

MARK EDWARD SOPER
DAVID L. PROWSE
SCOTT MUELLER



AUTHORIZED

Authorized Cert Guide

Learn, prepare, and practice for exam success



- › Master every topic on the new 220-801 and 220-802 exams
- › Assess your knowledge and focus your learning
- › Get the practical workplace knowledge you need!
- › Includes coverage of the new performance-based questions



220-801
220-802

Third Edition



CD FEATURES
TWO COMPLETE
PRACTICE EXAMS

Includes

- › 448 Practice Questions
- › Sample Beep Codes
- › Memory Tables
- › Searchable Glossary

PEARSON IT
CERTIFICATION

www.allitebooks.com

CompTIA A+ 220-801 and 220-802 Authorized Cert Guide

Third Edition

Mark Edward Soper
David L. Prowse
Scott Mueller

PEARSON

800 East 96th Street
Indianapolis, Indiana 46240 USA

CompTIA A+ 220-801 and 220-802 Authorized Cert Guide, Third Edition

Copyright © 2013 by Pearson Education, Inc.

All rights reserved. No part of this book shall be reproduced, stored in a retrieval system, or transmitted by any means, electronic, mechanical, photocopying, recording, or otherwise, without written permission from the publisher. No patent liability is assumed with respect to the use of the information contained herein. Although every precaution has been taken in the preparation of this book, the publisher and author assume no responsibility for errors or omissions. Nor is any liability assumed for damages resulting from the use of the information contained herein.

ISBN-13: 978-0-7897-4850-8

ISBN-10: 0-7897-4850-9

Library of Congress Cataloging-in-Publication data is on file.

Printed in the United States of America

First Printing: September 2012

Trademarks

All terms mentioned in this book that are known to be trademarks or service marks have been appropriately capitalized. Pearson IT Certification cannot attest to the accuracy of this information. Use of a term in this book should not be regarded as affecting the validity of any trademark or service mark.

Warning and Disclaimer

Every effort has been made to make this book as complete and as accurate as possible, but no warranty or fitness is implied. The information provided is on an “as is” basis. The authors and the publisher shall have neither liability nor responsibility to any person or entity with respect to any loss or damages arising from the information contained in this book or from the use of the CD or programs accompanying it.

Bulk Sales

Pearson IT Certification offers excellent discounts on this book when ordered in quantity for bulk purchases or special sales. For more information, please contact

U.S. Corporate and Government Sales

1-800-382-3419

corpsales@pearsontechgroup.com

For sales outside the United States, please contact

International Sales

international@pearsoned.com

Associate Publisher
Dave Dusthimer

Acquisitions Editor
Betsy Brown

Development Editor
Andrew Cupp

Managing Editor
Sandra Schroeder

Senior Project Editor
Tonya Simpson

Copy Editor
Apostrophe Editing
Services

Proofreader
Megan Wade

Technical Editor
Chris Crayton

Editorial Assistant
Vanessa Evans

Media Producer
Tim Warner

Book Designer
Gary Adair

Compositor
Bronkella Publishing

Contents at a Glance

	Introduction	xxxvii
CHAPTER 1	Technician Essentials and PC Anatomy	101 3
CHAPTER 2	Motherboards and Processors	29
CHAPTER 3	BIOS	85
CHAPTER 4	Power Supplies and System Cooling	129
CHAPTER 5	RAM	177
CHAPTER 6	I/O and Input Ports and Devices	207
CHAPTER 7	Video Displays and Video Cards	273
CHAPTER 8	Customized PCs and Multimedia Devices	313
CHAPTER 9	Laptop and Notebook Computers	345
CHAPTER 10	Mobile Devices	397
CHAPTER 11	Printers	449
CHAPTER 12	Storage Devices	501
CHAPTER 13	Installing and Upgrading Windows	565
CHAPTER 14	Using and Managing Windows	605
CHAPTER 15	Troubleshooting and Maintaining Windows	705
CHAPTER 16	Networking	769
CHAPTER 17	Security	869
CHAPTER 18	Operational Procedures and Communications Methods	929
GLOSSARY		953
	Index	995
CD Only:		
APPENDIX A	Memory Tables	
APPENDIX B	Memory Tables Answer Key	

Table of Contents

	Introduction	xxxvii
Chapter 1	Technician Essentials and PC Anatomy	101 3
	The Essential Parts of Any Computer	4
	Front and Rear Views of a Desktop PC	5
	All Around a Notebook (Laptop) Computer	7
	Quick Reference to PC Components	8
	Hardware, Software, and Firmware	9
	Hardware	10
	Software	10
	Firmware	11
	Why Hardware, Software, and Firmware Are Important to Understand	11
	Points of Failure	11
	Points of Failure on a Desktop Computer	12
	Points of Failure on a Notebook Computer	13
	The CompTIA Six-Step Troubleshooting Process	14
	PC Tools	15
	Basic Tools for Assembly/Disassembly of Computers	15
	ESD Protection	16
	System and Electrical Testing Tools	16
	Network Installation and Configuration Tools	17
	Printer Maintenance Tools	18
	Important Websites	18
	Review All the Key Topics	19
	Complete the Tables and Lists from Memory	19
	Define Key Terms	19
	Complete Hands-On Labs	19
	Lab 1-1: Determine the External Equipment Available on a Desktop or Laptop Computer	20
	Lab 1-2: Determine the Tool(s) to Use for Performing Specified Service on a PC	21
	Answer Review Questions	21

Answers to Hands-On Labs	24	
Lab 1-1: Determine the external equipment available on a desktop or laptop computer.	24	
Lab 1-2: Determine the tool(s) to use for performing specified service on a PC.	26	
Answers and Explanations to Review Questions	26	
Chapter 2	Motherboards and Processors	29
Motherboards and Their Components	30	
Form Factors	31	
Integrated I/O Ports	33	
Memory Slots	35	
Expansion Slots	36	
Chipset Components	42	
Jumpers and Jumper Blocks	44	
Fan Connectors	44	
Audio Connectors	45	
Front-Panel Connectors	46	
Installing Motherboards	48	
Step-by-Step Motherboard Removal	48	
Preparing the Motherboard for Installation	50	
Step-by-Step Motherboard Installation	51	
Troubleshooting Motherboards	52	
Unexpected Shutdowns	52	
Continuous Reboots (Power Supply and BSOD Problems)	53	
BIOS Time and Settings Resets	53	
System Lockups	54	
POST Code Beeps at Startup	54	
Blank Screen on Bootup	54	
Smoke or Burning Smells	55	
System Will Not Start	55	
Processors and CPUs	58	
Overview of Processor Differences	58	
Intel Processors	58	
AMD Processors	64	

CPU Technologies	69
Hyperthreading (HT Technology)	70
Multicore	70
Cache	70
Bus Speeds	71
Overclocking	72
32-bit Versus 64-bit Architecture	73
Virtualization Support	73
Integrated GPU	74
CPU Cooling	74
Passive and Active Heat Sinks	75
Liquid Cooling Systems	76
Review All the Key Topics	78
Complete the Tables and Lists from Memory	79
Define Key Terms	79
Complete Hands-On Lab	79
Lab 2-1: Determine Available USB Ports, Locations, and Types	79
Lab 2-2: Determine Smallest Form Factor Suitable for a New PC	80
Answer Review Questions	80
Answers to Hands-On Lab	82
Lab 2-1: Determine Available USB Ports, Locations, and Types	82
Lab 2-2: Determine Smallest Form Factor Suitable for a New PC	83
Answers and Explanations to Review Questions	83
Chapter 3 BIOS	85
Understanding BIOS, CMOS, and Firmware	86
Configuring the System BIOS	89
Accessing the BIOS Setup Program	89
UEFI and Traditional BIOS	91
BIOS Settings Overview	92
Automatic Configuration of BIOS/CMOS Settings	95
Main Menu	96
Standard Features/Settings	96
System Information	98
Boot Settings and Boot Sequence	98

Integrated Ports and Peripherals	100
Power Management	104
PnP/PCI Configurations	105
Hardware Monitor	105
Processor and Memory Configuration	106
Virtualization Support	106
Security Features	108
Exiting the BIOS and Saving/Discarding Changes	109
Power-On Self Test (POST) and Error Reporting	110
Beep Codes	111
POST Error Messages	112
POST Hex Codes	112
BIOS Updates	114
Flash BIOS Update	115
BIOS Chip Replacement	118
Review All the Key Topics	120
Complete the Tables and Lists from Memory	120
Define Key Terms	121
Complete Hands-On Labs	121
Lab 3-1: Disable Onboard Audio	121
Lab 3-2: Check Fan and Voltage Levels	121
Answer Review Questions	122
Answers to Hands-On Labs	125
Lab 3-1: Disable Onboard Audio	125
Lab 3-2: Check Fan and Voltage Levels	125
Answers and Explanations to Review Questions	125
Chapter 4 Power Supplies and System Cooling	129
Power Supplies	130
Power Supply Ratings	130
Multivoltage Power Supplies	133
Power Supply Form Factors and Connectors	135
Removing and Replacing the Power Supply	139

Troubleshooting Power Supplies	141
Overloaded Power Supplies—Symptoms and Solutions	141
Loud Noises from the Power Supply	142
Finding Solutions to a “Dead” System	143
Overheating	144
Fans Turn But System Doesn’t Start	149
Testing Power Supplies and Other Devices with a Multimeter	149
Avoiding Power Supply Hazards	154
Power Protection Types	155
Surge Suppressors	156
Battery Backup Units (UPS and SPS)	158
Buying the Correct-Sized Battery Backup System	159
Power-Conditioning Devices	160
System Cooling	161
Northbridge and Southbridge Chips and Voltage Regulators	161
Video Card Cooling	163
Case Fans	163
Thermal Compound	164
Review All the Key Topics	167
Complete the Tables and Lists from Memory	168
Define Key Terms	168
Complete Hands-On Lab	168
Lab 4-1: Check Power Supply Voltages	168
Lab 4-2: Check for Airflow Problems Inside the System	168
Answer Review Questions	169
Answers to Hands-On Lab	172
Lab 4-1: Check Power Supply Voltages	172
Lab 4-2: Check for Airflow Problems Inside the System	172
Answers and Explanations to Review Questions	173
Chapter 5	
RAM	177
RAM Basics	178
Memory Modules	180
DRAM	180
SRAM	181

SDRAM	181
DDR SDRAM	181
DDR2 SDRAM	182
DDR3 SDRAM	182
Rambus	183
Operational Characteristics	184
Comparison of Memory Modules	184
Memory Module Width	185
Parity and Non-Parity Memory	185
ECC and Non-ECC Memory	187
Registered and Unbuffered Memory	188
Single-Sided and Double-Sided Memory	188
Installing Memory Modules	189
Troubleshooting Memory	192
Verifying RAM Compatibility	192
Overclocking Can Lead to System Instability	192
Use Caution When Mismatching RAM Speeds	193
“Parity Error - System Halted” Message	194
RAM-Sizing Errors at Bootup	194
Determining Whether Cache RAM Is the Source of a Memory Problem	195
Other Methods for RAM Testing	195
Preventative Maintenance for Memory	196
Review All the Key Topics	197
Complete the Tables and Lists from Memory	197
Define Key Terms	197
Complete Hands-On Labs	198
Lab 5-1: Select and Install the Correct RAM	198
Answer Review Questions	199
Answers to Hands-On Labs	202
Lab 5-1: Select and Install the Correct RAM	202
Answers and Explanations to Review Questions	203

