

Index

Symbols

0xbad0004 error (VMFS), 189
0xbad0010 error (VMFS), 186
0xbad0023 error (VMFS), 186-189
1U server systems, 14-15
2U server systems, 15-16
802.1q, 232-234
 EST (external switch tagging), 232
 VGT (virtual guest tagging), 233
 VST (virtual switch tagging), 233

A

About to Install screens, ESX Version 3
 graphical installation, 515-516
 text installation, 497-498
access.conf file, 251
accessibility modes (VMFS), 184
Active Directory domain users, creating,
 249-255
Add Partition dialog (ESX Version 3
 graphical installation), 509
Add Partition screen (ESX Version 3
 text installation), 489
administration networks, 224-227
administrative users, creating
 Active Directory domain users, 249-255
 local users, 247

MUI (Management User Interface), 258
 non-Active Directory network users, 247-248
 overview, 246
 VIC (Virtual Infrastructure Client), 255-256
Advanced Options screen (ESX Version 3
 graphical installation), 513
alarms, 416
 accessing, 415
 advantages, 419
 creating, 416-418
 VM network usage alarms, 419
 VM/host disk usage alarms, 419
 VMotion alarms, 418
 weaknesses, 416
antivirus agents, 101
antivirus software, 130
application failure
 definition, 433
 recovery methods, 435
arbitrated loop topology, 172
assessing storage requirements, 191-195
ATA drives, 166
auditing
 Bastille, 124
 installing, 124
 output, 124-130
 overview, 111
 when to use, 131

- CISscan
 - /etc/motd and /etc/issue files, 123
 - /etc/pam.d/su file, 123
 - /etc/redhat-release file, 112
 - kernel configuration issues, 119-120
 - nonstandard SUID programs, 123-124
 - overview, 111
 - package issues, 122
 - permissions issues, 122-123
 - reboot issues, 123
 - running, 112-117
 - services that should be disabled, 118
 - SSH (Secure Shell) issues, 118
 - startup option issues, 121
 - unsafe device presentation issues, 120-121
 - user issues, 121-122
 - when to use, 131
 - Coroner's toolkit, 136
 - importance of, xx
 - Nessus, 136
 - NMAP, 136
 - overview, 130
 - process accounting, 135
 - root kits, checking for, 131
 - scripts, 136
 - sudo command, 131
 - Tara, 136
 - Tripwire, 131-135
 - authentication of Active Directory, 249-255
 - automating installation, 87-92
 - average bandwidth, 238
- B**
- backups
 - backup paths, 441-444
 - crash-consistent backups, 444
 - delta-mode processing, 447-449
 - enterprise class SAN backup options, 443
 - entry-level backup options, 440
 - ESXRanger, 458
 - ESX Server backups, 58
 - ESX versions
 - 2.5.x backup script, 452-453
 - 3 backup script, 449-452
 - earlier than 2.5.x, 453
 - full backups, 439-441
 - hot sites, 444-446
 - HP Data Protector, 459
 - HPSIM VMM, 458
 - Legato Networker, 460
 - local tape devices, 453-457
 - overview, 439
 - standard backups, 439-441
 - summary, 446
 - Tivoli Storage Manager, 460
 - Veritas NetBackup, 460
 - version differences, 46
 - VMDK-level backups, scheduling, 207
 - balancing. *See* DRLB
 - bandwidth
 - average bandwidth, 238
 - data stores, 204
 - peak bandwidth, 238
 - baseline utilization goals, 411
 - basic input/output system (BIOS), 62
 - Bastille, 102, 124, 145
 - installing, 124
 - output, 124-130
 - overview, 111
 - when to use, 131
 - BC (business continuity), 446-447
 - beacon monitoring, 236-237
 - best practices
 - administration networks, 227
 - DR (disaster recovery), 432
 - firmware, 62
 - hardware, 61
 - 1U server systems, 15
 - 2U server systems, 16
 - blade server systems, 14
 - disk drive space, 12
 - I/O cards, 9-10

- iSCSI, 22
 - L2 Cache, 6
 - local disks, 18
 - local storage, 19
 - memory, 7
 - processor standardization, 3
 - SANs (storage area networks), 21
 - summary, 12
 - virtual infrastructure on
 - non-ESX servers, 31
 - hardware agents, 211
 - internal VM operations, 204
 - iSCSI, 180
 - patches, 100
 - performance monitoring, 425
 - pNICs, 221
 - determination, 243
 - pSwitch configuration, 239
 - pSwitches, 221
 - resource allocation, 214
 - SANs (storage area networks), 177-179
 - SATA drives, 166
 - SCSI-2 Reservation conflicts,
 - avoiding, 205
 - security, 94
 - service console memory allocation, 65
 - storage, 164
 - VMDK movement, 182
 - VMkernel networks, 229
 - VMotion networks, 228
 - vNetworks, 242
 - BIOS (basic input/output system), 62
 - blade server systems, 13-14
 - boot controller selection, 69
 - boot disk location, 63
 - booting
 - boot disk location, 63
 - configuring server to boot from SAN or iSCSI, 68
 - advanced options, 70
 - BIOS, 68-69
 - boot controller selection, 69
 - Emulex FC HBAs setup, 71-73
 - ESX version 3, 76
 - QLogic FC HBAs setup, 74-75
 - TOE (TCP Offload Engine), 76
 - from iSCSI, 200-201
 - from SANs, 200-201
 - VMs (virtual machines), 210
 - Boot Leader Configuration screen (ESX Version 3 text installation), 493
 - boot steps (ESX Server), 37-39
 - boots, staggering, 209
 - bridges, 169
 - building disasters
 - definition, 434
 - local practices, 438
 - recovery methods, 437
 - burst size, 238
 - business continuity (BC), 446-447
- C**
- cache, 4-6
 - campus disasters
 - definition, 434
 - recovery methods, 437
 - case studies
 - datacenter, 22-23
 - disaster recovery, 28-29
 - office in a box, 23-25
 - SANs (storage area networks), 26-27
 - secure environment solution, 27-28
 - CD-ROMs, installing VMs via, 374-375
 - command line, 375
 - importance of CD-ROMs, 379
 - MUI, 374
 - VC1.x/VIC, 375
 - checklists
 - ESX Server networking checklist, 230-232
 - hardware checklist, 29-30
 - installation checklist, 56-57
 - security checklist, 98-99
 - storage checklist, 189-191
 - chkconfig command, 260
 - chkrootkit command, 102

- CISscan, 102, 145
 - /etc/motd and /etc/issue files, 123
 - /etc/pam.d/su file, 123
 - /etc/redhat-release file, 112
 - kernel configuration issues, 119-120
 - nonstandard SUID programs, 123-124
 - overview, 111
 - package issues, 122
 - permissions issues, 122-123
 - reboot issues, 123
 - running, 112-117
 - services that should be disabled, 118
 - SSH (Secure Shell) issues, 118
 - startup option issues, 121
 - unsafe device presentation issues, 120-121
 - user issues, 121-122
 - when to use, 131
- citywide disasters
 - definition, 434
 - recovery methods, 437
- clamav, 101
- clean installs, ESX Version 3
 - graphical installation, 505
 - text installation, 485
- clients
 - installing VMs (virtual machines) via, 377-379
 - VIC (Virtual Infrastructure Client), 408-409
 - administrative users, creating, 255-256
 - creating VMs from, 351-359
 - iSCSI network configuration, 318
 - iSCSI VMFS configuration, 336-338
 - licenses, entering, 274, 276
 - LUN manipulations, 304-305
 - NAS configuration, 320, 339-340
 - pNIC settings, 332
 - private vSwitch configuration, 321
 - security configuration, 260-261
 - service console configuration, 266-267, 310
 - traffic-shaping settings, 334
 - virtual hardware for
 - nondisk SCSI devices, installing, 382-383
 - raw disk map access to remote SCSI, installing, 384
 - VM network vSwitches, configuring, 311-313
 - VMFS. *See* VMFS
 - VMKernel gateway configuration, 330-331
 - VMotion vSwitches, configuring, 316
 - vSwitch port groups, 323
 - vSwitches
 - deleting, 324
 - properties, 328-330
 - security, 326-327
 - WWPN, determining, 300
- cloning VMs (virtual machines), 393
- clusters
 - between virtual and physical servers, 396
- ESX
 - between ESX Servers, 396
 - creating, 413-414
 - definition, 407, 413
 - in a box, 395-396
- command line
 - creating VMs (virtual machines) from, 368-373
- iSCSI
 - network configuration, 318
 - VMFS configuration, 335
- licenses, entering, 273-274
- LUN manipulations, 302-304
- NAS
 - configuration, 338-339
 - vSwitch configuration, 319-320
- pNIC
 - configuration, 321
 - settings, 331
- private vSwitch configuration, 320
- service console configuration, 308-309
- snapshots, 391
- traffic-shaping settings, 333
- virtual hardware for
 - nondisk SCSI devices, installing, 381-382

