of Digital Evidence, 366 Knoppix, 360 Knoppix STD, 360 "Know Your Enemy: Sebek ...", 129 Known Goods, 375 kstat tool, 358 Linux bootable CDs, 360 log files, real-time monitoring and alerting, 79 loopback devices, 366 lsof tool, 358 netcat tool, 345 netfilter, 102 ngrep tool, 63 ngrep-like tool, 70 NIST (National Institute of Standards and Technology), 375 NSRL (National Software Reference Library), 375 "Paranoid Penguin: Stealthful Sniffing ... and Logging," 69 Penguin Sleuth Kit, 360 phrack magazine, 484 PLAC, 360 PsInfo utility, 414 PsList utility, 414 Red Hat Linux, 78 Scan of the Month Challenge 22, 54 Scan of the Month Challenge 28, 80 The Sleuth Kit, 337 Sleuth Kit Informer newsletter, 335

Snort NIDS, 53 SnortConfig tool, 116 Solaris Fingerprint Database, 375 Swatch, 79 tcpdump, 53 UNFBurninhell, 468 UnxUtils, 413 U.S. Air Force Office of Special Investigations, "What are MAC Times?", 376 OOV (Order of Volatility), 343, 358 Open files, forensic analysis, 358–359 Open ports, determining, 287 OpenBSD PF Firewall, 51-52, 63 Operating system attacks, 566–567 Order of Volatility (OOV), 343, 358 Outbound activity, monitoring, 57–58 Owning a system, 57 p0f tool, 324

Packet Drop Mode (PDM), disabling, 153 Packet mangling, 217-218, 220-221 Packet Replace Mode (PRM), disabling, 153 Packets. See also TARGETS. capturing, 292-293 encryption, and network forensics, 304 inspecting, 293-294 Packets, GenII honeynets accepting, 103 acting on, 102-106 filtering with honeywalls, 99-102 IPTables, 102-106, 106-109 Snort-Inline, 106-109 forwarding, 99-102 hiding, 130 logging, 103 malicious, dropping, 110, 113-116 malicious, replacing, 110, 116-118 queuing, 103 rejecting, 103, 108-109 from Sebek clients, 130 selecting, 102-106 TARGETS, 102-106 Papers. See books and publications. "Paranoid Penguin: Stealthful Sniffing ... and

Logging," 69











Passive attacks, 560 Passive fingerprinting versus active, 317 description, 316-317 ICMP example, 320-324 ICMP packet signatures, 322 p0f tool, 324 pros and cons, 317 TCP example, 318-320 Passwordless authentication, 80 Passwords, trafficking in, 244 Patriot Act, 236 PDM (Packet Drop Mode), disabling, 153 Pen Register, Trap and Trace Devices statute, 236-238 Penguin Sleuth Kit, 360 Pepe, Matt, 329 phrack magazine, 484 PLAC, 360 Policy-based routing, 217, 220 Popular reference jargon, 527 Port scans, identifying, 287 Practical UNIX and Internet Security, 4 Preventing attacks. See data control; firewalls. Previous owner traffic, monitoring, 57 Privacy, legal issues. See legal issues, monitoring network users. PRM (Packet Replace Mode), disabling, 153 Problem statement, 369–371 Processes, forensic analysis, 358-359, 414 ProDiscover Forensics (DFT), 341 Profiling Acid Falz example, 548–551 blackhat characteristics, 545-547 event characteristics, 544-545 event consequences, 545 example, 674-678 with IRC, 551-556 overview, 543-544 target characteristics, 547-548 Program debugging. See debugging. Programming theory, 484 Prosise, Chris, 329 Protected computer, definition, 239 Protocols dealing with criminal activity, 246-249 network forensics, 283, 307-311 "Provider protection" exception, 229-231

Provos, Niels, 23 Proxy scanning pattern, 313-314 ps tool, 359 Pseudo-rules, 118-120 PsInfo utility, 414 PsList utility, 414 ptrace vulnerability, 623-624 Public Internet Zone, 135 Publications. See books and publications. QUEUE action, 103 Queuing packets, 103 RAID systems, forensic analysis, 360 Ranum, Marcus, 4 Raw image acquisition, 416-417 rc.firewall configuration, 717-719 data control, 51-52 Snort-Inline, 160 Read-only restrictions, forensic environment, 424-425 Reasonable expectation of privacy, 227 Reconnaissance, 563-565 Reconstructing rootkits, 303-304 sessions, 294-295 Recreation jargon, 528 Recycle Bin, forensic analysis, 427-430 Red Hat Linux, 78 Reed, Darren, 8 Reference material. See books and publications; online resources. regedit32.exe program, 434 Registry analysis, 433-435 REJECT action, 103 reject action, 108-109 Rejecting packets, 103, 108-109 Remote management decisions, 153 Remote syslog server, 146-148 Repeat visitors, monitoring, 56-57 Reserved files, 410-411 Resident MFT records, 409 Responding to attacks, 29–30

Reverse Challenge. See Honeynet Reverse

Challenge.