Chapter 6	I/O and Input Ports and Devices	207
	Introduction to I/O Ports	208
	USB	209
	USB Port Types, Speeds, and Technical Details	209
	Adding USB Ports	213
	Troubleshooting USB Ports and Devices	215
	IEEE-1394 (FireWire)	218
	IEEE 1394 Ports and Cables	218
	IEEE 1394–Compatible Devices	219
	Installing an IEEE 1394 Card	220
	Troubleshooting IEEE 1394 Ports and Devices	220
	SCSI	221
	Multiple Device Support with SCSI Host Adapters	222
	Jumper Block and DIP Switch Settings for Device IDs	223
	SCSI Standards	225
	SCSI Cables	225
	SCSI Signaling Types	227
	Daisy-Chaining SCSI Devices	227
	SCSI Host Adapter Card Installation	228
	SCSI Daisy-Chain Maximum Length	229
	SCSI Termination Methods	229
	COM (Serial)	231
	Serial Port Pinouts	233
	Types of Serial Cables	235
	How to Configure or Disable Serial Ports	236
	Serial Port Software Configuration	236
	Adding Additional Serial Ports	238
	Troubleshooting Serial Ports and Devices	238
	LPT (Parallel)	240
	Parallel Port Configuration	243
	Types of Parallel Cables	244
	How to Configure or Disable Parallel Ports	246
	Adding Parallel Ports	247
	Troubleshooting Parallel (LPT) Ports, Devices, and Switchboxes	247
	Testing Parallel and Serial Ports	248

PS/2 Mouse and Keyboard	249
Audio	249
Analog Audio Mini-Jacks	249
SPDIF Digital Audio	250
Mouse	251
Mouse Hardware Resource Use	252
Troubleshooting Mice and Pointing Devices	253
Maintaining Mice and Pointing Devices	257
Keyboard	258
Troubleshooting Keyboards	258
Maintaining Keyboards	259
Bar Code Reader	259
Touch Screen	260
Touch Screen Interfacing to the Computer	261
Installing a Touch Screen	262
Troubleshooting a Touch Screen	262
KVM Switch	263
Review All the Key Topics	264
Complete the Tables and Lists from Memory	265
Define Key Terms	265
Complete Hands-On Lab	265
Lab 6-1: Check USB Device Power Usage	265
Answer Review Questions	266
Answers to Hands-On Lab	269
Lab 6-1: Check USB Device Power Usage	269
Answers and Explanations to Review Questions	269
Chapter 7 Video Displays and Video Cards	273
Video Card Types	274
Video Card Cooling	275
Display Types	276
CRT Monitor	277
LCD Monitor	278
LED Monitor	279

Plasma	279
Data Projector	280
OLED	281
Installing a Video Card	282
BIOS Configuration	282
Video Card Physical and Driver Installation	282
Video Connector Types	285
VGA	285
DVI	286
HDMI	286
DisplayPort	288
Component/RGB	289
S-Video	289
Composite	289
Installing a Monitor	289
Video Display Settings	292
Resolution	292
Color Quality (Color Depth)	295
Refresh Rates	296
Troubleshooting Displays and Video Cards	297
Troubleshooting Picture Quality Problems with OSD	298
Using Advanced Display Properties for Troubleshooting	299
Troubleshooting Video Hardware	300
Preventative Maintenance for Displays	302
Review All the Key Topics	304
Complete the Tables and Lists from Memory	304
Define Key Terms	305
Complete Hands-On Labs	305
Lab 7-1: Select the Appropriate Video Connectors	305
Answer Review Questions	306
Answers to Hands-On Labs	309
Lab 7-1: Select the Appropriate Video Connectors	309
Answers and Explanations to Review Questions	310

Chapter 8 Customized PCs and Multimedia Devices 313

- Customized PC Configurations 314
 - Graphic/CAD/CAM Design Workstation 314
 - Audio/Video Editing Workstation 316
 - Virtualization Workstation 318
 - Gaming PC 319
 - Home Theater PC 321
 - Standard Thick Client 322
 - Thin Client 323
 - Home Server PC 323
- Evaluating Onboard Components 324
 - General System Information 324
 - Processor Information and Hardware-Assisted Virtualization Readiness 326
- Installing and Configuring Multimedia Devices 327
 - Webcams 327
 - Digital Cameras 328
 - Sound Cards 329
 - Installing a MIDI Enabled Device 332
 - Microphone 333
 - Video Capture and TV Tuner Cards 335
- Review All the Key Topics 337
- Complete the Tables and Lists from Memory 337
- Define Key Terms 338
- Complete Hands-On Labs 338
 - Lab 8-1: Evaluate a Computer's Suitability for Various Tasks 338
- Answer Review Questions 341
- Answers to Hands-On Labs 343
 - Lab 8-1: Evaluate a Computer's Suitability for Various Tasks 343
- Answers and Explanations to Review Questions 343

Chapter 9 Laptop and Notebook Computers 345

- Laptop Expansion Options 346
 - PCMCIA (PC Card, CardBus) 346
 - ExpressCard 350
 - Memory 352

Connecting USB Drives to Your Laptop	352
Flash Memory Cards	352
Best Practices for Laptop Disassembly	353
Hardware Device Replacement	354
Removing and Replacing the Battery	355
Replacing a Laptop Keyboard or Pointing Device	356
Replacing Speakers	358
Replacing a Laptop Hard Drive	358
Performing a Memory Upgrade	360
Replacing an Optical Drive	362
Removing a Wireless Card (Mini-PCI or Mini-PCIe)	362
Replacing the Screen	365
Replacing the Fan, Heat Sink, and CPU	366
Laptop Displays	368
LCD Displays	369
LED Displays	369
OLED Displays	369
Plasma Displays	370
Display Resolutions and Viewing Quality Considerations	370
Inverter and Backlight Components	372
Wi-Fi Antenna Components	373
Laptop Features	374
Special Laptop Function Keys	374
Working with Dual Displays	375
Working with Port Replicators and Docking Stations	380
Physically Securing a Laptop Computer	381
Troubleshooting Laptop Problems	382
Troubleshooting Display Problems	382
Power Problems	384
Keyboard Problems	385
Network Problems	386
Review All the Key Topics	387
Complete the Tables and Lists from Memory	388
Define Key Terms	388

Complete Hands-On Lab	388
Lab 9-1: Locate Laptop Hard Drive and Memory	388
Answer Review Questions	391
Answers to Hands-On Lab	394
Lab 9-1: Locate Laptop Hard Drive and Memory	394
Answers and Explanations to Review Questions	394
Chapter 10 Mobile Devices	397
Mobile Device Hardware	398
Examples of Mobile Device Hardware	398
Differences Between Tablets and Laptops	399
Tablet and Laptop Similarities	400
Upgrading and Replacing the Memory Card and the Battery in a Smartphone	400
Hardware Wrap-Up	403
Mobile Hardware Wrap-Up	404
Mobile Operating Systems	404
Android Versus iOS	404
Where and How to Get Applications	408
Adjusting the Display	408
GPS and Geotracking	411
Mobile OS Wrap-Up	412
Mobile Network Connectivity	412
GSM Cellular Connectivity	412
Wi-Fi Network Connectivity	414
Wi-Fi Troubleshooting	416
Bluetooth Configuration	418
Email Configurations	421
Mobile Network Connectivity Wrap-Up	424
Mobile Synchronization	424
Synchronizing an Android Device to a PC	424
Synchronizing an iPad2 to a PC	427
Synchronizing Other Devices	428
Mobile Sync Wrap-Up	429

Mobile Security	429
Protecting Against Stolen or Lost Devices	429
Protecting Against Compromised or Damaged Devices	432
Turning Off Applications and Resets	435
Security Wrap-Up	438
Review All the Key Topics	439
Define Key Terms	440
Complete Hands-On Labs	440
Lab 10-1: Troubleshoot a Mobile Wi-Fi Connection	440
Lab 10-2: Secure a Mobile Device	440
Answer Review Questions	441
Answers to Hands-On Labs	444
Lab 10-1: Troubleshoot a Mobile Wi-Fi Connection	444
Lab 10-2: Secure a Mobile Device	444
Answers and Explanations to Review Questions	445
Chapter 11 Printers	449
Laser Printers	450
Toner Cartridges	450
The Laser Printing (EP) Process	451
Color Laser Printing Differences	454
Inkjet Printers	455
Ink Cartridges	457
Calibrating the Printer	458
Thermal Printers	459
Thermal Print Processes	459
Thermal Printer Ribbons	460
Thermal Printer Paper	460
Impact Printers	461
Impact Dot Matrix Print Process	462
Impact Dot-Matrix Printheads	463
Impact Printer Ribbons	463
Impact Printer Paper and Media	464

Printer Installation and Configuration	464
Installing a Printer	465
Installing RAM	467
Upgrading Firmware	469
Printer Interface Types	469
Printer Sharing in Windows	471
Configuring Options and Device Settings	472
Printing a Test Page	476
Working with the Print Spooler	477
Printer Maintenance	478
Laser Printer Maintenance	478
Inkjet Printer Maintenance	480
Thermal Printer Maintenance	482
Impact Printer Maintenance	483
Printer Troubleshooting	484
Streaks and Smudges	484
Faded Prints	485
Ghost Images	486
Toner Not Fused to Paper	486
Creased Paper	487
Paper Not Feeding	487
Paper Jam	487
No Connectivity	488
Garbled Characters on Paper	488
Vertical Lines on a Page	489
Backed Up Print Queue	489
Low Memory Errors	490
Access Denied	492
Printer Won't Print	492
Color Output in Wrong Print Colors	492
Unable to Install Printer	492
Error Codes	492
Review All the Key Topics	494
Define Key Terms	494

Complete the Hands-On Lab	495
Lab 11-1: Solve Inkjet Printing Problems	495
Answer Review Questions	495
Answers to Hands-On Lab	498
Lab 11-1: Solve Inkjet Printing Problems	498
Answers and Explanations to Review Questions	498
Chapter 12 Storage Devices	501
Drive Interface Types	502
External and Internal Drive Interfaces	502
PATA and SATA Performance Characteristics	504
PATA Cabling, Configuration, and Setup	506
SATA Configuration and Cabling	508
SCSI IDs	510
Hot-Swappable Drive Interfaces	511
Hard Disk Drives	512
Performance Factors for SATA and PATA Hard Disks	512
Internal Hard Disk Drive Installation	513
eSATA Drives	519
SSD and Flash Drives	520
Flash Memory Cards	520
Flash Card Reader	523
USB Flash Memory Drives	524
SSD	525
RAID	526
Creating an ATA or SATA RAID Array	528
Optical Drives	531
Comparing CD, DVD, and Blu-ray Drives and Media	531
DVD Media Types	532
Blu-ray Media Types	532
Drive Speed Ratings	533
Recording Files to Optical Discs	533
Floppy Drives	538
Floppy Drive Capacities	538
Floppy Disk Drive Hardware Configuration	539
Maintaining Floppy Disks, Data, and Drives	540

Tape Drives	541
Troubleshooting Hard Drives, SSDs, and RAID Arrays	542
Read/Write Failures	543
Slow Performance	543
Noises Coming from Hard Disk	546
Boot Failure	547
Drive Not Recognized	548
Operating System Not Found	548
RAID Not Found	549
RAID Failure	549
Disk Surface and Data Recovery Tools	550
Review All the Key Topics	553
Complete the Tables and Lists from Memory	553
Define Key Terms	554
Complete Hands-On Lab	554
Lab 12-1: Configure SATA Ports	554
Lab 12-2: Configure PATA Jumper Blocks	555
Answer Review Questions	557
Answers to Hands-On Lab	560
Lab 12-1: Configure SATA Ports	560
Lab 12-2: Configure PATA Jumper Blocks	560
Answers and Explanations to Review Questions	561
Chapter 13 Installing and Upgrading Windows	565
Installing Windows	566
Minimum and Recommended Hardware Requirements	566
Boot Methods	570
Types of Installation	570
Time/Date/Language/Region Settings	579
Partitioning	580
File System Types and Formatting	586
Loading Alternative Third-Party Disk Drivers	588
Workgroup Versus Domain Setup	589
Transferring User Data	589
Windows Easy Transfer	590
User State Migration Tool	591