- raw disk map access to remote SCSI, installing, 384
- VM network vSwitches, configuring, 311
- VMFS (Virtual Machine File System)
 - creating, 279-281
 - deleting, 282-284, 306
 - extending, 281-282
 - renaming, 279
- VMKernel gateway configuration, 330
- VMotion vSwitches, configuring, 315
- vSwap files, creating, 277
- vSwitches
 - deleting, 324
 - port groups, 322-323
 - properties, 328
 - security, 325
- WWPN, determining, 300
- commands
 - chkconfig, 260
 - chkrootkit, 102
 - clamav, 101
 - esxcfg-auth, 248
 - esxcfg-firewall, 104, 259
 - esxcfg-vmhbadevs, 198
 - esxtop, 212-213, 423
 - fdisk, 280
 - kinit, 250
 - logcheck, 102, 138-144
 - logrotate, 137-139
 - passwd, 247
 - sar, 102
 - service, 260
 - shadow-utils, 101
 - Sophos, 101
 - sudo, 102, 131
 - useradd, 247
 - vdf, 208
 - vm-support, 40
 - vm-support requests, 208
 - vmkfstools, 40, 200, 208, 281
 - vmkload_mod, 40
 - vmkmultipath, 40, 208
 - vmkmultipath -q, 198
 - vmkpcidiv, 40
 - vmkusage, 213, 423
 - vmres.pl, 40
 - vmsnap_all, 40
 - vmsnap.pl, 40
 - vmware-cmd, 40
- communication failure
 - definition, 433
 - recovery methods, 436
- configuration
 - hardware, 60
 - installation, 84-86
 - overview, xxii
- configuration (ESX Server)
 - adding hosts to VC, 272-273
 - administrative users, creating
 - Active Directory domain users, 249-255
 - local users, 247
 - MUI (Management User Interface), 258
 - non-Active Directory network users, 247-248
 - overview, 246
 - VIC (Virtual Infrastructure Client), 255-256
 - advanced settings, 343-344
 - configuration tasks, 246, 271-272
 - information mapping, 340-342
 - iSCSI VMFS, 335-338
 - licenses, entering
 - from command line, 273-274
 - FlexLM licenses, 273
 - from MUI (Management User Interface), 276
 - from VIC (Virtual Infrastructure Client), 274-276
 - NAS (network-attached storage), configuring with, 338
 - command line, 338-339
 - VIC (Virtual Infrastructure Client), 339-340
 - NTP (Network Time Protocol), 263-264
 - overview, 245

- secure access to management
 - interfaces, 342-343
 - security, 259
 - ESX Server version 2.5.x
 - command line, 259-260
 - ESX Server version 3 command line, 259
 - MUI (Management User Interface), 262
 - VIC (Virtual Infrastructure Client), 260-261
 - server-specific tasks, 246
 - service console memory, 264
 - ESX Server version 2.5.x command line, 266
 - ESX Server version 3 command line, 265
 - MUI (Management User Interface), 268
 - VIC (Virtual Infrastructure Client), 266-267
 - virtual networking
 - iSCSI networks, 318
 - NAS vSwitches, 319-320
 - overview, 307-308
 - pNIC settings, 331-332
 - private vSwitches, 320-321
 - secondary pNICs, 321-322
 - service console, 308-310
 - traffic-shaping settings, 333-335
 - VM network vSwitches, 311-313
 - VMkernel gateways, 330-331
 - VMotion vSwitches, 315-317
 - vSwitch port groups, 322-324
 - vSwitch properties, 327-330
 - vSwitch removal, 324-325
 - vSwitch security, 325-327
 - VMFS (Virtual Machine File System).
 - See* VMFS
 - vSwap (virtual swap), 277-278
 - conflicts
 - SCSI Reservation conflicts, 186-189
 - SCSI-2 Reservation conflicts, avoiding, 204-211
 - Console Ethernet Selection screen (ESX Version 3 text installation), 494
 - console.perms file, 120
 - Consolidated Backup (VCB), 46
 - Continuous Access (HP), 176
 - Coroner's toolkit, 102, 136
 - COS (console operating system) version
 - differences, 37
 - ESX Server boot steps, 37-39
 - tools, 40-41
 - CPU utilization
 - DRLB (dynamic resource loading balancing), 409, 429-430
 - increasing, 212-213
 - crash-consistent backups, 444
- D**
- data stores
 - bandwidth, 204
 - version differences, 43-44
 - Database Server, 31
 - datacenters
 - case study, 22-23
 - definition, 407
 - disaster
 - definition, 434
 - recovery methods, 436
 - DC (dual core) processors, 3
 - deleting
 - extents, 197-198
 - VMFS (Virtual Machine File System)
 - from command line, 282-284, 306
 - with MUI (Management User Interface), 298-299, 307
 - with VIC (Virtual Infrastructure Client), 293-295, 306
 - vSwitches, 323-325
 - delta-mode processing, 447-449
 - delta.vmdk file extension, 369
 - destroying VMs (virtual machines), 393
 - device drivers, 7-8
 - disaster recovery. *See* DR
 - disk drives

- ATA drives, 166
- disk utilization, 410
- local disks, 18
- SATA (Serial ATA) drives, 166
- shared disk arrays, 19
- space, 10-12
- VM/host disk usage alarms, 419
- disk modes (VM), 387-391
- disk partitioning
 - setup (ESX Version 3 text installation), 486
 - warning, ESX Version 3
 - graphical installation, 507
 - text installation, 487
- DR (disaster recovery). *See also* DRLB
 - application failure
 - definition, 433
 - recovery methods, 435
 - backups
 - backup paths, 441-444
 - crash-consistent backups, 444
 - delta-mode processing, 447-449
 - enterprise class SAN backup options, 443
 - entry-level backup options, 440
 - ESX version 2.5.x backup script, 452-453
 - ESX version 3 backup script, 449-452
 - ESX versions earlier than 2.5.x, 453
 - ESXRanger, 458
 - full backups, 439-441
 - hot sites, 444-446
 - HP Data Protector, 459
 - HPSIM VMM, 458
 - Legato Networker, 460
 - local tape devices, 453-457
 - overview, 439
 - standard backups, 439-441
 - summary, 446
 - Tivoli Storage Manager, 460
 - Veritas NetBackup, 460
 - BC (business continuity), 446-447
 - building disaster
 - definition, 434
 - recovery methods, 437
 - campus disaster
 - definition, 434
 - recovery methods, 437
 - case study, 28-29
 - citywide disaster
 - definition, 434
 - recovery methods, 437
 - communication failure
 - definition, 433
 - recovery methods, 436
 - datacenter disaster
 - definition, 434
 - recovery methods, 436
 - ESX Server failure, 433
 - goals, 431
 - local practices, 438
 - machine failure, 436
 - multinational disaster
 - definition, 435
 - recovery methods, 437
 - national disaster
 - definition, 435
 - recovery methods, 437
 - overview, xxiii-xxiv, 431
 - plans, 432-433
 - rack disaster, 434
 - regional disaster
 - definition, 434
 - recovery methods, 437
 - track disaster, 436
 - VM failure
 - definition, 433
 - recovery methods, 435
 - world disaster
 - definition, 435
 - recovery methods, 437
- drivers, 7-8, 380
- DRLB (dynamic resource loading balancing)
 - definition, 407-408
 - ESX clusters, 413-414
 - ESX Servers, 212

- monitoring
 - alarms, 415-419
 - overview, 415
 - performance analysis, 419-426
 - shares, 426-428
 - VMM, 415
 - overview, xxiii
 - resource pools
 - creating, 411-412
 - definition, 411
 - performance optimization, 428-429
 - utilization goals
 - baselines, 411
 - CPU utilization, 409, 429-430
 - determining, 410
 - disk utilization, 410
 - memory utilization, 409
 - network utilization, 410
 - VIC (Virtual Infrastructure Client), 408-409
 - DRS (Dynamic Resource Scheduling), 408
 - .dsk file extension, 181
 - dual core (DC) processors, 3
 - DVD-ROMs, installing VMs (virtual machines) via, 374-375
 - command line, 375
 - importance of DVD-ROMs, 379
 - MUI, 374
 - VC1.x/VIC, 375
 - dynamic resource load balancing. *See* DRLB
 - Dynamic Resource Scheduling (DRS), 408
- E**
- E_PORT, 169
 - emulation, 345
 - Emulex FC HBAs setup, 71-73
 - end user license agreement, ESX Version 3
 - graphical installation, 505
 - text installation, 485
 - enterprise class SAN backup options, 443
 - entry-level backup options, 440
 - errors (VMFS error conditions), 185-189
 - 0xbad0004, 189
 - 0xbad0010, 186
 - 0xbad0023, 186-189
 - SCSI: 0/1, 186
 - SCSI: 0/4, 186
 - SCSI: 0/7, 186
 - SCSI: 2/0, 186
 - SCSI: 24/0, 185
 - SCSI: 24/7, 186
 - EST (external switch tagging), 232
 - ESX clusters, 413-414
 - ESX Servers
 - configuration. *See* configuration (ESX Server)
 - failure, 433
 - version 2.5.x
 - backup script, 452-453
 - beacon monitoring, 237
 - configuration. *See* configuration (ESX Server)
 - file system layouts, 67-68
 - loading balancing pNICs, 235
 - LUNs (logical unit numbers), searching for, 198
 - post-install configuration, 84-86
 - redundant pNICs, 236
 - security
 - locking system to specific IP addresses, 109-110
 - version 3
 - backup script, 449-452
 - beacon monitoring, 237
 - configuration. *See* configuration (ESX Server)
 - file system layouts, 67
 - firewalls, 104
 - Installer Complete screen (ESX Version 3 graphical installation), 517
 - loading balancing pNICs, 234
 - LUNs (logical unit numbers), searching for, 198
 - post-install configuration, 84-86
 - redundant pNICs, 236
 - security, 108-109

