

mitigating
 at host level, 23–25
 at network level, 25–26
Morris worm, characteristics of, 18
Nimda worm, characteristics of, 20–22
replacement login, example of, 17
signatures. *See* signatures
SQL Slammer worm, characteristics of, 21

authentication

802.1x, 78
role in layered defense, 79

Auto mode (software bypass), 63

automated response to attacks, 26

automatic blocking, 143–144

automatic summarization, 46

B

balanced systems, 186

behavioral security policies, 122–123

behavior-based detection, 44

benefits of IPSs, 137

HIPS

acceptable use policy enforcement,
95–96

attack prevention, 92

*internal attack propagation
prevention*, 93

patch relief, 92–93

policy enforcement, 94–95

security policy enforcement, 138

traffic normalization, 138

“benevolent” worms, 16

blade-based sensors, 153–154

block response, 61

block signature action, 47

branch office IPS deployment, 236–237

HIPS implementation, 238

limiting factors, 237

NIPS implementation, 239–240

security policy goals, 237

buffer overflow vulnerabilities, 22

buffer overrun exploit, 105–107

C

cabling, sensors, 221

capabilities

of Cisco IPS network components, 211

of IPSs

attack prevention, 27

regulatory compliance, 27

capturing network traffic

devices for, 158–161

with IPSs, 154

for Inline mode, 155–157

for promiscuous mode, 157–158

with RSPAN, 162

with SPAN, 162

with VACLs, 164

characteristics

of attacks

CIH virus, 19

Loveletter virus, 19–20

Morris worm, 18

Nimda worm, 20–22

replacement login attack, 17

SQL Slammer worm, 21

of signatures, 34

Chernobyl, 19

child processes, 107

CIH virus, 19

Cisco Catalyst 6500 series IDSM-2, 206–207

Cisco IDS Network Module, 207

- Cisco IOS IPS sensors, 208
- Cisco IPS 4200 series appliance sensors, 206
- classifying IPS hosts, 185–187
- client-server architecture, 8
- client-server computing, 7–9
- clipboard, 109
- collaboration between layers, 81–82
- COM (Component Object Model), 109
- communications, securing management
 - communication, 66–68
- comparing IPS and IDS functionality, 136
- complexity of attacks, 14–15
- conducting pilot tests, 194–196
- configuration updates, 62
- configuring
 - policy groups, 191–193
 - secondary policy groups, 192–193
 - sensors, 221
- corporate security policies, 79–80
 - default policy configuration,
 - customizing, 194
 - reviewing, 212
- correlation tools, 65–66
- criteria for sensor selection
 - form factor, 152–154
 - interfaces, 151–152
 - processing capacity, 150–151
- CSA (Cisco Security Agent), 77
 - phases of deployment, 177
 - conducting pilot tests*, 194–196
 - finalizing the project*, 198
 - full deployment*, 197–198
 - implementing management*, 189–194
 - predeployment planning*, 180–184
 - selection and classification of target hosts*, 184–188
 - tuning*, 196
 - understanding the product*, 178–179
- CSA MC (CSA Management Center),
 - organizational units, 190–191
- CS-MARs (Cisco Security Monitoring, Analysis and Response System), 82
- customizing default corporate security policy configuration, 194

D

- day zero attacks, 77
- default allow organizations, 214
- default deny organizations, 214
- defense-in-depth, 71
 - corporate security policy, 79–80
 - examples of, 72–79
- defining goals of IPS deployment, 213–216
- delivery mechanism of attacks, 13
- deny response, 61
- deploying IPSs
 - at medium financial enterprises, 240
 - HIPS implementation*, 241–242
 - limiting factors*, 241
 - NIPS implementation*, 242–243
 - security goals*, 241
 - at branch offices, 236–237
 - HIPS implementation*, 238
 - limiting factors*, 237
 - NIPS implementation*, 239–240
 - security policy goals*, 237
 - at home office, 250
 - HIPS implementation*, 251–252
 - limiting factors*, 251
 - NIPS implementation*, 252
 - security policy goals*, 251
 - at medium educational institutions, 243
 - HIPS implementation*, 245–246
 - limiting factors*, 244
 - NIPS implementation*, 246–247
 - security policy goals*, 245
 - at small offices, 247
 - HIPS implementation*, 248–249
 - limiting factors*, 248
 - NIPS implementation*, 250
 - security policy goals*, 248
- host IPS, 53
 - determining factors*, 54–55
- network IPS, 55
 - determining factors*, 56–58
- on large enterprise, 229–230
 - HIPS implementation*, 231–233
 - limiting factors*, 231
 - NIPS implementation*, 233, 236
 - security policy goals*, 231
- sensors
 - large deployments*, 169
 - small deployments*, 168