Updating Windows	592
Using Windows Update and Microsoft Update	592
Installing Service Packs Manually	593
Setting Up Recovery Partitions and Discs	595
Review All the Key Topics	597
Complete the Tables and Lists from Memory	597
Define Key Terms	598
Complete Hands-On Lab	598
Lab 13-1: Selecting Installation Options for Windows 7	598
Answer Review Questions	599
Answers to Hands-On Lab	602
Lab 13-1: Selecting Installation Options for Windows 7	602
Answers and Explanations to Review Questions	602
Chapter 14 Using and Managing Windows	605
Windows Versions and Editions	606
Windows XP Family	607
Windows Vista Family	607
Windows 7 Family	608
Windows Features	609
Windows Desktop (Aero, Aero Glass, Sidebar, Gadgets)	610
Shadow Copy	612
ReadyBoost	613
Compatibility Mode	615
Windows XP Mode	618
Administrative Tools	618
File Structure and Paths	620
Command-Line Tools	621
Starting a Command-Prompt Session with CMD.EXE	621
Internal Commands Overview	622
Using Wildcards to Specify a Range of Files	624
COPY	624
XCOPY	625
ROBOCOPY.EXE	627
MKDIR, CHDIR, and RMDIR (MD, CD, and RD)	628

Format/Format.exe	629
Diskpart	633
DEL	635
Tasklist	636
Taskkill	638
Administrative Features	640
Computer Management (MMC)	640
Performance Monitor/System Monitor	641
Services (Services.msc)	642
Task Scheduler	645
Print Management	648
Task Manager	648
Disk Management	650
Mount Points and Mounting a Drive	655
Windows File Systems	657
Run-Line Utilities	661
Notepad	662
Windows Explorer	662
MSInfo32 (System Information)	670
DXDiag (DirectX Diagnostics)	672
Control Panel	673
Starting Control Panel	674
Category and Icon Views	674
Shortcuts to Control Panel Functions	678
Display Options	678
Folder Options	679
System	680
Power Options	682
Add/Remove Programs (Windows XP)	686
Programs and Features (Windows Vista/7)	687
Automatic Updates (Windows XP)	688
Tablet PC Settings (Windows Vista/7)	688
Pen and Input Devices (Windows Vista)	689
Problem Reports and Solutions (Windows Vista, and 7)	689

Devices and Printers	689
HomeGroup (Windows 7)	690
Action Center (Windows 7)	691
Client-Side Virtualization	692
Host/Guest Virtualization	692
Hypervisor	692
Features and Benefits of Virtual Machines	693
Resource Requirements	693
Emulator Requirements	693
Security Requirements	694
Review All the Key Topics	695
Complete the Tables and Lists from Memory	695
Define Key Terms	696
Complete Hands-On Lab	696
Lab 14-1: Open and Use the Command Prompt	696
Lab 14-2: Using Microsoft Management Console	696
Answer Review Questions	697
Answers to Hands-On Lab	700
Lab 14-1: Open and Use the Command Prompt	700
Lab 14-2: Using Microsoft Management Console	701
Answers and Explanations to Review Questions	701
Chapter 15 Troubleshooting and Maintaining Windows	705
STOP (Blue Screen of Death) Errors	706
Causes of BSOD Errors	707
Researching Causes and Solutions	707
BSOD and Spontaneous Shutdown and Restart	708
Boot Failures	709
Windows 7/Vista Boot Errors	710
Windows XP Boot Errors	712
Missing Operating System Error	713
Missing Graphical Interface	714
GUI Fails to Load	714
Other Windows Problems	714
Improper Shutdowns	714
Device Fails to Start	715

Missing DLL Message	715
Services Fail to Start	715
Compatibility Error	716
Slow System Performance	716
Boots to Safe Mode	717
File Fails to Open	717
Windows Diagnostic and Repair Tools	717
Using System File Checker (SFC)	719
Using MSConfig	720
Using REGSVR32	721
Using REGEDIT	722
Using Event Viewer	724
Using Safe Mode and Other Advanced Boot Options	726
Using Device Manager	729
Using Windows XP Recovery Console	735
Using Automated System Recovery to Restore a Windows XP Installation	739
Using Windows Recovery Environment	741
Maintaining Windows	744
Using Windows Backup for XP	745
Using Windows Vista's Backup and Restore Center	748
Using Windows 7's Backup and Restore	750
CHKDSK.EXE	754
Defrag	755
System Restore and Restore Points	756
Firmware Updates	760
Review All the Key Topics	761
Complete the Tables and Lists from Memory	761
Define Key Terms	762
Complete Hands-On Lab	762
Lab 15-1: Check System Protection Settings	762
Lab 15-2: Using Event Viewer	762
Lab 15-3: Using Device Manager	762
Answer Review Questions	763

- Answers to Hands-On Lab 765
 - Lab 15-1: Check System Protection Settings 765
 - Lab 15-2: Using Event Viewer 765
 - Lab 15-3: Using Device Manager 766
- Answers to Review Questions 766

Chapter 16 Networking 769

- Network Models 770
 - Client/Server Versus Peer-to-Peer 770
 - LANs and WANs 773
 - Network Topologies 774
 - Network Devices 775
- Internet Connectivity Technologies 778
 - Modems and Dial-Up Internet Connectivity 778
 - ISDN Internet Connectivity 784
 - Broadband Internet Services (DSL, Cable, Satellite) 786
 - Fiber-Optic 790
 - Cellular 790
 - WiMAX 791
 - LANs and Internet Connectivity 791
- TCP/IP 792
 - HTTP/HTTPS 792
 - SSL 792
 - TLS 792
 - HTML 793
 - FTP 794
 - Telnet 794
 - SSH 795
 - DNS 795
 - DHCP 796
 - Email 797
 - Remote Desktop 798
 - SNMP 798
 - SMB 799
 - LDAP 799

TCP and UDP Ports	799
Cable and Connector Types	801
UTP and STP Cabling	801
Fiber-Optic Cabling	805
Coaxial Cabling	805
Plenum and PVC	806
Connector Types	806
Networking Tools	808
Network Types	809
Wireless Network Standards	811
Wireless Ethernet	811
Bluetooth	812
Infrared	813
Cellular	813
VoIP	813
Switches and Hubs	814
Building a Small Office/Home Office Network	815
Installing Network Interface Cards	815
Configuring Network Interface Cards	816
TCP/IPv4 Configuration	819
IPv6 Addressing	827
Setting Up Shared Resources	829
Administrative Shares	834
Setting Up the Network Client	834
Using Shared Resources	836
Browser Installation and Configuration	841
Multifunction Network Device Configurations	845
Using Network Command-Line Tools	846
Using the Net Command	847
Using Ping	847
Using Tracert	848
Using NSLookup	849
Using Ipconfig	849
Using Netstat	849
Using NBTSTAT	850

Network and Internet Troubleshooting	851
Can't Access Network Resources	851
Significant Drops in Network Performance	851
Unattended PC Drops Its Network Connection	852
All Users Lose Network Connection	853
Users Can Access Some Shared Resources But Not Others	853
Can't Print to a Network Printer	853
Ping and Tracert Work, But User Can't Display Web Pages with Browser	854
Overview of Creating a Small Office/Home Office Network	854
Review All the Key Topics	856
Complete the Tables and Lists from Memory	857
Define Key Terms	857
Complete Hands-On Labs	857
Lab 16-1: Select the Appropriate Type of Cable	858
Lab 16-2: Select the Appropriate IP Networks	858
Lab 16-3: Select the Network Option and Appropriate Ports	859
Lab 16-4: Install an Appropriate Wireless Network	859
Answer Review Questions	859
Answers to Hands-On Labs	864
Lab 16-1: Select the Appropriate Type of Cable	864
Lab 16-2: Select the Appropriate IP Networks	864
Lab 16-3: Select the Network Option and Appropriate Ports	864
Lab 16-4: Install an Appropriate Wireless Network	865
Answers and Explanations to Review Questions	865
Chapter 17 Security	869
Security Fundamentals	870
Secure and Insecure File Systems	870
Authentication Technologies	871
Protection Against Viruses and Malware	872
Software Firewalls	873
Data and Physical Security	873
Data Access Local Security Policy	874
Encryption Technologies	875

Backups	877
Data Migration	877
Data and Data Remnant Removal	877
Password Management	878
Locking a Workstation	878
Incident Reporting	879
Social Engineering	880
Physical Security	881
Securing Wireless Networks	883
WEP and WPA Encryption	883
Access Point Configuration for Maximum Security	885
Securing Wired Networks	891
Access Control Purposes and Principles	892
Operating System Access Control	892
Data Destruction/Disposal Techniques	898
Installing, Configuring, and Troubleshooting Security Features	899
BIOS Security Features	899
Software Firewalls	900
Configuring Exceptions	902
Wireless Network Configuration	904
Unused Wireless Connections	910
File Systems (Converting from FAT32 to NTFS)	912
Malicious Software Protection	913
Review All the Key Topics	919
Define Key Terms	919
Complete Hands-On Labs	920
Lab 17-1: Hard Drive Security and Disposal	920
Lab 17-2: Secure a Customer's Wireless Network	920
Answer Review Questions	921
Answers to Hands-On Labs	924
Lab 17-1: Hard Drive Security and Disposal	924
Lab 17-2: Secure a Customer's Wireless Network	924
Answers and Explanations to Review Questions	925

Chapter 18 Operational Procedures and Communications Methods 929

- Computer Safety 930
 - ESD 930
 - Electrical Safety 932
 - Physical Safety 934
- Environmental Controls 935
 - Temperature, Humidity, and Air 936
 - Material Safety Data Sheet (MSDS) 936
- Incident Response and Documentation 938
 - First Response 938
 - Documentation 938
 - Chain of Custody 939
- Communication Methods and Professionalism 939
 - How to Interact with to Customers 939
 - How to Treat Customers' Property 941
- Review All the Key Topics 942
- Complete the Tables and Lists from Memory 942
- Define Key Terms 942
- Complete Hands-On Labs 942
 - Lab 18-1: Select the Appropriate Power Protection Equipment 942
- Answer Review Questions 943
- Answers to Hands-On Labs 947
 - Lab 18-1: Select the Appropriate Power Protection Equipment 947
- Answers and Explanations to Review Questions 948
- Glossary 953**
- Index 976**

On the CD

APPENDIX A Memory Tables

APPENDIX B Memory Tables Answer Key

About the Authors

Mark Edward Soper has been working with PCs since the days of the IBM PC/XT and AT as a salesperson, technology advisor, consultant, experimenter, and technology writer and content creator. Since 1992, he has taught thousands of students across the country how to repair, manage, and troubleshoot the hardware, software, operating systems, and firmware inside their PCs. He has created many versions of his experimental computer known as “FrankenPC” for this and previous books. Mark earned his CompTIA A+ Certification in 1999 and has written four other A+ Certification books covering previous and current versions of the A+ Certification exams for Pearson imprints.

Mark has contributed to many editions of *Upgrading and Repairing PCs*, working on the 11th through 18th and 20th editions; co-authored *Upgrading and Repairing Networks*, Fifth Edition; and has written two books about digital photography, *Easy Digital Cameras* and *The Shot Doctor: The Amateur’s Guide to Taking Great Digital Photos*.

In addition, Mark has contributed to Que’s *Special Edition Using* series on Windows Me, Windows XP, and Windows Vista and to Que’s *Windows 7 In Depth*. He has also contributed to *Easy Windows Vista* and has written two books about Windows Vista: *Maximum PC Microsoft Windows Vista Exposed* and *Unleashing Microsoft Windows Vista Media Center*. Mark has also written two books about Windows 7: *Easy Microsoft Windows 7* and *Sams Teach Yourself Microsoft Windows 7 in 10 Minutes*. Mark has also created a number of hardware tutorial videos available from the OnGadgets&Hardware podcast channel at www.quepublishing.com.

Mark has also written many blog entries and articles for MaximumPC.com and *Maximum PC* magazine. He has taught A+ Certification and other technology-related subjects at Ivy Tech Community College in Evansville, Indiana. See Mark’s website at www.markesoper.com for news and information about upcoming projects.

David L. Prowse is an author, a computer network specialist, and a technical trainer. Over the past several years he has authored several titles for Pearson Education, including the well-received *CompTIA A+ Exam Cram*. As a consultant, he installs and secures the latest in computer and networking technology. Over the past decade he has taught CompTIA A+, Network+, and Security+ certification courses, both in the classroom and via the Internet. He runs the website www.davidlprowse.com, where he gladly answers questions from students and readers.

Dedication

For Mayer and Naomi.