Reverse engineering. See also Honeynet Reverse Challenge. active analysis analysis environment, 464-465 antidebugging tricks, 467-468 black box analysis, 465-466 debugging, 468-469 definition, 450 pros and cons, 451 sandboxing, 464-465 tracing, 466-467 data analysis layer, 276–279 definition, 447 example. See Honeynet Reverse Challenge. locating code weak spots, 532 methods, 450-452 prerequisites, 448-450 Reverse Challenge, 9 static analysis compiler used, 453 decompilation, example, 474-481 decompilation, order of, 463-464 decompilation, techniques, 459-463 definition, 450 disassembly, description, 456-458 disassembly, example, 473 dynamic linking, 453 embedded strings, 453 executable file formats, 452 fooling the disassembler, 457-458 high-level language characteristics, 454-456 high-level language used, 453 information gathering, description, 452-456 information gathering, example, 470-473 misaligned code, 457-458 multiple dimensional arrays, 455 pros and cons, 451 static linking, 453 string representations, 454-455 subroutine calling conventions, 455-456 symbol table regeneration, 458-459 target architecture/platform, 453 uses for, 448 Reymond, Eric, 507 Risks containing. See data control. criminal activity, 43 customization, 44

detection of the honevnet, 42 disabling the honeynet, 43 exploits, 541-542 harm to a system, 42 honeypots, 20-21 human monitoring, 43 mitigating, 43-44 violation, 43 virtual honeynets, 185 rm command, 60 Roesch, Marty, 6, 7 Rootkit chkrootkit tool, 358 reconstruction, 303-304 recovery, 646-650 Round Trip Time (RTT), 215 RST packet flag, 64 RTT (Round Trip Time), 215 Rules GenII honeynets IPTables, 104–106 pseudo-rules, 118–120 Snort-Inline, 107-109, 116 IPTables, 104-106

S

Samba program, 425 Sample program attacks, 569 Scan of the Month Challenge, 8 Scan of the Month Challenge 22, 54 Scan of the Month Challenge 28, 80 Scan of the Week Challenge, 8 Schneier, Bruce, 8 Scientific method, 329-331 Script kiddies, monitoring, 56 Scripts, 569 sdrop action, 108-109 Search warrants, 226-227 Searches hex-based, 431 keyword, 430-431, 437 memory, 431-433 Sebek. See also Snort. configuring, 142-144 installing, 142-144 ISLab example, 141–146 keystroke logs, 269-272

logs, example, 606-607







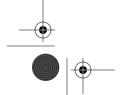








packets from clients, 130 and rc.firewall, 160 rules, 107-109, 116 running, 145 source for, 142 rules, GenII honeynets, 107–109, 116 testing, 145-146 running at system restart, 160 traffic, example, 153 Social control jargon, 527 Sectors, 406 Social function jargon, 528 secure log files, 395 Solaris compromise. See also Greek Honeynet Security community, 10–12 Project. Security of information. See data control. event timeline Security of information, history of. See Honeynet Day 1 event summary, 658-659 Project, history of. Day 2 event summary, 659 Seifried, Kurt, 194 Day 3 event summary, 674 Selecting packets, 102–106 DoS (denial of service) attack analysis, Self-contained virtual honeynets, 186-187 659-663 Self-reference jargon, 527 DoS (denial of service) tool detection, Session reconstruction, 294-295, 298-304 654-658 Session tracking, 71–73 eliminating competition, 650–652 Shah, Saumil, 7 event reconstruction, 644-645 Shimomura, Tsutomu, 64 exploit investigation, 638-644 Shutdown considerations, forensic analysis, 344 intruder tool recovery, 645-646 skas mode, 200 intrusion detection, 637-638 Skoudis, Ed, 6 IPv6 traffic analysis, 666–670 The Sleuth Kit, 335-337, 435-444 IPv6 tunnel setup, 670-674 Sleuth Kit Informer newsletter, 335 IRC traffic examination, 652-654, 663-666 Sniffer, deploying on the firewall, 80"Smashing the rootkit recovery, 646-650 Stack for Fun and Profit," 4 SSH backdoor access detection, 666-670 Sniffing network traffic, 83–85, 161–165 honeynet setup and configuration, 636-637 Snort. See also Sebek. intruder profile, 674-678 overview, 635 alerts, example, 600-601 Solaris Fingerprint Database, 375 alerts, logging, 162–165 ASCII session logging, 162, 168 sorter command, 438 binary logging, 161-162, 167 Sorter tool, 438 configuration, 703 Source code auditing, 532 data capture example, 72 South Florida Honeynet Project, 11 example, 78-79 Spafford, Gene, 4 intrusion detection alerts log files, 264-267 Spam, monitoring, 57 ISLab example, 161-169 Spammers, 592–593 log size, 161-165 Spanning tree protocol (STP), 99-102 network forensics. See network forensics, Snort. Specter, 21-22 session files, example, 602-606 Spitzner, Lance, 6, 51 sniffing network traffic, 161-165 SSH backdoor access detection, 666-670 Snort NIDS, 53 SSL vulnerability, 622-623 snort_fast file, 168 Standard protocols, network forensics, 283 Start-up file analysis, 390-393 snort full file, 168 Snort-Inline Start-up scripts, 348-349 data control, 156-162 statd attack, system log example, 60-61 database of known attacks, 113-114 Stateful inspection, 105-106. See also connection filtering packets, 106-109 tracking.