- ESX version 2.5.x. *See also* version comparison
 - Active Directory authentication, 255
 - backups, 46
 - COS (console operating system), 37
 - ESX Server boot steps, 37-39
 - tools, 40-41
 - data stores, 43-44
 - installation, 52
 - licensing, 47-48
 - security, 51-52
 - VCP (VMware Certified Professional) exam, 48
 - virtual hardware, 48-50
 - virtual machine management, 50-51
 - virtual networking, 41-42
 - virtual resources, 44-45
 - VMkernel, 34-37
- ESX version 3. *See also* version comparison
 - Active Directory authentication, 249-255
 - backups, 46
 - COS (console operating system), 37
 - ESX Server boot steps, 37-39
 - tools, 40-41
 - data stores, 43-44
 - graphical installation
 - About to Install screens, 515-516
 - Add Partition dialog, 509
 - Advanced Options screen, 513
 - clean installs, 505
 - disk partitioning warning, 507
 - end user license agreement, 505
 - ESX Server 3 Installer Complete screen, 517
 - Installing Packages screen, 517
 - keyboard selection, 503
 - main installation page, 501
 - media test screen, 502
 - mouse configuration, 504
 - Network Configuration screen, 513
 - overview, 501
 - partition disk after adding /tmp, 511
 - partition disk after adding /var, 510
 - partition disk after resize of /var/log, 509
 - partition disk after adding /vmimages, 512
 - Partitioning Options screen, 506
 - Selection Installation Type screen, 504
 - Set Root Password screen, 515
 - Time Zone Selection screen, 514
 - /tmp, adding, 510
 - Unreadable Partition Table Warning screen, 506
 - /var/log, resizing, 508
 - /var/log selection, 508
 - /vmimages, adding, 512
 - Welcome screen, 503
 - installation, 52
 - licensing, 47-48
 - security, 51-52
 - security script (code listing), 465-480
 - text installation
 - About to Install pages, 497-498
 - Add Partition screen, 489
 - add /tmp, 490
 - add /vmimages, 491
 - Boot Leader Configuration screen, 493
 - clean installs, 485
 - Console Ethernet Selection screen, 494
 - disk partitioning setup, 486
 - disk partitioning warning, 487
 - end user license agreement, 485
 - ESX Server 3 installer complete page, 500
 - file system formatting, 499
 - Hostname Configuration screen, 495
 - installation type, 484
 - keyboard selection, 483
 - main installation page, 482
 - media test screen, 482
 - mouse configuration, 484
 - network configuration, 494
 - overview, 481
 - package installation, 499
 - partition disk after add /tmp, 491
 - partition disk after add /var, 490

- partition disk after add
 - /vmimages, 492
- partition disk after resize of
 - /var/log, 489
- root password configuration, 496
- Time Zone Selection screen, 496
- unreadable partition table
 - warning, 486
- /var/log, resizing, 488
- /var/log selection, 487
- Welcome screen, 483
- VCP (VMware Certified Professional)
 - exam, 48
- virtual hardware, 48-50
- virtual machine management, 50-51
- virtual networking, 41-42
- virtual resources, 44-45
- VMkernel, 34-37
- esxcfg-auth command, 248
- esxcfg-firewall command, 104, 259
- esxcfg- scripts, 37
- esxcfg-vmhbadevs command, 198
- ESXCharter, 212
- ESXRanger, 458
- esxtop command, 212-213, 423
- /etc/fstab file, 120
- /etc/grub.conf file, 265
- /etc/issue file, 123
- /etc/krb5.conf file, 250
- /etc/logrotate.d file, 139
- /etc/motd file, 123
- /etc/nsswitch.conf file, 253
- /etc/ntp.conf file, 264
- /etc/ntp/step-tickers file, 264
- /etc/pam.d/su file, 123
- /etc/pam.d/system-auth file, 250-251
- /etc/redhat-release file, 112
- /etc/samba/smb.conf file, 252
- /etc/security/access.conf file, 251
- /etc/security/console.perms file, 120
- /etc/syslog file, 215
- EULA. *See* end user license agreement

- extending VMFS (Virtual Machine File System)
 - from command line, 281-282
 - with MUI (Management User Interface), 298
 - with VIC (Virtual Infrastructure Client), 291-293
- extents (VMFS), 197-198
- external storage
 - local disks, 18
 - NAS (network-attached storage), 21
 - overview, 18
 - SANs (storage area networks), 19-21
 - shared disk arrays, 19
- external switch tagging (EST), 232

F

- F_PORT, 169
- farms, 407
- fdisk command, 280
- Fibre Channel
 - device drivers, 8
 - switches, 168-169
 - VMFS (Virtual Machine File System)
 - overview, 299
 - WWPN, determining, 300-301
- figure of virtualization, 461
- file systems
 - formatting (ESX Version 3 text installation), 499
 - layouts, 66-68
 - VMFS (Virtual Machine File System). *See* VMFS
- files
 - delta.vmdk file extension, 369
 - /etc/fstab, 120
 - /etc/grub.conf file, 265
 - /etc/issue, 123
 - /etc/krb5.conf, 250
 - /etc/logrotate.d, 139
 - /etc/motd, 123
 - /etc/nsswitch.conf, 253
 - /etc/ntp.conf file, 264
 - /etc/ntp/step-tickers file, 264
 - /etc/pam.d/su, 123

- /etc/pam.d/system-auth, 250-251
- /etc/redhat-release file, 112
- /etc/samba/smb.conf, 252
- /etc/security/access.conf, 251
- /etc/security/console.perms, 120
- /etc/syslog, 215
- flat.vmdk file extension, 369
- .hlog file extension, 369
- kick-start files, 88-92
- log files, 137-139, 369
- .nvram file extension, 369
- rdm.vmdk file extension, 369
- twcfg.txt, 134
- twpol.txt, 134
- /usr/sbin/logcheck, 140
- /var/log/vmkwarning, 138
- .vmdk file extension, 369
- .vmsd file extension, 369
- .vmsn file extension, 369
- .vmss file extension, 369
- .vmx file extension, 369, 401-405
- .vmxf file extension, 369
- .vswp file extension, 369
- .vzsnp file extension, 369
- vSwap (virtual swap), 277-278
- firewalls, 104
 - ESX versions
 - 2.5.2 and earlier than version 3, 104-106
 - 3, 104
 - earlier than 2.5.2, 106
 - illustration, 94
 - iptables, 51, 101, 104-106, 111
 - kick-start option, 91
 - lab benches, 394-395
 - locking system to specific IP addresses
 - ESX version 2.5.2 and earlier, 109-110
 - ESX version 3, 108-109
 - overview, 106-108
 - logging capability, 110-111
 - private labs, 394
 - vFWs (virtual firewalls), 223

- firmware verification, 61-62
- FL_PORT, 169
- flat.vmdk file extension, 369
- FlexLM licenses, 273
- forged retransmits, 155
- formatting file systems (ESX Version 3 text installation), 499
- fstab file, 120
- full backups, 439-441
- full virtualization, 346
- future of virtualization, 461-463

G

- gateways
 - vGateways (virtual gateways), 224
 - VMkernel gateways, 330-331
- graphical installation (ESX Version 3)
 - About to Install screens, 515-516
 - Add Partition dialog, 509
 - Advanced Options screen, 513
 - clean installs, 505
 - disk partitioning warning, 507
 - end user license agreement, 505
 - ESX Server 3 Installer Complete screen, 517
 - Installing Packages screen, 517
 - keyboard selection, 503
 - main installation page, 501
 - media test screen, 502
 - mouse configuration, 504
 - Network Configuration screen, 513
 - overview, 501
 - partition disk after
 - add /tmp, 511
 - add /var, 510
 - add /vmimages, 512
 - resize of /var/log, 509
 - Partitioning Options screen, 506
 - Selection Installation Type screen, 504
 - Set Root Password screen, 515
 - Time Zone Selection screen, 514
 - /tmp, adding, 510
 - Unreadable Partition Table Warning screen, 506

- /var/log, resizing, 508
- /var/log selection, 508
- /vmimages, adding, 512
- Welcome screen, 503
- grub.conf file, 265
- guest OS (operating system) definitions, 372
- gui.maxconnection parameter (VMs), 405

H

- HA (High Availability), 408
- hard drives
 - ATA drives, 166
 - disk utilization, 410
 - local disks, 18
 - SATA (Serial ATA) drives, 166
 - shared disk arrays, 19
 - space, 10-12
 - VM/host disk usage alarms, 419
- hardware
 - 1U server systems, 14-15
 - 2U server systems, 15-16
 - agents, 211-213
 - best practices, 12
 - blade server systems, 13-14
 - checklist, 29-30
 - configuration, 60
 - disk drive space, 10-12
 - external storage
 - local disks, 18
 - NAS (network-attached storage), 21
 - overview, 18
 - SANs (storage area networks), 19-21
 - shared disk arrays, 19
 - I/O cards, 7-10
 - importance of understanding hardware
 - limitations and capabilities, xviii
 - large-class server systems, 17
 - memory
 - cache, 4-6
 - speed, 6-7
 - obsolete devices, 36