Acknowledgments

After more than 12 years as a full-time technology content provider, I'm more conscious than ever of two things—how richly I have been blessed by God in my family and in the team of technology experts I get to work with.

Thanks first and foremost to Almighty God. He gives gifts and strives earnestly to help us discover them.

Thanks also to my family, PC and Mac users alike, whose good-natured discussions keep everybody looking for the perfect technology. Thanks especially to Cheryl for her love and patience. A big thanks as well to Jeremy, for performing laptop tear-downs and assisting with system builds.

As always, Pearson has put together an outstanding team for this edition, and I especially want to thank the two Daves: Dave Dusthimer for his vision of becoming the leading provider of A+ study material and Dave Prowse, my co-author, for helping make this book the best edition yet.

Thanks again to Scott Mueller, whose original edition of *Upgrading and Repairing PCs* was the impetus for taking my tech career to the next level, and for the opportunity to work with him on many projects over the years, including this one.

Thanks also to Betsy Brown, Andrew Cupp, Sandra Schroeder, and Tonya Simpson for keeping this process rolling along. And a big thank-you to technical editor Chris Crayton for great suggestions and tips along the way.

Finally, a thank you to Vanessa, Tim, and Gary.

All of us want to see you, our readers, succeed both in passing your exams and in your IT careers. We all wish you the very best.

About the Technical Editor

Chris Crayton is an author, technical editor, technical consultant, and trainer. Formerly, he worked as a computer and networking instructor at Keiser University; as network administrator for Protocol, a global electronic customer relationship management (eCRM) company; and at Eastman Kodak headquarters as a computer and network specialist. Chris has authored several print and online books on PC repair, CompTIA A+, CompTIA Security+, and Microsoft Windows. Mr. Crayton has also served as technical editor and contributor on numerous technical titles for many of the leading publishing companies. He holds MCSE, A+, and Network+ certifications.

We Want to Hear from You!

As the reader of this book, you are our most important critic and commentator. We value your opinion and want to know what we're doing right, what we could do better, what areas you'd like to see us publish in, and any other words of wisdom you're willing to pass our way.

As an associate publisher for Pearson IT Certification, I welcome your comments. You can email or write me directly to let me know what you did or didn't like about this book—as well as what we can do to make our books better.

Please note that I cannot help you with technical problems related to the topic of this book. We do have a User Services group, however, where I will forward specific technical questions related to the book.

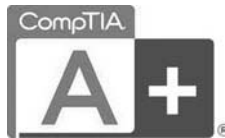
When you write, please be sure to include this book's title and author as well as your name, email address, and phone number. I will carefully review your comments and share them with the authors and editors who worked on the book.

Email: feedback@pearsonitcertification.com

Mail: David Dusthimer
Editor in Chief
Pearson IT Certification
800 East 96th Street
Indianapolis, IN 46240 USA

Reader Services

Visit our website and register this book at www.pearsonitcertification.com/register for convenient access to any updates, downloads, or errata that might be available for this book.



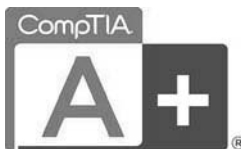
It Pays to Get Certified

In a digital world, digital literacy is an essential survival skill.

Certification proves you have the knowledge and skill to solve business problems in virtually any business environment. Certifications are highly-valued credentials that qualify you for jobs, increased compensation and promotion.



- The CompTIA A+ credential—provides foundation-level knowledge and skills necessary for a career in PC repair and support.
- Starting Salary—CompTIA A+ Certified individuals can earn as much as \$65,000 per year.
- Career Pathway—CompTIA A+ is a building block for other CompTIA certifications such as Network+, Security+ and vendor specific technologies.
- More than 850,000—Individuals worldwide are CompTIA A+ certified.
- Mandated/Recommended by organizations worldwide—Such as Cisco and HP and Ricoh, the U.S. State Department, and U.S. government contractors such as EDS, General Dynamics, and Northrop Grumman.



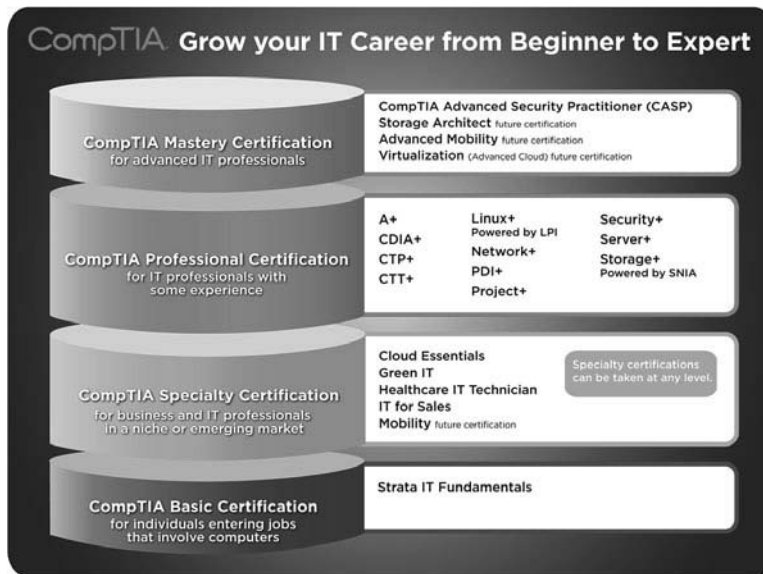
Certification Advances Your Career

Some of the primary benefits individuals report from becoming A+ certified are:

- More efficient troubleshooting
- Improved career advancement
- More insightful problem solving

CompTIA Career Pathway

CompTIA offers a number of credentials that form a foundation for your career in technology and allows you to pursue specific areas of concentration. Depending on the path you choose to take, CompTIA certifications help you build upon your skills and knowledge, supporting learning throughout your entire career.



Steps to Certification

Steps to Getting Certified and Staying Certified	
Review Exam Objectives	Review the certification objectives to make sure you know what is covered in the exam. http://www.comptia.org/certifications/testprep/examobjectives.aspx
Practice for the Exam	After you have studied for the certification, take a free assessment and sample test to get an idea what type of questions might be on the exam. http://www.comptia.org/certifications/testprep/practicetests.aspx
Purchase an Exam Voucher	Purchase your exam voucher on the CompTIA Marketplace, which is located at: www.comptiastore.com .
Take the Test!	Select a certification exam provider and schedule a time to take your exam. You can find exam providers at the following link: http://www.comptia.org/certifications/testprep/testingcenters.aspx

Join the Professional Community

Join IT Pro Community
<http://itpro.comptia.org>

The free IT Pro online community provides valuable content to students and professionals.

Career IT Job Resources

- Where to start in IT
- Career Assessments
- Salary Trends
- US Job Board

Forums on Networking, Security, Computing and Cutting Edge Technologies

Access to blogs written by Industry Experts

Current information on Cutting Edge Technologies

Access to various industry resource links and articles related to IT and IT careers

Content Seal of Quality

This courseware bears the seal of **CompTIA Approved Quality Content**.

This seal signifies this content covers 100% of the exam objectives and implements important instructional design principles. CompTIA recommends multiple learning tools to help increase coverage of the learning objectives.



Why CompTIA?

- **Global Recognition**—CompTIA is recognized globally as the leading IT non-profit trade association and has enormous credibility. Plus, CompTIA's certifications are vendor-neutral and offer proof of foundational knowledge that translates across technologies.
- **Valued by Hiring Managers**—Hiring managers value CompTIA certification because it is vendor- and technology-independent validation of your technical skills.
- **Recommended or Required by Government and Businesses**—Many government organizations and corporations either recommend or require technical staff to be CompTIA certified. (For example, Dell, Sharp, Ricoh, the U.S. Department of Defense, and many more.)
- **Three CompTIA Certifications ranked in the top 10**—In a study by DICE of 17,000 technology professionals, certifications helped command higher salaries at all experience levels.

How to obtain more information

Visit CompTIA online: www.comptia.org to learn more about getting CompTIA certified.

Contact CompTIA: Call 866-835-8020 ext. 5 or email questions@comptia.org

Connect with us :



Introduction

CompTIA A+ Certification is widely recognized as the first certification you should receive in an information technology (IT) career. Whether you are planning to specialize in PC hardware, Windows operating system management, or network management, the CompTIA A+ Certification exams measure the baseline skills you need to master to begin your journey toward greater responsibilities and achievements in IT.

CompTIA A+ Certification is designed to be a vendor-neutral exam that measures your knowledge of industry-standard technology.

Goals and Methods

The number one goal of this book is a simple one: to help you pass the 2012 version of the CompTIA A+ Certification exams 220-801 and 220-802.

Because CompTIA A+ Certification exams now stress problem-solving abilities and reasoning more than memorization of terms and facts, our goal is to help you master and understand the required objectives for each exam.

To aid you in mastering and understanding the A+ Certification objectives, this book uses the following methods:

- The beginning of each chapter defines the topics to be covered in the chapter; it also lists the corresponding CompTIA A+ objective numbers.
- The body of the chapter explains the topics from a hands-on and a theory-based standpoint. This includes in-depth descriptions, tables, and figures geared to build your knowledge so that you can pass the exam. The chapters are broken down into several topics each.
- The key topics indicate important figures, tables, and lists of information that you should know for the exam. They are interspersed throughout the chapter and are listed in table format at the end of the chapter.
- You can find memory tables and lists on the disc as Appendix A, “Memory Tables,” and Appendix B, “Memory Tables Answer Key.” Use them to help memorize important information.
- Key terms without definitions are listed at the end of each chapter. Write down the definition of each term, and check your work against the complete key terms in the glossary.

- Hand-on labs test you on your knowledge of key concepts. Develop possible solutions and check your work against the answers at the end of the chapter.
- Each chapter includes review questions meant to gauge your knowledge of the subjects. If an answer to a question doesn't come readily to you, be sure to review that portion of the chapter. The answers with detailed explanations are at the end of each chapter.

What's New?

You'll find plenty that's new and improved in this edition, including

- Updated coverage of motherboard features
- New coverage of custom system configurations
- Updated processor coverage
- Updated BIOS dialogs including UEFI BIOS examples
- USB 3.0
- SATA 6.0Gbps
- SSDs and how to fine-tune them for best performance
- Laptop teardown procedures
- Updated display technologies
- Video and display troubleshooting
- New seven-step laser printing process
- Better coverage of color laser printers
- New coverage of dealing with prohibited content/activity
- Enhanced coverage of Windows features
- Enhanced discussion of Windows upgrade paths and methods
- Windows 7 Enterprise features
- Virtualization
- Windows Virtual PC and Windows XP Mode
- Improved Control Panel discussion
- New Mobility domain covering iOS and Android devices

- Best practices for security (physical, digital, wireless network, wired network, and workstation folders)
- Drive wiping and destruction methods
- Security troubleshooting
- Wireless network troubleshooting

For a number of years, the CompTIA A+ Certification objectives were divided into a hardware exam and an operating systems exam. Starting with the 2006 exam, the exams were restructured so that knowledge of hardware and operating systems were needed for both exams. With the 2012 edition, the exams have been restructured again in a way that, we believe, will help you prepare more easily and avoid duplication of information. 220-801 covers hardware topics and operational procedures, whereas 220-802 covers operating systems, security, a brand new mobile devices domain, and troubleshooting.

For more information about how the A+ certification can help your career, or to download the latest official objectives, access CompTIA's A+ webpage at www.comptia.org/certifications/listed/a.aspx.

One method used by many A+ certification authors is to simply follow the objectives step by step. The problem is that because different parts of the computer—such as hard disk, display, Windows, and others—are covered in many different objectives, this approach creates a lot of overlap between chapters and does not help readers understand exactly how a particular part of the computer fits together with the rest.

In this book, we have used a subsystem approach. Each chapter is devoted to a particular part of the computer so that you understand how the components of each part work together and how each part of the computer works with other parts. To make sure you can relate the book's contents to the CompTIA A+ Certification objectives, each chapter contains cross-references to the appropriate objectives as needed, and we provide a master cross-reference list later in this introduction.

Who Should Read This Book?