Static analysis	System events logging, 139–141
compiler used, 453	System log example, statd attack, 60–61
decompilation, example, 474–481	System log files
decompilation, order of, 463–464	centralizing, 492–494
decompilation, techniques, 459–463	example, 607
definition, 450	forensic analysis, 268–269
disassembler, fooling, 457–458	Linux compromise, 607
disassembly, description, 456–458	System software, monitoring, 58
disassembly, example, 473	3, 1
dynamic linking, 453	Т
embedded strings, 453	Target architecture/platform, identifying, 453
executable file formats, 452	TARGETS, 102–106. See also packets.
high-level language characteristics, 454–456	TCP headers, analyzing, 285–286, 288
high-level language used, 453	tcpdump
information gathering, description, 452–456	GenI data capture, 64–65
information gathering, example, 470–473	logs, centralizing, 490–492
misaligned code, 457–458	online source for, 53
multiple dimensional arrays, 455	traffic analysis, 289
pros and cons, 451	Technical jargon, 526
static linking, 453	Threatening computer damage, 244
string representations, 454–455	Time synchronization, 40, 41, 222–223
subroutine calling conventions, 455–456	TIS Firewall Toolkit, 4
symbol table regeneration, 458–459	"To Build a Honeypot," 6
target architecture/platform, 453	Tools and utilities. See also HSC (Honeynet Securit
Static linking, 453	Console).
Status, hacker motivation, 517–519	ACID (Analysis Console for Intrusion
Status jargon, 527	Detection), 489
Stealth interface, 83–85	alerting. See Swatch.
Sterilizing media, 416	antidebugging tricks, 467–468
Stoll, Cliff, 5	arp command, 415
Store time information, 354–355	Autopsy Forensic Browser, 337–340, 435–444
STP (spanning tree protocol), 99–102	burndump, 468
Streams, definition, 259	burneye, 468
String representations, identifying, 454–455	chkrootkit, 358
strings command, 430–431	computer forensics
Subroutine calling conventions, 455–456	file system analysis tools, 335–337
Swap space, forensic analysis, 357	FTK (Forensic Toolkit), 341
Swatch	Linux-based tools, 335–340
configuration, 705–707	netcat tool, 344–345
ISLab example, 177–180	Windows-based tools, 341
online source for, 79	Coroner's Toolkit, 359
uses for, 79	Cygwin, 413
Symantec Decoy Server example, 25–27	data capture
Symbol jargon, 528	See also log files
Symbol table regeneration, 458–459	See also logging
SYN scans, 287	See also Snort
Syslogd, 139–140, 146–148	See also tcpdump
-10.,,	