- processors
 - choosing, 4
 - DC (dual core) processors, 3
 - matching processor speeds or stepping, 2-3
 - SC (single core) processors, 3
- sample solutions
 - disaster recovery, 28-29
 - existing datacenter case study, 22-23
 - latest and greatest hardware, 25-26
 - office in a box, 23-25
 - SAN (storage area network), 26-27
 - secure environment, 27-28
- verification, 61
- virtual hardware
 - infrastructure on non-ESX servers, 30-31
 - for nondisk SCSI devices, 380-384
 - for raw disk map access to remote SCSI, 384-385
 - for RDM-like access to local SCSI, 385-387
 - version differences, 48-50
 - VMware Hardware Compatibility Lists (HCLs), 2
- HBAs
 - Emulex FC HBAs setup, 71-73
 - QLogic FC HBAs setup, 74-75
- HCLs (Hardware Compatibility Lists), 2
- High Availability (HA), 408
- .hlog file extension, 181, 369
- host connections, configuring ESX Server from
 - adding hosts to VC, 272-273
 - administrative users, creating
 - Active Directory domain users, 249-255
 - local users, 247
 - MUI (Management User Interface), 258
 - non-Active Directory network users, 247-248
 - overview, 246
 - VIC (Virtual Infrastructure Client), 255-256
 - advanced settings, 343-344
 - configuration tasks, 246, 271-272

- information mapping, 340-342
 - iSCSI VMFS, 335-338
 - licenses, entering
 - from command line, 273-274
 - FlexLM licenses, 273
 - from MUI (Management User Interface), 276
 - from VIC (Virtual Infrastructure Client), 274-276
 - NAS (network-attached storage),
 - configuring with, 338
 - command line, 338-339
 - VIC (Virtual Infrastructure Client), 339-340
 - NTP (Network Time Protocol), 263-264
 - overview, 245
 - secure access to management
 - interfaces, 342-343
 - security, 259
 - ESX Server version 2.5.x command line, 259-260
 - ESX Server version 3 command line, 259
 - MUI (Management User Interface), 262
 - VIC (Virtual Infrastructure Client), 260-261
 - server-specific tasks, 246
 - service console memory, 264
 - ESX Server version 2.5.x command line, 266
 - ESX Server version 3 command line, 265
 - MUI (Management User Interface), 268
 - VIC (Virtual Infrastructure Client), 266-267
 - virtual networking
 - iSCSI networks, 318
 - NAS vSwitches, 319-320
 - overview, 307-308
 - pNIC settings, 331-332
 - private vSwitches, 320-321
 - secondary pNICs, 321-322
 - service console, 308-310
 - traffic-shaping settings, 333-335
 - VM network vSwitches, 311-313
 - VMkernel gateways, 330-331
 - VMotion vSwitches, 315-317
 - vSwitch port groups, 322-324
 - vSwitch properties, 327-330
 - vSwitch removal, 324-325
 - vSwitch security, 325-327
 - VMFS (Virtual Machine File System).
 - See VMFS
 - vSwap (virtual swap), 277-278
 - Hostname Configuration screen (ESX Version 3 text installation), 495
 - hot sites, 444-446
 - HP
 - Continuous Access, 176
 - Data Protector, 459
 - VMM, 415
 - HPSIM VMM, 458
- |
- I/O cards, 7-10
 - information mapping, 340-342
 - installation
 - automating, 87-92
 - Bastille, 124
 - BIOS settings, 62
 - boot disk location, 63
 - checklist, 56-57
 - configuring server to boot from SAN or iSCSI, 68
 - advanced options, 70
 - BIOS, 68-69
 - boot controller selection, 69
 - Emulex FC HBAs setup, 71-73
 - ESX version 3, 76
 - QLogic FC HBAs setup, 74-75
 - TOE (TCP Offload Engine), 76
 - documentation, 60
 - ESX Version 3 graphical installation
 - About to Install screens, 515-516
 - Add Partition dialog, 509

- Advanced Options screen, 513
- clean installs, 505
- disk partitioning warning, 507
- end user license agreement, 505
- ESX Server 3 Installer Complete screen, 517
- Installing Packages screen, 517
- keyboard selection, 503
- main installation page, 501
- media test screen, 502
- mouse configuration, 504
- Network Configuration screen, 513
- overview, 501
- partition disk after adding /tmp, 511
- partition disk after adding /var, 510
- partition disk after adding /vmimages, 512
- partition disk after resize of /var/log, 509
- Partitioning Options screen, 506
- Selection Installation Type screen, 504
- Set Root Password screen, 515
- Time Zone Selection screen, 514
- /tmp, adding, 510
- Unreadable Partition Table Warning screen, 506
- /var/log, resizing, 508
- /var/log selection, 508
- /vmimages, adding, 512
- Welcome screen, 503
- ESX Version 3 text installation
 - About to Install pages, 497-498
 - add /tmp, 490
 - add /vmimages, 491
 - Add Partition screen, 489
 - Boot Leader Configuration screen, 493
 - clean installs, 485
 - Console Ethernet Selection screen, 494
 - disk partitioning setup, 486
 - disk partitioning warning, 487
 - end user license agreement, 485
 - ESX Server 3 installer complete page, 500
 - file system formatting, 499
 - Hostname Configuration screen, 495
 - installation type, 484
 - keyboard selection, 483
 - main installation page, 482
 - media test screen, 482
 - mouse configuration, 484
 - network configuration, 494
 - overview, 481
 - package installation, 499
 - partition disk after add /tmp, 491
 - partition disk after add /var, 490
 - partition disk after add /vmimages, 492
 - partition disk after resize of /var/log, 489
 - root password configuration, 496
 - Time Zone Selection screen, 496
 - unreadable partition table warning, 486
 - /var/log, resizing, 488
 - /var/log selection, 487
 - Welcome screen, 483
- file system layouts, 66-68
- firmware version verification, 61-62
- hardware
 - configuration, 60
 - verification, 61
- MUI connection, 83
- overview, 55
- PCI device allocations, 66
- planning, xix-xx
- post-install configuration, 84-86
- Release Notes, 60
- scripted installations, 87-92
- service console, 64-65
- software packages, 86-87

starting, 76-79, 81-83

upgrades

- ESX Server backups, 58
- ESX Server preparation, 59-60
- overview, 57-58
- pre-upgrade tests, 59
- Release Notes, 58
- upgradeable versions of ESX, 57

version differences, 52

VM license and installation

- materials, 64

VMkernel swap size, 65

VMs (virtual machines)

- with client device or ISO, 377-379
- with local ESX Server
 - CD/DVD-ROM devices, 374-375, 379
- with local or shared ESX Server ISO images, 376-377
- OS installation peculiarities, 392
- over network, 379
- overview, 374
- virtual guest tagging drivers, 380
- virtual hardware for nondisk SCSI devices, 380-384
- virtual hardware for raw disk map access to remote SCSI, 384-385
- virtual hardware for RDM-like access to local SCSI, 385-387
- VM disk modes and snapshots, 387-391
- VMware ESX Server license, 63

Installing Packages screen (ESX Version 3 graphical installation), 517

Internet SCSI. *See* iSCSI

IP (Internet Protocol). *See* iSCSI

IP addresses, locking system to

- ESX version 2.5.2 and earlier, 109-110
- ESX version 3, 108-109
- overview, 106-108

iptables, 101, 104-106, 111

- firewalls, 51
- package, 86

iSCSI (SCSI over IP), 21-22

- best practices, 180
- booting from, 200-201
- configuring server to boot from, 68
 - advanced options, 70
 - BIOS, 68-69
 - boot controller selection, 69
 - Emulex FC HBAs setup, 71-73
 - ESX version 3, 76
 - QLogic FC HBAs setup, 74-75
 - TOE (TCP Offload Engine), 76
- networks, adding to service console vSwitch, 318
- overview, 166
- VMFS, 335-338

ISO images, installing VMs via, 376-377

isolation.tools.copy.disable configuration parameter (VMs), 405

isolation.tools.paste.disable configuration parameter (VMs), 405

issue file, 123

K

Kerberos, 248

keyboard selection, ESX Version 3

- graphical installation, 503
- text installation, 483

keyboard.typematicMinDelay configuration parameter (VMs), 405

kick-start files, 88-92

kinit command, 250

krb5.conf file, 250

L

L1 Cache, 5

L2 Cache, 4-6

large-class server systems, 17

layouts

- file system, 66-68
- VMFS, 183-184

LDAP, administrative users, creating, 248

Legato Networker, 460

License Source dialog, 275

License Type dialog, 276
 licenses
 entering from
 command line, 273-274
 MUI (Management User Interface), 276
 VIC (Virtual Infrastructure Client), 274-276
 FlexLM licenses, 273
 version differences, 47-48
 VM license, 64
 VMware ESX Server license, 63
LINUX in a Nutshell, 5th Edition, 519
Linux iptables Pocket Reference, 519
Linux Kernel in a Nutshell, 519
 load balancing pNICs, 234-235
 local administrative users, creating, 247
 local disks, 18
 local DR (disaster recovery) practices, 438
 local ISO images, installing VMs via, 376-377
 command line, 377
 MUI, 376
 VC1.x/VIC, 377
 local tape devices, backing up to, 453-457
 localizing scripts to single host, 208
 locking system to specific IP addresses
 ESX version 2.5.2 and earlier, 109-110
 ESX version 3, 108-109
 overview, 106-108
 log files, 137-139, 181, 369
 logcheck command, 102, 138-144
 logging firewalls, 110-111
 logrotate command, 137-139
 LUNs (Logical Unit Numbers)
 manipulation with, 302
 command line, 302-304
 VIC (Virtual Infrastructure Client), 304-305
 masking, 177
 number of operations per LUN, 210-211
 SCSI-2 Reservation conflicts, avoiding, 204-211