The CompTIA A+ exams measure the necessary competencies for an entry-level IT professional with the equivalent knowledge of at least 500 hours of hands-on experience in the lab or field. This book is written for people who have that amount of experience working with desktop PCs and laptops. Average readers will have attempted in the past to replace a hardware component within a PC; they should also understand how to navigate through Windows and access the Internet.

Readers will range from people who are attempting to attain a position in the IT field to people who want to keep their skills sharp or perhaps retain their job due to a company policy that mandates that they take the new exams.

This book is also aimed at the reader who wants to acquire additional certifications beyond the A+ certification (Network+, Security+, and so on). The book is designed in such a way to offer easy transition to future certification studies.

Strategies for Exam Preparation

Strategies for exam preparation will vary depending on your existing skills, knowledge, and equipment available. Of course, the ideal exam preparation would consist of building a PC from scratch and installing and configuring the operating systems covered including Windows 7 (Ultimate edition is recommended), Windows Vista (Ultimate edition is preferred), and Windows XP Professional. To make things easier for the reader, we recommend that you use Microsoft's Windows Virtual PC (which works with Windows 7 Professional, Ultimate, and Enterprise) or Virtual PC 2007 (which works with other Windows 7 editions, Windows Vista, and Windows XP). Either program enables you to run virtual operating systems from within your current operating system without the need for an additional computer and can be downloaded for free from Microsoft's website. We also recommend that you have access to a laptop, a laser printer, and as many peripheral PC devices as possible. This hands-on approach will really help to reinforce the ideas and concepts expressed in the book. However, not everyone has access to this equipment, so the next best step you can take is to read through the chapters in this book, jotting down notes with key concepts or configurations on a separate notepad. Each chapter contains a quiz that you can use to test your knowledge of the chapter's topics. It's located near the end of the chapter.

After you have read through the book, look at the current exam objectives for the CompTIA A+ Certification Exams listed at <http://certification.comptia.org/home.aspx>. If there are any areas shown in the certification exam outline that you would still like to study, find those sections in the book and review them.

When you feel confident in your skills, attempt the practice exams included on the disc with this book. As you work through the practice exams, note the areas where you lack confidence and review those concepts or configurations in the book. After you review the areas, work through the practice exam a second time and rate your skills. Keep in mind that the more you work through the practice exam, the more familiar the questions will become.

After you have worked through the practice exams a second time and feel confident with your skills, schedule the real CompTIA A+ 220-801 and 220-802 exams through either Sylvan Prometric (www.2test.com) or Pearson Vue (www.vue.com).

To prevent the information from evaporating out of your mind, you should typically take the exam within a week of when you consider yourself ready to take the exam.

The CompTIA A+ Certification credential for those passing the certification exams is now valid for 3 years (effective January 1, 2011). To renew your certification without retaking the exam, you must participate in continuing education (CE) activities and pay an annual maintenance fee of \$25.00 (\$75.00 for 3 years). To learn more about the certification renewal policy, see <http://certification.comptia.org/getCertified/stayCertified.aspx>.

CompTIA A+ 220-801 and 220-802 Exam Objectives

Table I-1 lists the objectives and the chapters where they are covered. Be sure to check <http://certification.comptia.org/home.aspx> for any updates to the objectives.

Table I-1 CompTIA A+ 220-801 and 220-802 Exam Objectives

Objective	Chapters
220-801	
1.0 PC Hardware	
1.1 Configure and apply BIOS settings.	1, 3
1.2 Differentiate between motherboard components, their purposes, and properties.	1, 2
1.3 Compare and contrast RAM types and features.	1, 5
1.4 Install and configure expansion cards.	7, 8
1.5 Install and configure storage devices and use appropriate media.	1, 12
1.6 Differentiate among various CPU types and features and select the appropriate cooling method.	1, 2
1.7 Compare and contrast various connection interfaces and explain their purpose.	1, 6, 7
1.8 Install an appropriate power supply based on a given scenario.	1, 4
1.9 Evaluate and select appropriate components for a custom configuration, to meet customer specifications or needs.	8
1.10 Given a scenario, evaluate types and features of display devices.	1, 7
1.11 Identify connector types and associated cables.	1, 6, 7
1.12 Install and configure various peripheral devices.	6, 8
2.0 Networking	
2.1 Identify types of network cables and connectors.	16
2.2 Categorize characteristics of connectors and cabling.	16

Table I-1 Continued

Objective	Chapters
2.3 Explain properties and characteristics of TCP/IP.	16
2.4 Explain common TCP and UDP ports, protocols, and their purpose.	16
2.5 Compare and contrast wireless networking standards and encryption types.	16
2.6 Install, configure, and deploy a SOHO wireless/wired router using appropriate settings.	16
2.7 Compare and contrast Internet connection types and features.	16
2.8 Identify various types of networks.	16
2.9 Compare and contrast network devices their functions and features.	16
2.10 Given a scenario, use appropriate networking tools.	16
3.0 Laptops	
3.1 Install and configure laptop hardware and components.	9
3.2 Compare and contrast the components within the display of a laptop.	9
3.3 Compare and contrast laptop features.	9
4.0 Printers	
4.1 Explain the differences between the various printer types and summarize the associated imaging process.	11
4.2 Given a scenario, install, and configure printers.	11
4.3 Given a scenario, perform printer maintenance.	11
5.0 Operational Procedures	
5.1 Given a scenario, use appropriate safety procedures.	18
5.2 Explain environmental impacts and the purpose of environmental controls.	4, 18
5.3 Given a scenario, demonstrate proper communication and professionalism.	18
5.4 Explain the fundamentals of dealing with prohibited content/activity.	18
220-802	
1.0 Operating Systems	
1.1 Compare and contrast the features and requirements of various Microsoft Operating Systems.	14
1.2 Given a scenario, install, and configure the operating system using the most appropriate method.	13
1.3 Given a scenario, use appropriate command line tools.	14
1.4 Given a scenario, use appropriate operating system features and tools.	13, 14
1.5 Given a scenario, use Control Panel utilities (the items are organized by “classic view/large icons” in Windows).	14

Objective	Chapters
1.6 Setup and configure Windows networking on a client/desktop.	16
1.7 Perform preventive maintenance procedures using appropriate tools.	15
1.8 Explain the differences among basic OS security settings.	17
1.9 Explain the basics of client-side virtualization.	14
2.0 Security	
2.1 Apply and use common prevention methods.	17
2.2 Compare and contrast common security threats.	17
2.3 Implement security best practices to secure a workstation.	17
2.4 Given a scenario, use the appropriate data destruction/disposal method.	17
2.5 Given a scenario, secure a SOHO wireless network.	17
2.6 Given a scenario, secure a SOHO wired network.	17
3.0 Mobile Devices	
3.1 Explain the basic features of mobile operating systems.	10
3.2 Establish basic network connectivity and configure email.	10
3.3 Compare and contrast methods for securing mobile devices.	10
3.4 Compare and contrast hardware differences in regards to tablets and laptops.	10
3.5 Execute and configure mobile device synchronization.	10
4.0 Troubleshooting	
4.1 Given a scenario, explain the troubleshooting theory.	1
4.2 Given a scenario, troubleshoot common problems related to motherboards, RAM, CPU and power with appropriate tools.	1, 2, 3, 4, 5, 6
4.3 Given a scenario, troubleshoot hard drives and RAID arrays with appropriate tools.	1, 12
4.4 Given a scenario, troubleshoot common video and display issues.	7
4.5 Given a scenario, troubleshoot wired and wireless networks with appropriate tools.	1, 16
4.6 Given a scenario, troubleshoot operating system problems with appropriate tools.	15
4.7 Given a scenario, troubleshoot common security issues with appropriate tools and best practices.	17
4.8 Given a scenario, troubleshoot, and repair common laptop issues while adhering to the appropriate procedures.	9
4.9 Given a scenario, troubleshoot printers with appropriate tools.	1, 11

Pearson IT Certification Practice Test Engine and Questions on the Disc

The disc in the back of the book includes the Pearson IT Certification Practice Test engine—software that displays and grades a set of exam-realistic multiple-choice questions. Using the Pearson IT Certification Practice Test engine, you can either study by going through the questions in *Study Mode* or take a simulated exam that mimics real exam conditions.

The installation process requires two major steps: installing the software and then activating the exam. The disc in the back of this book has a recent copy of the Pearson IT Certification Practice Test engine. The practice exam—the database of exam questions—is not on the disc.

NOTE The cardboard disc case in the back of this book includes the disc and a piece of paper. The paper lists the activation code for the practice exam associated with this book. Do not lose the activation code. On the opposite side of the paper from the activation code is a unique, one-time use coupon code for the purchase of the Premium Edition eBook and Practice Test.

Install the Software from the Disc

The Pearson IT Certification Practice Test is a Windows-only desktop application. You can run it on a Mac using a Windows Virtual Machine, but it was built specifically for the PC platform. The minimum system requirements are

- Windows XP (SP3), Windows Vista (SP2), or Windows 7
- Microsoft .NET Framework 4.0 Client
- Microsoft SQL Server Compact 4.0
- Pentium class 1GHz processor (or equivalent)
- 512MB RAM
- 650MB disc space plus 50MB for each downloaded practice exam

The software installation process is pretty routine compared with other software installation processes. If you have already installed the Pearson IT Certification Practice Test software from another Pearson product, there is no need for you to reinstall the software. Simply launch the software on your desktop and proceed to activate the practice exam from this book by using the activation code included in the disc sleeve.

The following steps outline the installation process:

- Step 1.** Insert the disc into your PC.
- Step 2.** The software that automatically runs is the Pearson software to access and use all disc-based features, including the exam engine and the disc-only appendixes. From the main menu, click the option to **Install the Exam Engine**.
- Step 3.** Respond to windows prompts as with any typical software installation process.

The installation process gives you the option to activate your exam with the activation code supplied on the paper in the disc sleeve. This process requires that you establish a Pearson website login. You need this login to activate the exam, so please do register when prompted. If you already have a Pearson website login, there is no need to register again. Just use your existing login.

Activate and Download the Practice Exam

After the exam engine is installed, you should then activate the exam associated with this book (if you did not do so during the installation process) as follows:

- Step 1.** Start the Pearson IT Certification Practice Test software from the Windows **Start** menu or from your desktop shortcut icon.
- Step 2.** To activate and download the exam associated with this book, from the **My Products** or **Tools** tab, select the **Activate** button.
- Step 3.** At the next screen, enter the Activation Key from the paper inside the cardboard disc holder in the back of the book. When entered, click the **Activate** button.
- Step 4.** The activation process downloads the practice exam. Click **Next** and then click **Finish**.

After the activation process finishes, the **My Products** tab should list your new exam. If you do not see the exam, make sure you have selected the **My Products** tab on the menu. At this point, the software and practice exam are ready to use. Simply select the exam, and click the **Open Exam** button.

To update a particular exam you have already activated and downloaded, simply select the **Tools** tab, and select the **Update Products** button. Updating your exams will ensure you have the latest changes and updates to the exam data.

If you want to check for updates to the Pearson Cert Practice Test exam engine software, simply select the **Tools** tab, and select the **Update Application** button. This will ensure you are running the latest version of the software engine.

Activating Other Exams

The exam software installation process, and the registration process, must happen only once. Then, for each new exam, only a few steps are required. For instance, if you buy another new Pearson IT Certification Cert Guide or Cisco Press Official Cert Guide, extract the activation code from the disc sleeve in the back of that book—you don't even need the disc at this point. From there, all you need to do is start the exam engine (if not still up and running), and perform Steps 2–4 from the previous list.

Premium Edition

In addition to the two free practice exams provided on the disc, you can purchase two additional exams with expanded functionality directly from Pearson IT Certification. The Premium Edition eBook and Practice Test for this title contains two additional full practice exams as well as an eBook (in both PDF and ePub format). In addition, the Premium Edition title also has remediation for each question to the specific part of the eBook that relates to that question.

If you have purchased the print version of this title, you can purchase the Premium Edition at a deep discount. There is a coupon code in the disc sleeve that contains a one-time use code as well as instructions for where you can purchase the Premium Edition.

To view the premium edition product page, go to www.informit.com/title/978078978492.