deployment phases

- of CSA, 177
 - conducting pilot tests, 194–196*
 - finalizing the project, 198*
 - full deployment, 197–198*
 - implementing management, 189–194*
 - predeployment planning, 180–184*
 - selection and classification of target hosts, 184–188*
 - tuning, 196*
 - understanding the product, 178–179*
- of IPS, 204
 - finalizing the project, 225*
 - predeployment planning, 212–220*
 - sensor deployment, 221–222*
 - tuning, 222–224*
 - understanding the product, 205–211*

devices

- failure
 - inline sensor failure, 62*
 - management console failure, 63–64*
- intrinsic IPS, 80–81

device-to-device communication, securing, 68**directory traversal attacks, 40****DMZ firewall, role in layered defense, 75****drive-by spamming, 14****drop signature action, 46****dropping**

- all packets from source IP address, 137
- all packets on connection, 137

E**encoding mechanisms, 40****encryption, role in layered defense, 78–79****endpoint agents, access control process, 101**

- access resource, identifying, 102
- consulting the security policy, 119–124
- determining system state, 115–116, 119
- gathering operation data, 110–115
- taking action, 124

enforcing security policies, 138**EtherChannel, 63****event correlation, 65–66****event horizon, 36****events, 109****evolution of security threats, 6**

- client-server computing, 7–9
- Internet, 9
- mobile computing, 10–11
- wireless connectivity, 10

examples

- of attacks
 - CIH virus, 19*
 - Loveletter virus, 19–20*
 - Morris worm, 18*
 - Nimda worm, 20–22*
 - replacement login, 17*
 - SQL Slammer worm, 21*
- of effective defense-in-depth, 72
 - external attack against corporate database, 72–77*
 - internal attacks against management servers, 77–79*

exploits, 104**F****false negatives, 59****false positives, 59****finalizing CSA deployment, 198****firewalls, 6****flows, 164****form factor as sensor selection criteria, 152–154****forwarding devices, 136****full CSA deployment, 197–198****future of IPS, intrinsic IPS, 80–81****G-H****generating alerts, 141****goals of IPS deployment**

- defining, 213–216

HIDS (host-based intrusion detection systems), 25**hierarchical management model, 127****HIPS (host-based intrusion prevention systems), 89, 101**

- benefits of
 - acceptable use policy enforcement, 95–96*
 - attack prevention, 92*