searching for, 198
 sizes, 192-195
 unlocking, 200

M

MAC addresses, spoofing, 154
 machine failure recovery methods, 436
 management user interface. *See* MUI
 mapping information, 340-342
 masks (LUN), modifying with, 177, 302
 command line, 302-304
 VIC (Virtual Infrastructure Client), 304-305
 media test screen, ESX Version 3
 graphical installation, 502
 text installation, 482
 memory
 cache, 4-6
 operational issues, 213-214
 service console memory
 allocation, 64-65
 configuring, 264-267
 speed, 6-7
 utilization, 409
 VMs (virtual machines), 213-214, 347
 migrations, limiting to one per LUN, 208
 minicom, 87
 mks.ipc.maxBufferedBytes configuration parameter (VMs), 405
 mks.ipc.maxBufferedPackets configuration parameter (VMs), 405
 monitoring
 alarms, 416
 accessing, 415
 advantages, 419
 creating, 416-418
 VM network usage alarms, 419
 VM/host disk usage alarms, 419
 VMotion alarms, 418
 weaknesses, 416
 Bastille, 145
 beacon monitoring, 236-237
 CISscan, 145
 importance of, xx
 logcheck command, 138-144

logrotate command, 137-139
 Nessus, 145-151
 NMAP, 145
 overview, 137, 415
 performance analysis
 overview, 419
 rules, 419-422
 tools, 423, 426
 VC2.x host performance chart, 425
 VC2.x VM performance chart, 424
 performance-gathering agents, 211-213
 remote monitoring, 151-152
 shares, 426-428
 VMM, 415
 motd file, 123
 mouse configuration, ESX Version 3
 graphical installation, 504
 text installation, 484
 MT, 87
 MTX, 87
 MUI (management user interface), 83
 administrative users, creating, 258
 connecting to, 83
 creating VMs (virtual machines)
 from, 364
 processors, memory, and
 workload, 365
 standard options, 364-365
 virtual disks, 366-367
 virtual hardware configuration,
 367-368
 Vm creation, 365
 installing VMs (virtual machines)
 from, 374
 licenses, entering, 276
 pNIC
 configuration, 322
 settings, 332-333
 private vSwitch configuration, 321
 security configuration, 262
 service console memory, configuring,
 268
 traffic-shaping settings, 335

virtual hardware, 383-385
 VM network vSwitches, configuring, 313
 VMFS (Virtual Machine File System)
 creating, 297-298
 deleting, 298-299, 307
 extending, 298
 renaming, 296
 VMotion vSwitches, configuring, 316-317
 vSwap files, creating, 277-278
 vSwitches
 deleting, 324-325
 port groups, 323-324
 WWPAN, determining, 301
 multinational disasters
 definition, 435
 recovery methods, 437
 multipath fabric topology, 173
 multipath failover, 177-178

N

naming VMs (virtual machines), 206
 NAS (network-attached storage), 21, 338
 configuring with
 command line, 338-339
 VIC (Virtual Infrastructure Client),
 339-340
 overview, 167
 vSwitches, 319-320
 national disasters
 definition, 435
 recovery methods, 437
 Nessus, 102, 136, 145-151
 Network Configuration screen (ESX Version 3
 graphical installation), 513
 network interface cards. *See* NICs
 Network Time Protocol (NTP), 263-264
 network-attached storage. *See* NAS
 networks
 administration networks, 224-227
 configuration (ESX Version 3 text
 installation), 494
 customer example, 219
 ESX Server networking checklist, 230-232
 installing VMs (virtual machines) from, 379

- NAS (network-attached storage),
 - configuring with, 21, 338
 - command line, 338-339
 - VIC (Virtual Infrastructure Client), 339-340
- overview, xxi, 217-219
- physical and virtual network layout, 220
- pNICs (physical NICs)
 - load balancing, 234
 - overview, 221
 - pNIC determination, 243
 - redundant pNICs, 235-236
- pSwitches (physical switches)
 - overview, 220-221
 - settings, 239
- SANs (storage area networks), 19, 21, 26-27
 - best practices, 179
 - booting from, 200-201
 - bridges, 169
 - configuring server to boot from, 68, 71-76
 - enterprise class SAN backup options, 443
 - Fibre Channel switches, 168-169
 - GBICs (gigabyte interface converters), 168
 - multipath failover, 177-178
 - overview, xxi, 168
 - replication, 174-176
 - topologies, 169-174
 - zoning, 176-177
- service console network information, 64
- table of components, 217
- utilization, 410
- vFWs (virtual firewalls), 223
- vGateways (virtual gateways), 224
- virtual networks
 - iSCSI networks, 318
 - NAS vSwitches, 319-320
 - overview, 307-308
 - pNIC settings, 331-332
 - private vSwitches, 320-321
 - secondary pNICs, 321-322
 - service console configuration, 308-310
 - traffic-shaping settings, 333-335
 - version differences, 41-42
 - VM network vSwitches, 311, 313
 - VMkernel gateways, 330-331
 - VMotion vSwitches, 315-317
 - vSwitch port groups, 322-324
 - vSwitch properties, 327-330
 - vSwitch removal, 324-325
 - vSwitch security, 325, 327
- VM networks, 229-230, 419
- VMkernel networks, 228-229
- VMotion networks, 228
- vNetwork examples, 239-242
- vNICs (virtual NICs), 223
- vRouters (virtual routers), 224
- vSwitches (virtual switches)
 - 802.1q, 232-234
 - beacon monitoring, 236-237
 - creating, 244
 - functionality, 222-223
 - load balancing, 234
 - overview, 221
 - redundant mode, 235-236
 - traffic shaping, 238
- New Virtual Machine Wizard, 351-352
- NICs (network interface cards), 7
 - pNICs (physical NICs)
 - load balancing, 234
 - overview, 221
 - pNIC determination, 243
 - redundant pNICs, 235-236
 - vNICs (virtual NICs), 223
- NIS, administrative users, creating, 248
- NMAP, 102, 136, 145
- non-Active Directory network users,
 - creating, 247-248
- nonstandard SUID programs, 123-124
- nsswitch.conf, 253
- NTP (Network Time Protocol), 263-264
- ntp.conf file, 264
- .nvram file extension, 181, 369

O

- obsolete devices, 36
- office in a box case study, 23-25
- operating systems. *See* OSs
- operational issues
 - bandwidth, 204
 - data store performance, 204
 - memory, 213-214
 - overview, xxi, 203
 - performance-gathering agents, 211-213
 - Sarbanes-Oxley, 214-215
 - SCSI-2 Reservation conflicts, 204-211
- OSs (operating systems)
 - guest OS (operating system)
 - definitions, 372
 - installation peculiarities, 392
 - security console OS versions, 99

P

- packages, 86-87
 - CISscan output, 122
 - installation, ESX Version 3
 - graphical installation, 517
 - text installation, 499
- paravirtualization, 346
- Partitioning Options screen (ESX Version 3 graphical installation), 506
- passwd command, 247
- passwords
 - root passwords, 103, 496
 - shadow passwords, 103
- patches, 99-100
- paths, 441-444
- PCI devices, 66, 346
- peak bandwidth, 238
- Peer-to-Peer Remote Copy (PPRC), 175
- performance
 - analysis
 - overview, 419
 - rules, 419-422
 - tools, 423, 426
 - VC2.x host performance chart, 425
 - VC2.x VM performance chart, 424

- CPU utilization, 212-213
- data stores, 204
- effect of VMs (virtual machines) on, 211-212
- performance-gathering agents, 211-213
- Sarbanes-Oxley, 214-215
- performance-gathering agents, 211-213
- permissions, 122-123, 156-162
- persistent VM disk modes, 208
- philosophy (security), 97
- physical NICs. *See* pNICs
- physical switches. *See* pSwitches
- plans
 - disaster recovery, 432-433
 - installation, xix-xx
- pNICs (physical NICs), 36
 - determination, 243
 - load balancing, 234-235
 - overview, 221
 - redundant pNICs, 235-236
 - secondary pNICs, adding, 321-322
 - settings, 331-332
- point-to-point topology, 169-170
- pools. *See* resource pools
- ports (vSwitch port groups), 322
 - adding, 323
 - deleting, 323-324
- post-install configuration, 84-86
- %post section kick-start option, 91
- PPRC (Peer-to-Peer Remote Copy), 175
- preparing ESX Server for upgrades, 59-60
- private labs, 394
- private vSwitches, 320-321
- process accounting, 135
- processors
 - choosing, 4
 - DC (dual core) processors, 3
 - matching processor speeds or stepping, 2-3
 - SC (single core) processors, 3
- promiscuous mode, 153
- protocols
 - IP addresses, 106-110
 - NTP (Network Time Protocol), 263-264
- psacct, 87

pSwitches (physical switches)
 overview, 220-221
 settings, 239

Q–R

QLogic 4010, 167
 QLogic FC HBAs setup, 74-75

rack disasters
 definition, 434
 recovery methods, 436

RAID(redundant array of inexpensive drives), 8

raw disk maps (RDMs), 185, 385-387

raw map access, virtual hardware installation via, 384-385
 command line, 384
 MUI, 385
 VIC (Virtual Infrastructure Client), 384

RDMs (raw disk maps), 185, 385-387
 -rdm.vmdk file extension, 369

rebooting
 password protecting, 123
 staggering, 209

recovery. *See* DR (disaster recovery)