This page intentionally left blank



This chapter covers the following subjects:

- **Power Supplies**—This section describes the device that transforms AC power from the wall outlet into DC power that your computer can use. It also describes the various form factors and voltage levels, and how to protect your power supply.
- **Troubleshooting Power Problems**—This section demonstrates how to troubleshoot complete failure and intermittent power supply problems that you might encounter.
- **Avoiding Power Supply Hazards**—This section has guidelines for avoiding shock and fire hazards when working with power supplies.
- **Power Protection Types**—In this section you learn about devices that can protect your computer from over and under voltage issues. These include surge protectors, uninterruptible power supplies, and line conditioners.
- **System Cooling**—This last section describes the various ways to cool your system, including fans and liquid cooling, and demonstrates how to monitor the system temperature.

This chapter covers **CompTIA A+ 220-801 objectives 1.8 and 5.2** and **CompTIA A+ 220-802 objective 4.2**.

Power Supplies and System Cooling

Clean, well-planned power is imperative, from the AC outlet to the electrical protection equipment to the power supply. Many of the issues that you see concerning power are due to lack of protection or improper planning, and as such you will see several questions on the A+ exams regarding this subject.

In this chapter we delve into how power is conveyed to the computer, which power supply to select depending on your configuration and needs, how to install and troubleshoot power supplies, and how to cool the system.

Foundation Topics

Power Supplies

220-801**Objective:****220-801: 1.8**

Power issues are largely ignored by most computer users, but a properly working power supply is the foundation to correct operation of the system. When the power supply stops working, the computer stops working, and when a power supply stops functioning properly—even slightly—all sorts of computer problems can take place. From unexpected system reboots to data corruption, from unrecognized bus-powered USB devices to system overheating, a bad power supply is bad news. The power supply is vital to the health of the computer. So, if your computer is acting “sick,” you should test the power supply to see if it’s the cause. To keep the power supply working properly, use surge suppression and battery backup (UPS) units.

**Key
Topic**

The **power supply** is really misnamed: It is actually a power converter that changes high-voltage alternating current (**AC**) to low-voltage direct current (**DC**). There are lots of wire coils, capacitors, and other components inside the power supply that do the work, and during the conversion process, a great deal of heat is produced. Most power supplies include one or two fans to dissipate the heat created by the operation of the power supply; however, a few power supplies designed for silent operation use passive heat sink technology instead of fans. On power supplies that include fans, fans also help to cool the rest of the computer. Figure 4-1 shows a typical desktop computer’s power supply.

Power Supply Ratings

**Key
Topic**

Power supply capacity is rated in watts, and the more watts a power supply provides, the more devices it can safely power.

You can use the label attached to the power supply, shown in Figure 4-2, to determine its wattage rating and see important safety reminders.

**Key
Topic**

Figure 4-1 A typical ATX power supply.

NOTE The power supply shown in Figure 4-2 is a so-called “split rail” design with two separate 12V outputs ($+12V_1$ and $+12V_2$). This type of design is frequently used today to provide separate 12V power sources for processors (which reduce 12V power to the power level needed) and other devices such as PCI Express video cards, fans, and drives). Add the values together to get the total 12V output in amps (34A).

Typically, power supplies in recent tower-case (upright case) machines use 400-watt or larger power supplies, reflecting the greater number of drives and cards that can be installed in these computers. Power supplies used in slimline desktop computers have typical ratings of around 220–300 watts. The power supply rating is found on the top or side of the power supply, along with safety rating information and amperage levels produced by the power supply’s different DC outputs.

How can you tell whether a power supply meets minimum safety standards? Look for the appropriate safety certification mark for your country or locale. For example, in the U.S. and Canada, the backward UR logo is used to indicate the power supply has the UL and UL Canada safety certifications as a component (the familiar circled UL logo is used for finished products only).



1. Power supply rating
2. AC input voltage levels
3. DC output levels by type
4. +3.3V, +5V, and +12V maximum load
5. Hazard warnings
6. Product certifications

Figure 4-2 A typical power supply label.

CAUTION Power supplies that do not bear the UL or other certification marks should not be used, as their safety is unknown. For a visual guide to electrical and other safety certification marks in use around the world, visit the Standard Certification Marks page at www.technick.net/public/code/cp_dpape.php?aiocp_dp=guide_safetymarks.

Key Topic

Use the following methods to determine the wattage rating needed for a replacement power supply:

- Whip out your calculator and add up the wattage ratings for everything connected to your computer that uses the power supply, including the motherboard, processor, memory, cards, drives, and bus-powered USB devices. If the total wattage used exceeds 70% of the wattage rating of your power supply, you should upgrade to a larger power supply. Check the vendor spec sheets for wattage ratings.
- If you have amperage ratings instead of wattage ratings, multiply the amperage by the volts to determine wattage and then start adding. If a device uses two or three different voltage levels, be sure to carry out this calculation for each voltage level, and add up the figures to determine the wattage requirement for the device.
- Use an interactive power supply sizing tool such as the calculators provided by eXtreme Outervision (www.extreme.outervision.com) or PC Power and Cooling (www.pcpower.com).

Table 4-1 provides calculations for typical compact desktop and performance desktop systems.

Table 4-1 Calculating Power Supply Requirements

MicroATX System with Integrated Video		Full-Size ATX System with SLI (Dual Graphics Cards)	
Components	Wattage	Components	Wattage
AMD A8 3800 (4 core with in-core graphics and L2 cache)	65	Intel Core i7-3960X Extreme Edition (6 cores with L3 cache)	130
microATX motherboard	60	ATX motherboard	100
4GB RAM	60	8GB RAM	120
Rewritable DVD drive	30	Rewritable Blu-ray drive	30
SATA hard disk	20	SATA hard disk	20
Two case fans	6	Three case fans	9
CPU fan	3	CPU fan	3
Integrated graphics (in CPU)	—	High-end SLI video cards (2)	210 (105×2)
Estimated wattage	244	Estimated wattage	622
Minimum power supply size recommended (80% efficiency assumed)	350	Minimum power supply size recommended (80% efficiency assumed)	750

NOTE The 80 PLUS certification standard is an industry standard for evaluating power supply efficiency. 80 PLUS certified power supplies achieve 80% efficiency at up to 100% of rated load. The use of power supplies with 80 PLUS certification is assumed in Table 4-1. Higher standards (80 PLUS Bronze, Silver, Gold, and Platinum) achieve up to 89% efficiency at 100% of rated load on 115V power and up to 91% on 230V power. For more information, see the Ecova Plug Load Solutions website at <http://www.plugloadsolutions.com/>. For non-80 PLUS power supplies, assume 70% efficiency.

Multivoltage Power Supplies



Most power supplies are designed to handle two different voltage ranges:

- 110–120V/60Hz
- 220–240V/50Hz

Standard North American power is now 115–120V/60Hz-cycle AC (the previous standard was 110V). The power used in European and Asian countries is typically 230–240V/50Hz AC (previously 220V). Power supplies typically have a slider switch with two markings: 115 (for North American 110–120V/60Hz AC) and 230 (for European and Asian 220–240V/50Hz AC). Figure 4-3 shows a slider switch set for correct North American voltage. If a power supply is set to the wrong input voltage, the system will not work. Setting a power supply for 230V with 110–120V current is harmless; however, feeding 220–240V into a power supply set for 115V will destroy the power supply, and possibly other onboard hardware.

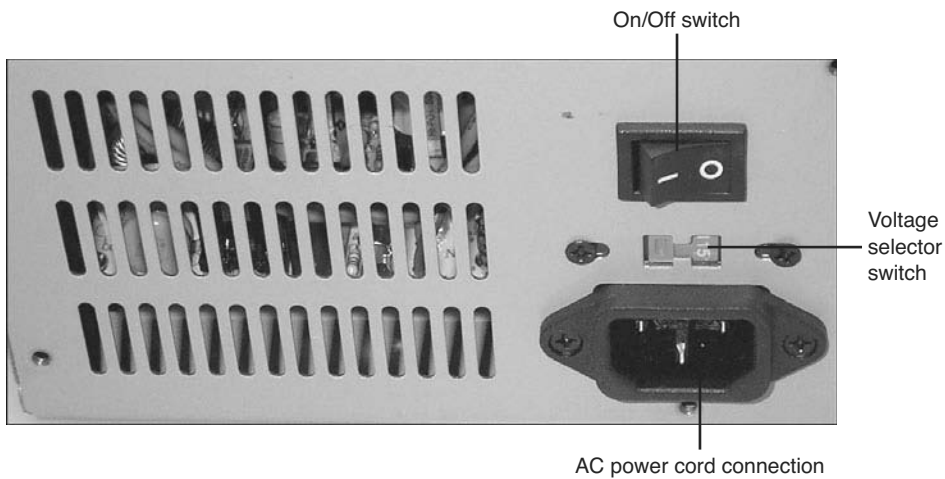


Figure 4-3 A typical power supply's sliding voltage switch set for correct North American voltage (115V). Slide it to 230V for use in Europe and Asia.

NOTE Note that some power supplies for desktop and notebook computers can automatically determine the correct voltage level and cycle rate. These are referred to as *autoswitching power supplies* and lack the voltage/cycle selection switch shown in Figure 4-3.

The on/off switch shown in Figure 4-3 controls the flow of current into the power supply. It is not the system power switch, which is located on the front of most recent systems and is connected to the motherboard. When you press the system power switch, the motherboard signals the power supply to provide power.

CAUTION Unless the power supply is disconnected from AC current or is turned off, a small amount of power can still be flowing through the system, even when it is not running. Do not install or remove components or perform other types of service to the inside of a PC unless you disconnect the AC power cord or turn off the power supply. Wait a few seconds afterward to ensure that the power is completely off. Some desktop motherboards have indicator lights that turn off when the power has completely drained from the system.

Power Supply Form Factors and Connectors

When you shop for a power supply, you also need to make sure it can connect to your motherboard. There are two major types of power connectors on motherboards:

- 20-pin, used by older motherboards in the ATX family
- 24-pin, used by recent ATX/BTX motherboards requiring the ATX12V 2.2 power supply standard

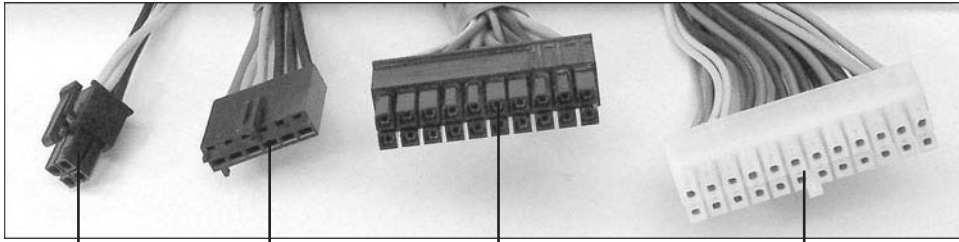
Some high-wattage power supplies with 20-pin connectors might also include a 20-pin to 24-pin adapter. Some 24-pin power supplies include a 24-pin to 20-pin connector.

Some motherboards use power supplies that feature several additional connectors to supply added power, as follows (see Figure 4-4):

- The four-wire square ATX12V connector provides additional 12V power to the motherboard; this connector is sometimes referred to as a “P4” or “Pentium 4” connector.
- Many recent high-end power supplies use the eight-wire EPS12V connector (see Figure 4-6) instead of the ATX12V power connector. Often, the EPS12V lead is split into two four-wire square connectors to be compatible with motherboards that use either ATX12V or EPS12V power leads.
- Some older motherboards use a six-wire AUX connector to provide additional power.

Figure 4-5 lists the pinouts for the 20-pin and 24-pin ATX power supply connectors shown in Figure 4-4.

Key Topic



ATX12V secondary AUX secondary ATX primary (20-pin) ATX12V 2.2 primary (24-pin)

Figure 4-4 20-pin ATX and 24-pin ATX power connectors compared to four-pin ATX12V and six-wire AUX power connectors.