- internal attack propagation prevention*, 93
 - patch relief*, 92–93
 - policy enforcement*, 94–95
 - endpoint agents, 101
 - access control process*, 101–124
 - limitations of, acceptable use policy enforcement, 96–97
 - management infrastructure, 125
 - management center*, 127–129
 - management interface*, 129
 - required capabilities, 90–92
 - role in layered defense, 79
 - security policies
 - anomaly-based*, 120
 - atomic-rule based*, 121
 - behavioral*, 122–123
 - home office IPS deployment, 250**
 - HIPS implementation, 251–252
 - limiting factors, 251
 - NIPS implementation, 252
 - security policy goals, 251
 - Host IPS**
 - deploying, 53–55
 - role in layered defense, 77
 - signature tuning, 59–60
 - host-based signatures**
 - atomic, 35
 - stateful, 36
 - triggering mechanisms, 39
 - host-level attack mitigation, 23**
 - antivirus, 23–24
 - HIDS, 25
 - personal firewalls, 24
 - hosts, classifying, 185–187**
 - hubs, 158**
 - hybrid IPS/IDS systems, 140, 145**
- I**
- IDS/MS-2 sensors, 207**
 - impact of attack, 16**
 - incident response plans, 66**
 - individual management method, 65**
 - information theft, 12**
 - inline mode sensor operation, 208**
 - capturing network traffic, 155, 157
 - sensor failure, 62
 - inline on a stick, 152**
 - inline prevention, 26**
 - insecure management protocol, 67**
 - installing**
 - IPS MC, 222
 - sensors, 221–222
 - integrated IPS software, 154**
 - interfaces as sensor selection criteria, 151–152**
 - Internet as security threat, 9**
 - Internet perimeter firewall, role in layered defense, 74**
 - Internet perimeter router, role in layered defense, 73**
 - intrinsic IPS, 80–81**
 - IP blocking, 143–146**
 - IP logging, 142**
 - IP spoofing, 144**
 - IPSs**
 - hosts, classifying, 185–187
 - integrated software, 154
 - network management options, 209–211
 - network traffic, capturing, 154–158
 - phases of deployment, 204
 - finalizing the project*, 225
 - predeployment planning*, 212–220
 - sensor deployment*, 221–222
 - tuning*, 222–224
 - understanding the product*, 205–211
 - response methods
 - alerting actions*, 166
 - blocking actions*, 167
 - dropping actions*, 167
 - logging actions*, 167
 - sensors
 - Cisco Catalyst 6500 series IDSM-2*, 206–207
 - Cisco IDS Network Module*, 207
 - Cisco IOS IPS sensors*, 208
 - Cisco IPS 4200 series appliance sensors*, 206
 - Cisco product availability*, 205
 - large deployments*, 169
 - selecting location for placement*, 216–218
 - small deployments*, 168
 - signature updates, 212
 - IPS MC (IPS Management Center), installing, 222**

K-L

kernel, 109

- modification, 111
- modules, 108

large enterprise IPS deployment, 229–230

- HIPS implementation, 231–233
- limiting factors, 231
- NIPS implementation, 233, 236
- security policy goals, 231
- sensor deployment, 169

layered defense. *See also* defense-in-depth

- against corporate database attacks, 72–77
- against management server attacks, 77–79

least privilege, 124

lifecycle of attacks, 103

- application execution, 107
- file resources, 108
- memory resources, 105, 107
- network resources, 104–105
- persistence process, 107, 109

limitations

- of IPS, 138–140, 145
- of HIPS, acceptable use policy enforcement, 96–97

line cards, 153–154

location state conditions, 116

log response, 61

log signature action, 47

logging

- attacker traffic, 142
- traffic between attacker and victim, 143
- victim traffic, 142

Loveletter virus, 19–20

M

MAC (mandatory access control), 124

mainframes, 7

malicious mobile code, 103

malware, 232

management communication

- device-to-device, securing, 68
- OOB, securing, 67
- securing, 66

management console failure, 63–64

management infrastructure, 125

- management center, 125–129
- management interface, 129

management method, selecting, 65

manager-of-managers, 127

McAfee Enterccept, 122

medium educational institution IPS deployment, 243

- HIPS implementation, 245–246
- limiting factors, 244
- NIPS implementation, 246–247
- security policy goals, 245

medium financial enterprise IPS deployment, 240

- HIPS implementation, 241–242
- limiting factors, 241
- NIPS implementation, 242–243
- security goals, 241

Microsoft Component Object Model, 109

mirroring traffic, 158

mitigating attacks

- at host level, 23
 - antivirus*, 23–24
 - HIDS*, 25
 - personal firewalls*, 24
- at network level, 25
 - inline prevention*, 26
 - promiscuous monitoring*, 25
 - system log analysis*, 25

mobile computing as security threat, 10–11

modems, 13

monitoring IPS activities, 64

Morris worm, 16, 18

Morris, Robert, 16

N

NetFlow, role in layered defense, 76

network adapters, 94

network flows, 164

network IPS

- deploying, 55
 - determining factors*, 56–58
- role in layered defense, 75, 78
- signature tuning, 59–60