Red Hat Enterprise Linux Server version 3.0 Update 6 (RHEL3-ES), 37

redhat-release file, 112

.REDO file extension, 181

redundant array of inexpensive drives (RAID), 8

redundant fabric topology, 174

redundant mode (vSwitches), 235-236

redundant pNICs, 235-236

references, 519-520

regional disasters
 definition, 434
 recovery methods, 437

Release Notes, 58-60

remote monitoring, 151-152

renaming VMFS (Virtual Machine File System)
 with command line, 279

with MUI (Management User Interface), 296

from VIC (Virtual Infrastructure Client), 284-286

replication, 174-176

resizing /var/log, 488, 508

resource pools
 creating, 411-412
 definition, 411
 performance optimization, 428-429

resource shares, 426-428

RHEL3-ES (Red Hat Enterprise Linux Server version 3.0 Update 6), 37

roles, 156-162

root kits, checking for, 131

root passwords, 103, 496

rotating log files, 137-139

routers (vRouters), 224

running CISscan, 112-117

S

Samba, 87

Samba-3 By Example, 519

sandpile.org, 519

SANs (storage area networks), 19-21
 best practices, 179
 booting from, 200-201
 bridges, 169
 case study, 26-27
 configuring server to boot from, 68
 advanced options, 70
 BIOS, 68-69
 boot controller selection, 69
 Emulex FC HBAs setup, 71-73
 ESX version 3, 76
 QLogic FC HBAs setup, 74-75
 enterprise class SAN backup options, 443
 Fibre Channel switches, 168-169
 GBICs (gigabyte interface converters), 168
 multipath failover, 177-178
 overview, xxi, 168
 replication, 174-176

- topologies, 169
 - arbitrated loop, 172
 - multipath fabric, 173
 - point-to-point, 169-170
 - redundant fabric, 174
 - switched fabric, 170
- zoning, 176-177
- sar command, 102
- Sarbanes-Oxley, 214-215
- SAS (serial attached SCSI), 166
- SATA (Serial Advanced Technology Attachment), 8, 166
- SC (single core) processors, 3
- scanning. *See* Bastille; CISscan
- scheduling VMDK-level backups, 207
- scripts
 - auditing, 136
 - backup
 - ESX version 2.5.x, 452-453
 - ESX version 3, 449-452
 - ESX versions earlier than 2.5.x, 453
 - local tape devices, 453-457
 - esxcfg- scripts, 37
 - installation scripts, 87-92
 - localizing to single host, 208
 - security script for ESX Version 3 (code listing), 465-480
 - staggering, 208
- SCSI (small computer systems interface)
 - device drivers, 8
 - iSCSI
 - best practices, 180
 - booting from, 200-201
 - configuring server to boot from, 68, 71-76
 - networks, adding to service console vSwitch, 318
 - overview, 166
 - VMFS, 335-338
 - Reservation conflicts, 186-189
 - SCSI pass thru (VMFS), 185
 - storage, 165
 - virtual hardware for
 - nondisk SCSI devices, installing via, 380-384
 - raw disk map access to remote SCSI, installing via, 384-385
 - RDM-like access to local SCSI, 385-387
 - vSCSI, 348-349
- SCSI-2 Reservation conflicts, avoiding, 204-211
- SCSI: 0/1 error (VMFS), 186
- SCSI: 0/4 error (VMFS), 186
- SCSI: 0/7 error (VMFS), 186
- SCSI: 2/0 error (VMFS), 186
- SCSI: 24/0 error (VMFS), 185
- SCSI: 24/7 error (VMFS), 186
- SDRF (Symmetrix Remote Data Facility), 175
- searching for LUNs (logical unit numbers), 198
- secondary pNICs, adding, 321-322
- secure environment sample solution, 27-28
- Secure Shell (SSH), 118
- security
 - antivirus software, 130
 - auditing. *See also* Bastille; CISscan
 - Coroner's toolkit, 136
 - Nessus, 136
 - NMAP, 136
 - overview, 130
 - process accounting, 135
 - root kits, checking for, 131
 - scripts, 136
 - sudo command, 131
 - Tara, 136
 - Tripwire, 131-135
- Bastille, 124
 - installing, 124
 - output, 124-130
 - overview, 111
 - when to use, 131
- checklist, 98-99
- CISscan
 - /etc/motd and /etc/issue files, 123
 - /etc/pam.d/su file, 123
 - /etc/redhat-release file, 112
 - kernel configuration issues, 119-120

- nonstandard SUID programs, 123-124
- overview, 111
- package issues, 122
- permissions issues, 122-123
- reboot issues, 123
- running, 112-117
- services that should be disabled, 118
- SSH (Secure Shell) issues, 118
- startup option issues, 121
- unsafe device presentation issues, 120-121
- user issues, 121-122
- when to use, 131
- configuration, 259
 - ESX Server version 2.5.x command line, 259-260
 - ESX Server version 3 command line, 259
 - MUI (Management User Interface), 262
 - VIC (Virtual Infrastructure Client), 260-261
- ESX-specific security concerns, 152-155
- ESX version 3 versus version 2.5.x, 100
- firewalls, 104
 - ESX version 2.5.2 and earlier than version 3, 104-106
 - ESX version 3, 104
 - ESX versions earlier than 2.5.2, 106
- illustration, 94
- iptables, 101, 104-106, 111
- logging capability, 110-111
- goals, 100
- locking system to specific IP addresses
 - ESX version 2.5.2 and earlier, 109-110
 - ESX version 3, 108-109
- overview, 106-108
- monitoring
 - Bastille, 145
 - CISscan, 145
 - logcheck command, 138-144
 - logrotate command, 137-139
 - Nessus, 145-151
 - NMAP, 145
 - overview, 137
 - remote monitoring, 151-152
- overview, 93-94
- passwords, 103
- patches, 99-100
- roles and permissions, 156-162
- samples, 97
- script for ESX Version 3 (code listing), 465-480
- secure access to management interfaces, 342-343
- tools, 101-102
- version differences, 51-52
- vFWs (virtual firewalls), 223
- VMkernel, 152
- VMotion, 153
- VMs (virtual machines), 95-98
- vSwitches, 325-327
- Selection Installation Type screen (ESX Version 3 graphical installation), 504
- sendmail, 86
- Serial Advanced Technology Attachment (SATA), 8, 166
- serial attached SCSI (SAS), 166
- Serial Number dialog, 276
- server systems
 - 1U server, 14-15
 - 2U server, 15-16
 - blade server, 13-14
 - large-class server, 17
- servers
 - Database Server, 31
 - VCB (VMware Consolidated Backup) proxy server, 30
 - VirtualCenter Management Server, 30
 - VMware License Server, 31
- service command, 260
- service console
 - configuration, 308-310
 - ESX version 3 command line, 308

- ESX versions earlier than 3
 - command line, 309
- VIC (Virtual Infrastructure Client), 310
- memory allocation, 64-65
- memory configuration, 264
 - ESX Server version 2.5.x command line, 266
 - ESX Server version 3 command line, 265
- MUI (Management User Interface), 268
- VIC (Virtual Infrastructure Client), 266-267
- network information, 64
- OS versions, 99
- services, startup options, 121
- Set Root Password screen (ESX Version 3 graphical installation), 515
- shadow passwords, 103
- shadow-utils, 101
- shaping traffic, 238
 - average bandwidth, 238
 - burst size, 238
 - peak bandwidth, 238
 - traffic-shaping settings, 333-335
- shared disk arrays, 19
- shared ISO images, installing VMs (virtual machines) via, 376-377
- shares, 426-428
- shells
 - security script for ESX Version 3 (code listing), 465-480
 - SSH (Secure Shell), 118
- single core (SC) processors, 3
- size
 - LUNs (logical unit numbers), 192-195
 - VMDKs, 196-197
 - VMFS (Virtual Machine File System), 197-198
- small computer systems interface. *See* SCSI
- smb.conf file, 252
- snapshots (VM), 387-391
- software packages, 86-87
- Sophos, 101
- speed of memory, 6-7
- spoofing MAC addresses, 154
- SPs (storage processors), 174
- SSH (Secure Shell), 118
- staggering
 - boots/reboots, 209
 - scripts, 208
- standard backups, 439-441
- starting ESX Server installations, 76-83
- startup options for services, 121
- step-tickers file, 264
- storage
 - assessing storage requirements, 191-195
 - ATA drives, 166
 - checklist, 189-191
 - data stores, 43-44
 - iSCSI (SCSI over IP)
 - best practices, 180
 - overview, 166, 200-201
 - local disks, 18
 - LUNs (logical unit numbers)
 - searching for, 198
 - sizes, 192-195
 - unlocking, 200
 - NAS (network-attached storage), 21, 167
 - overview, 18, 163-165
 - SANs (storage area networks), 19-21
 - best practices, 179
 - booting from, 200-201
 - bridges, 169
 - Fibre Channel switches, 168-169
 - GBICs (gigabyte interface converters), 168
 - multipath failover, 177-178
 - overview, xxi, 168
 - replication, 174-176
 - topologies, 169-174
 - zoning, 176-177
 - SATA (Serial ATA) drives, 166
 - shared disk arrays, 19
 - VMDKs, 196-197