Key Topic

ATX 20-pin power connector (top view)

11	+3.3v	Orange	Orange	+3.3v	1
12	-12v	Blue	Orange	+3.3v	2
13	Ground	Black	Black	Ground	3
14	PS-On	Green	Red	+5v	4
15	Ground	Black	Black	Ground	5
16	Ground	Black	Red	+5v	6
17	Ground	Black	Black	Ground	7
18	-5v	White	Gray	Power Good	8
19	+5v	Red	Purple	+5v Standby	9
20	+5v	Red	Yellow	+12v	10

ATX version 2.2 24-pin power connector (top view)

13	+3.3v	Orange	Orange	+3.3v	1
14	-12v	Blue	Orange	+3.3v	2
15	Ground	Black	Black	Ground	3
16	PS-On	Green	Red	+5v	4
17	Ground	Black	Black	Ground	5
18	Ground	Black	Red	+5v	6
19	Ground	Black	Black	Ground	7
20	NC	White	Gray	Power Good	8
21	+5v	Red	Purple	+5v Standby	9
22	+5v	Red	Yellow	+12v	10
23	+5v	Red	Yellow	+12v	11
24	Ground	Black	Orange	+3.3v	12

Figure 4-5 Pinout for standard ATX 20-pin and 24-pin power connectors.

The power supply also powers various peripherals, such as the following:

- PATA hard disks, CD and DVD optical drives, and case fans that do not plug into the motherboard use a four-pin Molex power connector.
- 3.5-inch floppy drives use a four-pin Berg power connector.
- Serial ATA (SATA) hard disks use an L-shaped 15-pin thinline power connector.
- High-performance PCI Express x16 video cards that require additional 12V power use a PCI Express six-pin or eight-pin power cable.

Figure 4-6 illustrates these power connectors.

Key
Topic

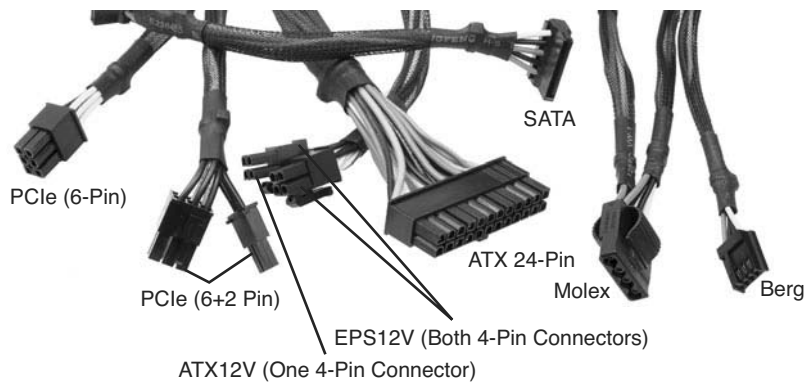


Figure 4-6 Power supply connectors for peripherals and modern motherboards.

If your power supply doesn't have enough connectors, you can add Y-splitters to divide one power lead into two, but these can short out and can also reduce your power supply's efficiency. You can also convert a standard Molex connector into an SATA or floppy drive power connector with the appropriate adapter.

Some power supplies (see Figure 4-7) use modular connections so that you can customize the power supply connections needed for your hardware.

CAUTION Many recent and older Dell desktop computers use proprietary versions of the 20-pin or 24-pin ATX power supply connectors. Dell's versions use a different pinout that routes voltages to different wires than in standard power supplies. Consequently, if you plug a standard power supply into a Dell PC that uses the proprietary version or use a regular motherboard as an upgrade for a model that has the proprietary power supply, stand by for smoke and fire! To determine whether a particular Dell computer model requires a proprietary power supply, check the PC Power and Cooling PSU recommendation for your Dell system at www.pcpower.com/Dell.html.



Figure 4-7 A modular power supply includes cables you can attach to customize support for your system's needs.

If your wattage calculations or your tests (covered later in this chapter) agree that it's time to replace the power supply, make sure the replacement meets the following criteria:

- Have the same power supply connectors and the same pinout as the original.
- Have the same form factor (shape, size, and switch location)
- Have the same or higher wattage rating; a higher wattage rating is highly desirable
- Support any special features required by your CPU, video card, and motherboard, such as SLI support (support for PCI Express connectors to power dual high-performance PCI Express x16 video cards), high levels of +12V power (ATX12V v2.2 4-pin or EPS12V 8-pin power connectors), and so on

TIP To ensure form factor connector compatibility, consider removing the old power supply and taking it with you if you plan to buy a replacement at retail. If you are buying a replacement online, measure the dimensions of your existing power supply to ensure that a new one will fit properly in the system.

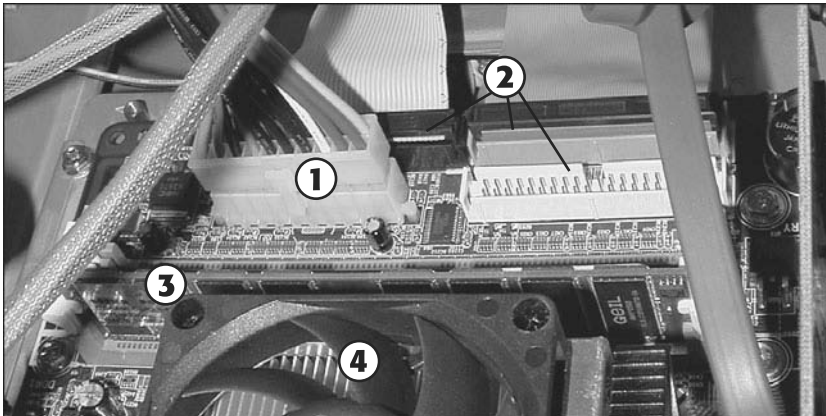
Removing and Replacing the Power Supply

Installing a new power supply is one of the easier repairs to make. You don't need to fiddle with driver CDs or Windows Update to get the new one working. But, you do need to be fairly handy with a screwdriver or nut driver.

Typical power supplies are held in place by several screws that attach the power supply to the rear panel of the computer. The power supply also is supported by a shelf inside the case, and screws can secure the power supply to that shelf. To remove a power supply, follow these steps:

Key Topic

- Step 1.** Power down the computer. If the power supply has an on/off switch, turn it off as well.
- Step 2.** Disconnect the AC power cord from the computer.
- Step 3.** Open the case to expose the power supply, which might be as simple as removing the cover on a desktop unit or as involved as removing both side panels, front bezel, and case lid on a tower PC. Consult the documentation that came with your computer to determine how to expose the power supply for removal.
- Step 4.** Disconnect the existing power supply from the motherboard (see Figure 4-8). The catch securing the power supply connector must be released to permit the connector to be removed.



1. Catch securing power supply connector
2. PATA/IDE drive connectors
3. Memory module
4. Active heat sink for processor

Figure 4-8 Disconnecting the power supply from the motherboard.

- Step 5.** Disconnect all other power supply leads to the motherboard (fan monitors, ATX12V, EPS12V, AUX).
- Step 6.** Disconnect the power supply from all drives and add-on cards.
- Step 7.** Disconnect the power supply from all fans.
- Step 8.** Remove the power supply screws from the rear of the computer case (see Figure 4-9).

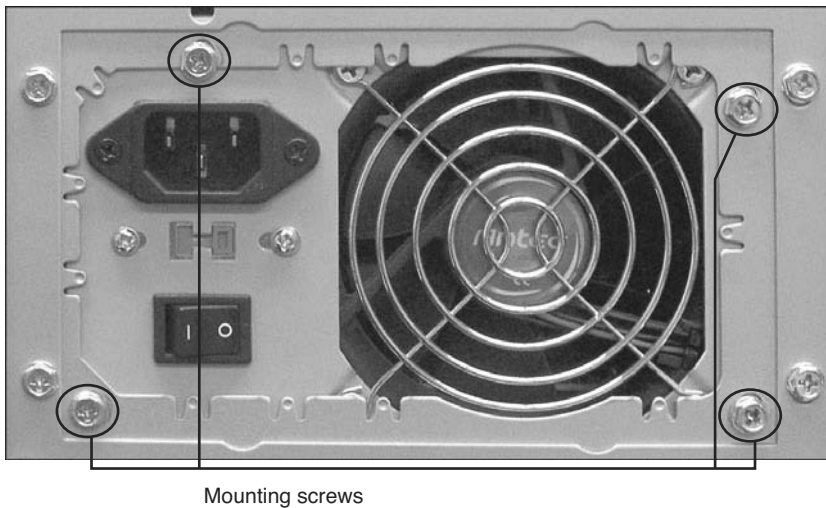


Figure 4-9 Removing the mounting screws from a typical power supply.

- Step 9.** Remove any screws holding the power supply in place inside the case. (Your PC might not use these additional screws.)
- Step 10.** Lift or slide the power supply out of the case.

Before installing the replacement power supply, compare it to the original, making sure the form factor, motherboard power connectors, and switch position match the original. If the new power supply has a fan on top (as well as the typical rear-mounted fan), make sure the fan faces the inside of the case.

To install the replacement power supply, follow these steps:

- Step 1.** Lift or slide the power supply into the case.
- Step 2.** Attach the power supply to the shelf with screws (if required).
- Step 3.** Slide the power supply to the rear of the computer case; line up the holes in the unit carefully with the holes in the outside of the case.

- Step 4.** Connect the power supply to all fans, drives, add-on cards, and motherboard.
- Step 5.** Check the voltage setting on the power supply. Change it to the correct voltage for your location if necessary.
- Step 6.** Connect the AC power cord to the new power supply.
- Step 7.** Turn on the computer.
- Step 8.** Start the system normally to verify correct operation, and then run the normal shutdown procedure for the operating system. If necessary, turn off the system with the front power switch only.
- Step 9.** Close the case and secure it.

Troubleshooting Power Supplies

220-802

Objective:
220-802: 4.2

Problems with power supplies can cause a variety of symptoms, including

- Overheating
- Spontaneous rebooting
- Intermittent device failure (particularly of bus-powered USB devices)
- Loud noises

What can cause these symptoms, and how can you solve the problems behind the symptoms?

Overloaded Power Supplies—Symptoms and Solutions

**Key
Topic**

What happens if you connect devices that require more wattage than a power supply can provide? This is a big problem called an *overload*. An overloaded power supply has three major symptoms:

- Overheating
- Spontaneous rebooting (cold boot with memory test) due to incorrect voltage on the Power Good line running from the power supply to the motherboard

- Intermittent failures of USB bus-powered devices (mice, keyboard, USB flash drives, portable USB hard disks) because these devices draw power from the system's power supply via the USB port

Here's a good rule of thumb: If your system starts spontaneously rebooting and you don't see a blue screen (STOP) error, replace the power supply as soon as possible. However, power supply overheating can have multiple causes; follow the steps listed in the section "Overheating," later in this chapter, before replacing an overheated power supply.

To determine whether Power Good or other motherboard voltage levels are within limits, perform the measurements listed in the section "Testing Power Supplies and Other Devices with a Multimeter," later in this chapter.

Loud Noises from the Power Supply

Key Topic

Computers usually run quietly, but if you hear loud noises coming from the power supply, it's a sure sign of problems. A whirring, rattling, or thumping noise while the system is on usually indicates a fan failure. If a fan built in to a component such as a heat sink or power supply is failing, replace the component immediately.

CAUTION Should you try to replace a standard power supply fan? No. Because the power supply is a sealed unit, you would need to remove the cover from most power supplies to gain access to the fan. The capacitors inside a power supply retain potentially *lethal* electrical charges. Instead, scrap the power supply and replace it with a higher-rated unit. Refer to the section "Removing and Replacing the Power Supply," earlier in the chapter.

A power supply that makes a loud bang, followed by a system crash, has had an onboard capacitor blow up. The easiest way to diagnose this is to smell the power supply after turning it off and disconnecting it from AC power. If you can smell a burnt odor with a chemical overtone to it coming from the power supply's outside vent, your power supply has died. This odor can linger for weeks. Sadly, when a power supply blows up like this, it can also destroy the motherboard, bus-powered USB devices connected to the computer, and other components.