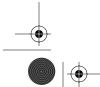
keystroke logger, 129-132 Sebek, 129-132 system logs, 132-133 dd, 415, 417-420 Deception Toolkit, 28 DFT (ProDiscover Forensics), 341 disassemblers, 456-458 EnCase Forensic, 341 Ethereal sniffer, 289 file system analysis, 335–337 FISQ (Firewall SQL Import Script), 488 fport, 415 FTK (Forensic Toolkit), 341 Fyodor's Nmap Security Scanner, 316 grep command, 430-431 Honeyd, 23-25, 317 Honeynet Project Tools page, 52 honeywalls, ISLab example, 150–152 IDA Pro, 456-458 "Identifying ICMP Hackery Tools," 324 keystroke logger, 129–132 kregedit program, 434 kstat, 358 lsof, 358 ndisasm, 456-458 netcat, 421-422 netstat, 415 network intrusion detection. See Snort. network traffic capture. See tcpdump. ngrep, 63 ngrep-like, 70 nonnative Windows, 413 ntreg, 435 objdump, 456–458 OpenBSD PF Firewall, 51-52 p0f, 324 passive fingerprinting, 324 Penguin Sleuth Kit, 360 PsInfo utility, 414 PsList utility, 414 regedit32.exe program, 434 Samba program, 425 Sebek, 129-132 The Sleuth Kit, 335-337, 435-444 SnortConfig, 116 Solaris Fingerprint Database, 375 Sorter, 438

strings command, 430-431 Swatch, 79 system logs, 132-133 TIS Firewall Toolkit, 4 UNFBurninhell, 468 UNIX tools for Windows, 413 UnxUtils, 413 volume_dump program, 416 WinDasm, 456-458 wipe program, 416 Topology, 133-136, 137 Traceroute pattern, 314–316 Tracing, 466-467 Traffic analysis. See network forensics, traffic analysis. Traffic dumps, 59 Trafficking in passwords, 244 Triple indirect block pointers, 353-354 Trojans, 571-572 TTY logging, 199

sorter command, 438

U

UML (User-Mode Linux) building, 200-205 confirming setup, 202-205 features, 199-200 file system, 201 fingerprinting, 200 fingerprints, default, 204 hiding UML kernel data, 200 hppfs (HoneyPot Proc FS), 200 installing, 200-205 keystroke logging, 199 pros and cons, 198-199 skas mode, 200 TTY logging, 199 Unallocated space analysis, 396-397 Unauthorized access, 243 UNFBurninhell, 468 University of Texas Honeynet Project, 11 UNIX forensics. See computer forensics, UNIX. UnxUtils, 413 U.S. Air Force Office of Special Investigations, U.S. Constitution, legal issues, 226-227 U.S. contracts and policies, legal issues, 238













U.S. statutes, legal issues, 227–238 USA Patriot Act, 236 "The Use of Honeynets ... Across Large ... Networks," 35 User-Mode Linux (UML). See UML (User-Mode Linux). Users, analyzing, 358-359

Venema, Wietse, 9, 335 verbose option, Snort, 290–291 Victim machines. See honeynets; honeypots. Violation of a system, risk of, 43 Virtual hardware write blockers, 424-425 Virtual honeynets See also distributed honeynets See also GenI honeynets See also GenII honeynets See also honeynets classic/virtual hybrid, 188-189 description, 183-186 fingerprinting, 185 implementation options, 190-191 limitations, 185 pros and cons, 185 risks, 185 self contained, 186-187 UML (User-Mode Linux) building, 200-205 confirming setup, 202-205 features, 199-200 file system, 201 fingerprinting, 200 fingerprints, default, 204 hiding UML kernel data, 200 hppfs (HoneyPot Proc FS), 200 installing, 200-205 keystroke logging, 199 pros and cons, 198-199 skas mode, 200 TTY logging, 199 VMware ESX Server, 192–193 VMware GSX Server backing up installed honeypots, 197-198 banners, 193 building a virtual honeynet, 194-198 detection, 193 features, 193-194

fingerprinting, 193 installing VMware tools, 196-197 issues, 193-194 pros and cons, 191-192 resetting a virtual machine, 194 suspending a virtual machine, 194 VMware Workstation, 190-191 Virtual LANS (VLANs), 217 Virtual machines, 194 Vision, Max, 7, 305 VLANs (virtual LANS), 217 VMware ESX Server, 192–193 VMware GSX Server backing up installed honeypots, 197-198 banners, 193 building a virtual honeynet, 194-198 detection, 193 features, 193-194 fingerprinting, 193 installing VMware tools, 196-197 issues, 193-194 pros and cons, 191-192 resetting a virtual machine, 194 suspending a virtual machine, 194 VMware Workstation, 190-191 Volatile data acquisition, 357-359, 412-415 volume_dump program, 416 Vulnerability, 531-534

warez traders, 592 Web resources. See online resources. West Point Honeynet Project, 11 "What are MAC Times?", 376 Whitehats, definition, 507-509 Windows forensics. See computer forensics, Windows. Windows worms, log example, 61 wipe program, 416 Wiretap Act, 228-236 Worms, 56, 61 wtmp/wtmpx log files, 395

xferlog log files, 395

Zalewski, Michal, 324