- VMFS (Virtual Machine File System)
 - accessibility modes, 184
 - error conditions, 185-189
 - extents, 197-198
 - files, table of, 181
 - increasing size of, 197-198
 - layout, 183-184
 - overview, 165, 180
 - raw disk maps, 185
 - SCSI pass thru, 185
 - VMDK movement, 182
 - VMFS created on one ESX
 - Server not appearing on another, 198-199
 - VMFS-1, 183
 - VMFS-2, 183
 - VMFS-3, 183
 - storage area networks. *See* SANs
 - storage processors (SPs), 174
 - sudo command, 102, 131
 - SUIDs, 123-124
 - suspending VMs (virtual machines), 208
 - svga.maxHeight configuration
 - parameter (VMs), 405
 - svga.maxWidth configuration parameter (VMs), 405
 - svga.vramSize parameter (VMs), 405
 - swap size (VMkernel), 65
 - switched fabric topology, 170
 - switches
 - Fibre Channel switches, 168-169
 - pSwitches (physical switches)
 - overview, 220-221
 - settings, 239
 - vSwitches (virtual switches)
 - 802.1q, 232-234
 - beacon monitoring, 236-237
 - creating, 244
 - functionality, 222-223
 - load balancing, 234
 - overview, 221
 - redundant mode, 235-236
 - traffic shaping, 238
 - Symmetrix Remote Data Facility (SDRF), 175
 - syslog file, 110, 215
 - sysstat, 87
 - system-auth file, 250-251
- T**
- tape devices, backing up to, 453-457
 - Tara, 136
 - TCP Offload Engine (TOE), 8, 76, 167
 - templates for VMs (virtual machines), 393
 - text installation (ESX Version 3)
 - About to Install pages, 497-498
 - add /tmp, 490
 - add /vmimages, 491
 - Add Partition screen, 489
 - Boot Leader Configuration screen, 493
 - clean installs, 485
 - Console Ethernet Selection screen, 494
 - disk partitioning
 - setup, 486
 - warning, 487
 - end user license agreement, 485
 - ESX Server 3 installer complete page, 500
 - file system formatting, 499
 - Hostname Configuration screen, 495
 - installation type, 484
 - keyboard selection, 483
 - main installation page, 482
 - media test screen, 482
 - mouse configuration, 484
 - network configuration, 494
 - overview, 481
 - package installation, 499
 - partition disk after
 - add /tmp, 491
 - add /var, 490
 - add /vmimages, 492
 - resize of /var/log, 489
 - root password configuration, 496
 - Time Zone Selection screen, 496
 - unreadable partition table warning, 486
 - /var/log, resizing, 488
 - /var/log selection, 487
 - Welcome screen, 483

Time Zone Selection screens, ESX Version 3
 graphical installation, 514
 text installation, 496
 Tivoli Storage Manager, 460
 /tmp, adding, 490, 510
 TOE (TCP Offload Engine), 8, 76, 167
 topologies, 169
 arbitrated loop, 172
 multipath fabric, 173
 point-to-point, 169-170
 redundant fabric, 174
 switched fabric, 170
 traffic shaping, 238
 average bandwidth, 238
 burst size, 238
 peak bandwidth, 238
 traffic-shaping settings, 333-335
 Tripwire, 102, 131-135
 trivial fabric topology, 170
 troubleshooting. *See* errors
 trunking. *See* 802.1q
 twcfg.txt file, 134
 twpol.txt file, 134

U

U_PORT, 169
Understanding LINUX Network Internals, 519
Understanding the LINUX Kernel, 519
UNIX Backup and Recovery, 519
 unlocking LUNs (logical unit numbers), 200
 Unreadable Partition Table Warning screens,
 ESX Version 3
 graphical installation, 506
 text installation, 486
 upgrades
 ESX Servers, 58-60
 overview, 57-58
 pre-upgrade tests, 59
 Release Notes, 58
 upgradeable versions of ESX, 57
 useradd command, 247

users
 accounts, securing, 121-122
 administrative users, creating
 Active Directory domain users, 249-255
 local users, 247
 MUI (Management User Interface), 258
 non-Active Directory network users,
 247-248
 overview, 246
 VIC (Virtual Infrastructure Client),
 255-256
 /usr/sbin/logcheck file, 140
 utilization goals
 baselines, 411
 CPU utilization, 409, 429-430
 determining, 410
 disk utilization, 410
 memory utilization, 409
 network utilization, 410

V

/var/log (ESX Version 3)
 resizing
 graphical installation, 508
 text installation, 488
 selecting
 graphical installation), 508
 text installation, 487
 /var/log/vmkwarning file, 138
 VC (VC Server), 415
 alarms
 accessing, 415
 creating, 416-418
 VM network usage alarms, 419
 VM/host disk usage alarms, 419
 VMotion alarms, 418
 weaknesses, 416
 VC as VM (virtual machine), 396
 VC1.x, creating VMs (virtual machines) from,
 359-367
 configurations, selecting, 359-360
 disk capacity, 362
 guest OS, 361
 network type, 362-363

- Ready to Complete stage, 362
- VM group selection, 359-361
- VM names, 361-362
- Welcome to New Virtual Machine Wizard screen, 359-360
- VCB (VMware Consolidated Backup), 30, 46
- vCharter from Vizioncore, 423
- VCP (VMware Certified Professional) exam, 48
- vCPUs (virtual CPUs), 346
- VCs (virtual centers), configuring ESX Server from
 - adding hosts to VC, 272-273
 - advanced settings, 343-344
 - configuration tasks, 271-272
 - information mapping, 340-342
 - iSCSI VMFS, 335-338
 - licenses, entering
 - from command line, 273-274
 - FlexLM licenses, 273
 - from MUI (Management User Interface), 276
 - from VIC (Virtual Infrastructure Client), 274-276
- NAS (network-attached storage), configuring with, 338
 - command line, 338-339
 - VIC, 339-340
- secure access to management interfaces, 342-343
- virtual networking
 - iSCSI networks, 318
 - NAS vSwitches, 319-320
 - overview, 307-308
 - pNIC settings, 331-332
 - private vSwitches, 320-321
 - secondary pNICs, 321-322
 - service console, 308-310
 - traffic-shaping settings, 333-335
 - VM network vSwitches, 311-313
 - VMkernel gateways, 330-331
 - VMotion vSwitches, 315-317
 - vSwitch port groups, 322-324
 - vSwitch properties, 327-330
 - vSwitch removal, 324-325
 - vSwitch security, 325-327
- VMFS (Virtual Machine File System). *See* VMFS
- vSwap (virtual swap), 277-278
- vdf tool, 208
- vDisplay (virtual displays), 347
- verification
 - firmware, 61-62
 - hardware, 61
- Veritas NetBackup, 460
- Version 3. *See* ESX Version 3
- version comparison
 - backup differences, 46
 - COS (console operating system), 37
 - ESX Server boot steps, 37-39
 - tool differences, 40-41
 - data stores, 43-44
 - installation differences, 52
 - licensing differences, 47-48
 - overview, 33-34
 - security differences, 51-52
- VCP (VMware Certified Professional) exam, 48
- virtual hardware, 48-50
- virtual machine management, 50-51
- virtual networking, 41-42
- virtual resources, 44-45
- VMkernel differences, 34-37
- vFloppy (virtual floppy drives), 347
- vFWs (virtual firewalls), 223
- vGateways (virtual gateways), 224
- VGT (virtual guest tagging), 233, 380
- VIC (Virtual Infrastructure Client), 408-409
 - administrative users, creating, 255-256
 - creating VMs (virtual machines) from, 351-359
 - data stores, 352-354
 - guest OS, 355
 - host selection, 352-353
 - memory, 356-357
 - name and folder, 352-353
 - network connections, 356

- New Virtual Machine Wizard, 351-352
- Ready to Complete stage, 358-359
- resource pool selection, 352-354
- vCPUs, 355-356
- virtual disk capacity, 358
- iSCSI
 - network configuration, 318
 - VMFS configuration, 336-338
- licenses, entering, 274-276
- LUN manipulations, 304-305
- NAS (network-attached storage)
 - configuration, 339-340
 - vSwitch configuration, 320
- pNIC settings, 332
- private vSwitch configuration, 321
- security configuration, 260-261
- service console
 - configuration, 310
 - memory, configuring, 266-267
- traffic-shaping settings, 334
- virtual hardware for
 - nondisk SCSI devices, installing, 382-383
 - raw disk map access to remote SCSI, installing, 384
- VM network vSwitches, configuring, 311-313
- VMFS (Virtual Machine File System)
 - creating, 286-291
 - deleting, 293-295, 306
 - extending, 291-293
 - renaming, 284-286
- VMKernel gateway configuration, 330-331
- VMotion vSwitches, configuring, 316
- vSwitches
 - deleting, 324
 - port groups, 323
 - properties, 328-330
 - security, 326-327
- WWPN, determining, 300
- VIC (Virtual Infrastructure Client), 322
- vIDEs (virtual IDE drives), 347
- virtual appliances, 397-400
- virtual centers. *See* VCs, 271
- virtual CPUs (vCPUs), 346
- virtual displays (vDisplay), 347
- virtual firewalls (vFWs), 223
- virtual floppy drives (vFloppy), 347
- virtual gateways (vGateways), 224
- virtual guest tagging (VGT), 233, 380
- virtual hardware
 - considerations (VM creation), 349-351
 - nondisk SCSI devices, installing via, 380-384
 - command line, 381-382
 - MUI, 383-384
 - VIC (Virtual Infrastructure Client), 382-383
 - raw disk map access to remote SCSI, installing via, 384-385
 - command line, 384
 - MUI, 385
 - VIC (Virtual Infrastructure Client), 384
 - RDM-like access to local SCSI, 385-387
 - version differences, 48-50
- virtual IDE drives (vIDEs), 347
- Virtual Infrastructure
 - documentation, 519
 - IO HCL, 519
 - on non-ESX servers, 30-31
 - SAN HCL, 520
 - Systems HCL, 520
- Virtual Infrastructure Client. *See* VIC
- virtual keyboards (vKeyboard), 347
- Virtual Machine File System. *See* VMFS
- Virtual Machine Manager (VMM), 45, 50-51, 415
- Virtual Machine Monitors, 408
- virtual machines. *See* VMs
- virtual mouse (vMouse), 347
- virtual networks
 - NAS vSwitches, 319-320
 - overview, 307-308
 - pNIC settings, 331-332