network taps, 159

network traffic

- analyzing, 114
 - via anomaly operations*, 165
 - via atomic operations*, 164
 - via normalizing operations*, 165–166
 - via protocol decode operations*, 165
 - via stateful operations*, 164–165
- capturing, 154
 - devices for*, 158–161
 - with inline mode IPS*, 155–157
 - with promiscuous mode IPS*, 157–158
 - with RSPAN*, 162
 - with SPAN*, 162
 - with VACLs*, 164

network-based signatures

- atomic signatures, 35
- stateful signatures, 37
- triggering mechanisms, 39

network-level attack mitigation, 25

- inline prevention, 26
- promiscuous monitoring, 25
- system log analysis, 25

Nimda worm, 20–22**NIPS, selecting management architecture, 218–220****normalizing traffic, 138, 165–166****NTP (Network Time Protocol), 65****O****Off mode (software bypass), 63****On mode (software bypass), 63****OOB (out-of-band) management**

- communication, securing, 67

operating systems

- events, 109
- kernel, 109–111

organizational units (CSA MC), 190–191**OSI reference model, 26****OTPs (one-time passwords), 79****P****parent processes, 107****passwords, OTPs, 79****pattern detection, 40–41****pattern matching, regular expressions, 40****pattern-based security policies, 122****PCs, zombies, 12****peer-to-peer networks, 9****permissive systems, 186****persistence process**

- application execution, 107
- file modification, 108
- system configuration, 108

personal firewalls, 24**phases of deployment, 177**

for CSA

- conducting pilot tests*, 194–196
- finalizing the project*, 198
- full deployment*, 197–198
- implementing management*, 189–194
- predeployment planning*, 180–184
 - selection and classification of target hosts*, 184–188
 - tuning*, 196
 - understanding the product*, 178–179
- for IPS, 204
 - finalizing the project*, 225
 - predeployment planning*, 212–218, 220
 - sensor deployment*, 221–222
 - tuning*, 222–224
 - understanding the product*, 205–211

pilot test, conducting, 194, 196**placing IPS sensors in network, 216–218****policy groups**

- configuring, 191–193
- secondary groups, 192–193

port security, 78**PortMapper, 45****predeployment planning phase of IPS**

deployment, 212–220

processing capacity as sensor selection

criteria, 150–151

promiscuous mode sensor operation, 25, 246

- capturing network traffic, 157–158

protocol decodes, 38, 165**Pull model (management console), 64****Push model (management console), 64****R****RBAC (role-based access control) matrix, 124****regular expressions, 40****regulatory compliance, 27**

- remote delivery mechanisms, 14
- replacement login, example of, 17
- required HIPS capabilities, 90–92
- reset signature action, 47
- resetting TCP connections, 143
- responses to suspicious activity
 - alerting actions, 166
 - blocking actions, 167
 - dropping actions, 167
 - logging actions, 167
- restrictive systems, 186
- reviewing corporate security policies, 212
- RFI (Request for Information), sample questions, 261–269
- rootkit, 109, 119
- RPC (Remote Procedure Call), 45
- RRs (risk ratings), 223
- RSPAN (Remote Switch Port Analyzer), capturing network traffic, 162
- rule modules, 190