- private vSwitches, 320-321
- secondary pNICs, 321-322
- service console configuration, 308-310
 - ESX version 3 command line, 308
 - ESX versions earlier than 3
 - command line, 309
 - VIC (Virtual Infrastructure Client), 310
- traffic-shaping settings, 333-335
- version differences, 41-42
- VM network vSwitches, 311-313
- VMkernel gateways, 330-331
- VMotion vSwitches, 315-318
- vSwitches
 - port groups, 322-324
 - removal, 324-330
- virtual NICs (vNICs), 223, 347
- virtual resources, 44-45
- virtual routers (vRouters), 224
- virtual SCSI (vSCSI), 348-349
- virtual swap (vSwap), 277-278
- virtual switch tagging (VST), 233
- virtual switches (vSwitches)
 - 802.1q, 232-234
 - EST (external switch tagging), 232
 - VGT (virtual guest tagging), 233
 - VST (virtual switch tagging), 233
- beacon monitoring, 236-237
- creating, 244
- functionality, 222-223
- load balancing, 234-235
- NAS vSwitches, 319-320
- overview, 221
- port groups
 - adding, 322-323
 - deleting, 323-324
- private vSwitches, 320-321
- properties, 327-330
- redundant mode, 235-236
- removing, 324-325
- secondary pNICs, 321-322
- security, 325-327
- traffic shaping, 238
- VM network vSwitches, 311-313
- VMotion vSwitches, 315-317
- VirtualCenter Management Server, 30
- virtualization, 33, 461-463
- Vizioncore, 423
- vKeyboard (virtual keyboards), 347
- VLAN tagging, 232-234
- VM networks, 229-230
- vmaccepteula kick-start option, 91
- .vmdk file extension, 181, 369
- VMDKs
 - backups, scheduling, 207
 - movement, 182
 - sizes, 196-197
- VMFS (Virtual Machine File System), 278
 - accessibility modes, 184
 - created on one ESX Server not appearing on another, 198-199
 - creating with
 - command line, 279-281
 - MUI (Management User Interface), 297-298
 - VIC (Virtual Infrastructure Client), 286-291
 - deleting with
 - command line, 282-284, 306
 - MUI (Management User Interface), 298-299, 307
 - VIC (Virtual Infrastructure Client), 293-295, 306
 - error conditions, 185-189
 - 0xbad0004, 189
 - 0xbad0010, 186
 - 0xbad0023, 186-189
 - SCSI: 0/1, 186
 - SCSI: 0/4, 186
 - SCSI: 0/7, 186
 - SCSI: 2/0, 186
 - SCSI: 24/0, 185
 - SCSI: 24/7, 186

- extending with
 - command line, 281-282
 - MUI (Management User Interface), 298
 - VIC (Virtual Infrastructure Client), 291-293
- extents, 197-198
- Fibre Channel VMFS
 - overview, 299
 - WWPN, determining, 300-301
- files, table of, 181
- increasing size of, 197-198
- iSCSI VMFS, 335-338
- layout, 183-184
- masking and max LUN
 - manipulations, 302
 - command line, 302-304
 - VIC (Virtual Infrastructure Client), 304-305
- overview, 165, 180
- raw disk maps, 185
- renaming with
 - command line, 279
 - MUI (Management User Interface), 296
 - VIC (Virtual Infrastructure Client), 284-286
- SCSI pass thru, 185
- VMDK movement, 182
- VMFS-1, 183
- VMFS-2, 183
- VMFS-3, 183
- /vmimages, adding, 491, 512
- VMkernel
 - gateways, 330-331
 - networks, 228-229
 - security, 152
 - swap size, 65
 - version differences, 34-37
- vmkfstools command, 40, 200, 208, 281
- vmkload_mod command, 40
- vmkmultipath command, 40, 208
- vmkmultipath -q command, 198
- vmkpcidiv command, 40
- vmkusage command, 213, 423
- vmlicense kick-start option, 91
- %vmlicense_text section kick-start option, 91
- VMM (Virtual Machine Manager), 45, 50-51, 415
- VMotion, 2-3
 - alarms, 418
 - security, 153
 - VMotion networks, 228
- vMouse (virtual mouse), 347
- vmres.pl command, 40
- VMs (virtual machines)
 - booting, 210
 - cloning, 393
 - creating
 - from command line, 368-373
 - from MUI, 364
 - from VIC (Virtual Infrastructure Client), 351-359
 - from VC1.x, 359-367
 - virtual hardware considerations, 349-351
 - destroying, 393
 - effect on performance, 211-212
 - emulation, 345
 - failure
 - definition, 433
 - recovery methods, 435
 - files associated with, 369
 - full virtualization, 346
 - installation
 - with client device or ISO, 377-379
 - with local ESX Server CD/DVD-ROM devices, 374-375, 379
 - with local or shared ESX Server ISO images, 376-377
 - over network, 379
 - OS installation peculiarities, 392
 - overview, 374
 - virtual guest tagging drivers, 380
 - virtual hardware for nondisk SCSI devices, 380-384

- virtual hardware for raw disk map
 - access to remote SCSI, 384-385
- virtual hardware for RDM-like
 - access to local SCSI, 385-387
- VM disk modes and snapshots, 387-391
- license and installation materials, 64
- memory, 213-214, 347
- naming conventions, 206
- networks, 229-230
- overview, xxii-xxiii, 345
- paravirtualization, 346
- PCI devices, 346
- persistent VM disk modes, 208
- security, 95-98
- solutions
 - clusters, 395-396
 - firewalled lab benches, 394-395
 - private labs, 394
 - VC as VM, 396
 - virtual appliances, 397-400
- suspending, 208
- templates, 393
- vCPUs (virtual CPUs), 346
- vDisplay (virtual displays), 347
- version differences, 50-51
- vFloppy (virtual floppy drives), 347
- vIDEs (virtual IDE drives), 347
- Virtual Machine Monitors, 408
- vKeyboard (virtual keyboards), 347
- vMouse (virtual mouse), 347
- VMware Tools, 400-401
- VMX files, 401-405
- vNIC (virtual NICs), 347
- vSCSI, 348-349
- .vmsd file extension, 369
- .vmsn file extension, 369
- vmsnap_all command, 40
- vmsnap.pl command, 40
- .vmss file extension, 181, 369
- vm-support command, 40
- vm-support requests, 208
- .vmtd file extension, 181
- .vmtx file extension, 181
- VMware
 - ACE, 33
 - Administration, 33
 - Certified Professional (VCP) exam, 48
 - Clustering technology, 408
 - community forums, 519
 - Consolidated Backup (VCB) proxy server, 30
 - Dynamic Resource Scheduling (DRS), 408
 - ESX Server license, 63
 - Hardware Compatibility Lists (HCLs), 2
 - High Availability (HA), 408
 - License Server, 31
 - links website, 519
 - Player, 33
 - Professional, 519
 - Tools, 33, 400-401
 - Virtual Infrastructure
 - documentation, 519
 - IO HCL, 519
 - SAN HCL, 520
 - Systems HCL, 520
 - Workstation, 33
- vmware-cmd command, 40
- VMware ESX Server: Advanced Technical Design Guide*, 519
- VMX files, 181, 369, 401-405
- .vmxf file extension, 369
- vmxnet_console, 225-226
- vNetwork examples, 239-242
- vNICs (virtual NICs), 223, 347
- vRouters (virtual routers), 224
- vSCSI, 348-349
- VST (virtual switch tagging), 233
- vSwap (virtual swap), 277-278
- vSwitches (virtual switches), 41-42
 - 802.1q, 232-234
 - EST (external switch tagging), 232
 - VGT (virtual guest tagging), 233
 - VST (virtual switch tagging), 233
- beacon monitoring, 236-237
- creating, 244
- functionality, 222-223

- load balancing, 234-235
- NAS vSwitches, 319-320
- overview, 221
- port groups
 - adding, 322-323
 - deleting, 323-324
- private vSwitches, 320-321
- properties, 327-330
- redundant mode, 235-236
- removing, 324-325
- secondary pNICs, 321-322
- security, 325-327
- traffic shaping, 238
- VM network vSwitches, 311, 313
- VMotion vSwitches, 315-317
- .vswp file extension, 181, 369
- .vzsnp file extension, 369

W–Z

- Welcome screens, ESX Version 3
 - graphical installation, 503
 - text installation, 483
- Workstation, 33
- world disasters
 - definition, 435
 - recovery methods, 437
- WWNNs (World Wide Name Numbers), 176
- WWNs (World Wide Names), 176
- WWPN, determining via, 300
 - command line, 300
 - MUI (Management User Interface), 301
 - VIC (Virtual Infrastructure Client), 300
- X Windows, 87
- XtraVirt, 520
- zoning, 176-177