S

- sample RFI questions, 261–269
- sandbox, 113
- scenarios for IPS deployment
 - at branch offices, 236–240
 - at home office, 250–252
 - at large enterprises, 229–233, 236
 - at medium educational institutions, 243–247
 - at medium financial enterprises, 240–243
 - at small offices, 247–250
- secondary policy groups, configuring, 192–193
- securing management communication, 66
 - device-to-device, 68
 - OOB, 67
- security policies
 - anomaly-based, 120
 - atomic rule-based, 121–122
 - behavioral, 122–123
 - pattern-based, 122
- selecting
 - location for IPS sensor placement, 216–218
 - management method, 65
 - NIPS management architecture, 218–220
- sensors, criteria
 - form factor*, 152–154
 - interfaces*, 151–152
 - processing capacity*, 150–151
- sensors
 - alerts, risk ratings, 223
 - Cisco Catalyst 6500 series IDSM-2, 206–207
 - Cisco IDS Network Module, 207
 - Cisco IOS IPS sensors, 208
 - Cisco IPS 4200 series appliance sensors, 206
 - Cisco product availability, 205
 - configuring, 221
 - inline mode
 - failure of*, 62
 - functionality*, 208
 - installing, 221–222
 - large deployments, 169
 - promiscuous mode, 246
 - selection criteria
 - form factor*, 152–154
 - interfaces*, 151–152
 - processing capacity*, 150–151
 - small deployments, 168
- shared IPS/IDS capabilities, 145
 - alert generation, 141
 - initiating IP blocking, 143–144
 - IP logging, 142
 - logging attacker traffic, 142
 - logging traffic between
 - attacker and victim, 143
 - logging victim traffic, 142
 - resetting TCP connections, 143
- shims, 111
- signature updates, 212
- signatures, 33
 - alerts, 45
 - allow signature action, 47
 - atomic signatures, 34–35
 - host-based*, 35
 - network-based*, 35
 - block signature action, 47
 - cabling, 221
 - characteristics of, 34
 - drop signature action, 46
 - event horizon, 36
 - event responses, 61
 - log signature action, 47

- reset signature action, 47
- stateful, 36
 - host-based*, 36
 - network-based*, 37
 - with anomaly-based triggering mechanism*, 43
- triggering mechanisms, 37–39
 - anomaly-based detection*, 42–43
 - behavior-based detection*, 44
 - pattern detection*, 40–41
- tuning, 59–60
- single packets, dropping, 136**
- single-server management model, 127**
- small IPS sensor deployments, 168**
- small office IPS deployment, 247**
 - HIPS implementation, 248–249
 - limiting factors, 248
 - NIPS implementation, 250
 - security policy goals, 248
- social engineering, 105**
- software bypass, 63**
- software updates, 61**
- source IP addresses**
 - dropping all packets from, 137
 - spoofing, 144
- Spacefiller, 19**
- spam, 14**
- SPAN (Switch Port Analyzer), capturing network traffic, 162**
- spyware, 248**
- SQL Slammer worm, 230**
- stack memory, 106**
- standalone appliance sensors, 153**
- stateful operation method of network traffic analysis, 164–165**
- stateful signatures, 36**
 - host-based, 36
 - network-based, 37
- summary alerts, 46**
- suspicious activity, IPS response methods**
 - alerting actions, 166
 - blocking actions, 167
 - dropping actions, 167
 - logging actions, 167
- switch ports, role in layered defense, 78**
- switches, 136**
 - capturing network traffic, 160
- symbolic links, 110**
- system call interception, 111–113**

- system log analysis, 25**
- system state conditions, 118–119**

T

- TCP connections**
 - resetting, 143
 - three-way handshake, 74
- TCP Reset interface, 207**
- TCP/IP, 10**
- threats to security, evolution of, 6**
 - client-server computing, 7, 9
 - Internet, 9
 - mobile computing, 10–11
 - wireless connectivity, 10
- three-way handshake, 74**
- tiered management model, 127**
- traffic mirroring, 158**
- traffic flows, 164**
- traffic normalization, 138**
- triggers, 37–39**
 - anomaly-based detection*, 42–43
 - behavior-based detection*, 44
 - pattern detection*, 40–41
- Trojan horses, 19**
 - rootkits, 119
- true negatives, 60**
- true positives, 60**
- tuning phase of CSA deployment, 196**

U

- uRPF (unicast reverse path forwarding), 73**
- user state conditions, 117**

V

- VACLs (VLAN access control lists), capturing network traffic, 164**
- virtual operating systems, 113**
- viruses, 18**
 - CIH virus, characteristics of, 19
 - Loveletter virus, characteristics of, 19–20
- vulnerabilities, 93, 104**

W-X-Y-Z

war-dialers, 13

wireless connectivity as security threat, 10

wireless network adapters, 94

worms, 19

Nimda, characteristics of, 20–22

SQL Slammer, characteristics of, 21

zombies, 12