**Key
Topic****Finding Solutions to a “Dead” System**

A dead system that gives no signs of life when turned on can be caused by the following:

- Defects in AC power to the system
- Power supply failure or misconfiguration
- Temporary short circuits in internal or external components
- Power supply or other component failure

With four suspects, it's time to play detective. Use the procedure outlined next to find the actual cause of a dead system. If one of the test procedures in the following list corrects the problem, the item that was changed is the cause of the problem. Power supplies have a built-in safety feature that shuts down the unit immediately in case of short circuit.

**Key
Topic**

The following steps are designed to determine whether the power problem is caused by a short circuit or another problem:

- Step 1.** Smell the power supply's outside vent. If you can detect a burnt odor, the power supply has failed (see previous section).
- Step 2.** Check the AC power to the system; a loose or disconnected power cord, a disconnected surge protector, a surge protector that has been turned off, or a dead AC wall socket will prevent a system from receiving power. If the wall socket has no power, reset the circuit breaker in the electrical service box for the location.
- Step 3.** Check the AC voltage switch on the power supply; it should be set to 115V for North America. Turn off the power, reset the switch, and restart the system if the switch was set to 230V. Note that many desktop computer power supplies no longer require a switch selection because they are autoranging.

CAUTION If your area uses 230V and the power supply is set to 115V, you need a new power supply and possibly other components, because they've been damaged or destroyed by 100% overvoltage.

- Step 4.** If the system uses a PS/2 mouse or keyboard, check the connectors; a loose keyboard connector could cause a short circuit.

- Step 5.** Turn off the system, disconnect power, and open the system. Verify that the power leads are properly connected to the motherboard. Connect loose power leads, reconnect power, and restart the computer.
- Step 6.** Check for loose screws or other components such as loose slot covers, modem speakers, or other metal items that can cause a short circuit. Correct them and retest.
- Step 7.** Remove all expansion cards and disconnect power to all drives; restart the system and use a multimeter to test power to the motherboard per Table 4-3.
- Step 8.** If the power tests within accepted limits with all peripherals disconnected, reinstall one card at a time and check the power. If the power tests within accepted limits, reattach one drive at a time and check the power.
- Step 9.** If a defective card or drive has a dead short, reattaching the defective card or drive should stop the system immediately upon power-up. Replace the card or drive and retest.
- Step 10.** Check the Power Good line at the power supply motherboard connector with a multimeter.

It's a long list, but chances are you will track down the offending component before you reach the end of it.

Overheating

Key Topic

Got an overheated power supply? Not sure? If you touch the power supply case and it's too hot to touch, it's overheated. Overheated power supplies can cause system failure and possible component damage, due to any of the following causes:

- Overloading
- Fan failure
- Inadequate airflow outside the system
- Inadequate airflow inside the system
- Dirt and dust

Use the following sections to figure out the possible effects of these problems in any given situation.

Overloading

An overloaded power supply is caused by connecting devices that draw more power (in watts) than the power supply is designed to handle. As you add more card-based devices to expansion slots, use more bus-powered USB and IEEE-1394 drives and devices, and install more internal drives in a system, the odds of having an overloaded power supply increase.

If a power supply fails or overheats, check the causes listed in the following sections before determining whether you should replace the power supply. If you determine that you should replace the power supply, purchase a unit that has a higher wattage rating.

Fan Failure

The fan(s) inside the power supply cool it and are partly responsible for cooling the rest of the computer. If they fail, the power supply and the entire computer are at risk of damage. Fans also might stop turning as a symptom of other power problems.

A fan that stops immediately after the power comes on usually indicates incorrect input voltage or a short circuit. If you turn off the system and turn it back on again under these conditions, the fan will stop each time.

To determine whether a fan has failed, listen to the unit; it should make less noise if the fan has failed. You can also see the fan blades spinning rapidly on a power supply fan that is working correctly. If the blades aren't turning or are turning very slowly, the fan has failed or is too clogged with dust to operate correctly.

To determine whether case fans have failed, look at them through the front or rear of the system, or, if they are connected to the motherboard, use the system monitoring feature in the system BIOS to check fan speed. Figure 4-10 illustrates a typical example.

NOTE If a fan has failed because of a short circuit or incorrect input voltage, you will not see any picture onscreen because the system cannot operate.

If the system starts normally but the fan stops turning later, this indicates a true fan failure instead of a power problem.

PC Health Status	
Chassis Intrusion	Disabled
CPU Fan Detection	Enabled
CPU Temperature	49°C/120°F
System Temperature	35°C/95°F
CPU Fan Speed	5000 RPM
System Fan Speed	0 RPM
Vcore	1.744 V
+ 5.0V	5.030 V
+12.0V	12.288 V
-12.0V	-12.564 V
- 5.0V	-5.127 V
Battery	3.408 V
+5V SB	4.993 V

Figure 4-10 The system fan (case fan) has either failed or was never connected to the motherboard power/monitor header.

Inadequate Airflow Outside the System

The power supply's capability to cool the system depends in part on free airflow space outside the system. If the computer is kept in a confined area (such as a closet or security cabinet) without adequate ventilation, power supply failures due to overheating are likely.

Even systems in ordinary office environments can have airflow problems; make sure that several inches of free air space exist behind the fan outputs for any computer.

Inadequate Airflow Inside the System

As you have seen in previous chapters, the interior of the typical computer is a messy place. Wide ribbon cables used for some types of drives, drive power cables, and expansion cards create small air dams that block airflow between the heat sources—such as the motherboard, CPU, drives, and memory modules—and the fans in the power supply. Figure 4-11 illustrates a typical system with a lot of cable clutter that can interfere with airflow.

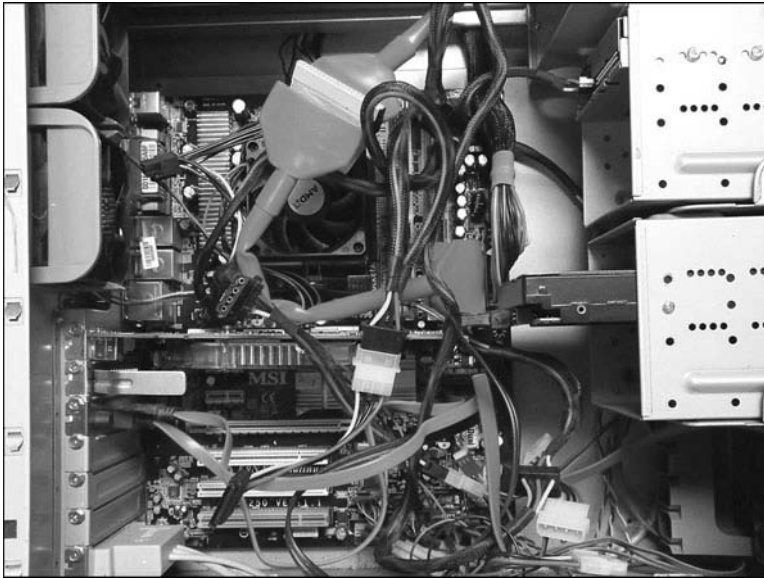


Figure 4-11 A cluttered system with plenty of unsecured cables to block airflow.

You can do the following to improve airflow inside the computer:

- Use cable ties to secure excess ribbon cable and power connectors out of the way of the fans and the power supply.
- Replace any missing slot covers.
- Make sure that auxiliary case fans, chipset fans, and CPU fans are working correctly.
- Use SATA drives in place of PATA drives. SATA drives use narrow data cables.

Figure 4-12 illustrates a different system that uses cable management (cable ties, bundling cables between the drive bays and outer case wall, and routing behind the motherboard) to improve airflow.

For more information about cooling issues, see the section “System Cooling,” later in this chapter for details.

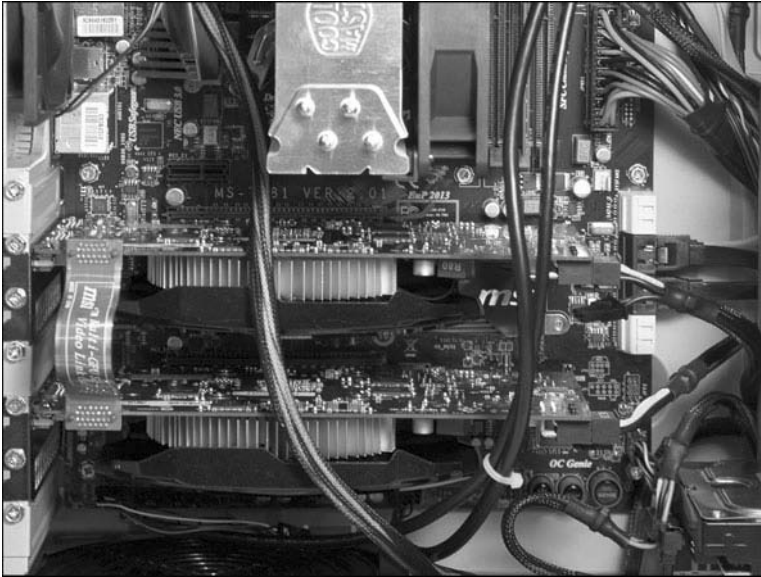


Figure 4-12 A system with good airflow due to intelligent cable management.

Dirt and Dust

Most power supplies, except for a few of the early ATX power supplies, use a cooling technique called *negative pressure*; in other words, the power supply fan works like a weak vacuum cleaner, pulling air through vents in the case, past the components, and out through the fan. Vacuum cleaners are used to remove dust, dirt, cat hairs, and so on from living rooms and offices, and even the power supply's weak impression of a vacuum cleaner works the same way.

When you open a system for any kind of maintenance, look for the following:

- Dirt, dust, hair, and gunk clogging the case vents
- A thin layer of dust on the motherboard and expansion slots
- Dirt and dust on the power supply vent and fans

Yuck! You never know what you'll find inside a PC that hasn't been cleaned out for a year or two. So how can you get rid of the dust and gunk? You can use either a vacuum cleaner specially designed for computer use or compressed air to remove dirt and dust from inside the system. If you use compressed air, be sure to spread newspapers around the system to catch the dirt and dust. If possible, remove the computer from the computer room so the dust is not spread to other equipment.

Fans Turn But System Doesn't Start

Fans connected directly to the power supply will run as soon as the system is turned on, but if the system doesn't start up, this could indicate a variety of problems. Check the following:

- Make sure the main ATX and 12V ATX or EPS power leads are securely connected to the appropriate sockets.
- Make sure the CPU and memory modules are securely installed in the appropriate sockets.

Testing Power Supplies and Other Devices with a Multimeter

How can you find out that a defective power supply is really defective? How can you make sure that a cable has the right pinouts? Use a multimeter. A **multimeter** is one of the most flexible diagnostic tools around. It is covered in this chapter because of its usefulness in testing power supplies, but it also can be used to test coaxial, serial, and parallel cables, as well as fuses, resistors, and batteries.

Multimeters are designed to perform many different types of electrical tests, including the following:

- DC voltage and polarity
- AC voltage and polarity
- Resistance (Ohms)
- Diodes
- Continuity
- Amperage

All multimeters are equipped with red and black test leads. When used for voltage tests, the red is attached to the power source to be measured and the black is attached to ground.

Multimeters use two different readout styles: digital and analog. Digital multimeters are usually *autoranging*, which means they automatically adjust to the correct range for the test selected and the voltage present. Analog multimeters, or non-autoranging digital meters, must be set manually to the correct range and can be damaged more easily by overvoltage. Figure 4-13 compares typical analog and digital multimeters.



Figure 4-13 Typical analog (left) and digital (right) multimeters. Photos courtesy of Colacino Electric Supply, Newark, NJ.

Key Topic

Multimeters are designed to perform tests in two ways: in series and in parallel. Most tests are performed in parallel mode, in which the multimeter is not part of the circuit but runs parallel to it. On the other hand, amperage tests require that the multimeter be part of the circuit, so these tests are performed in series mode. Many low-cost multimeters do not include the ammeter feature for testing amperage (current), but you might be able to add it as an option.

Figure 4-14 shows a typical parallel mode test (DC voltage for a motherboard CMOS battery) and the current (amperage) test, which is a serial-mode test.

Table 4-2 summarizes the tests you can perform with a multimeter.

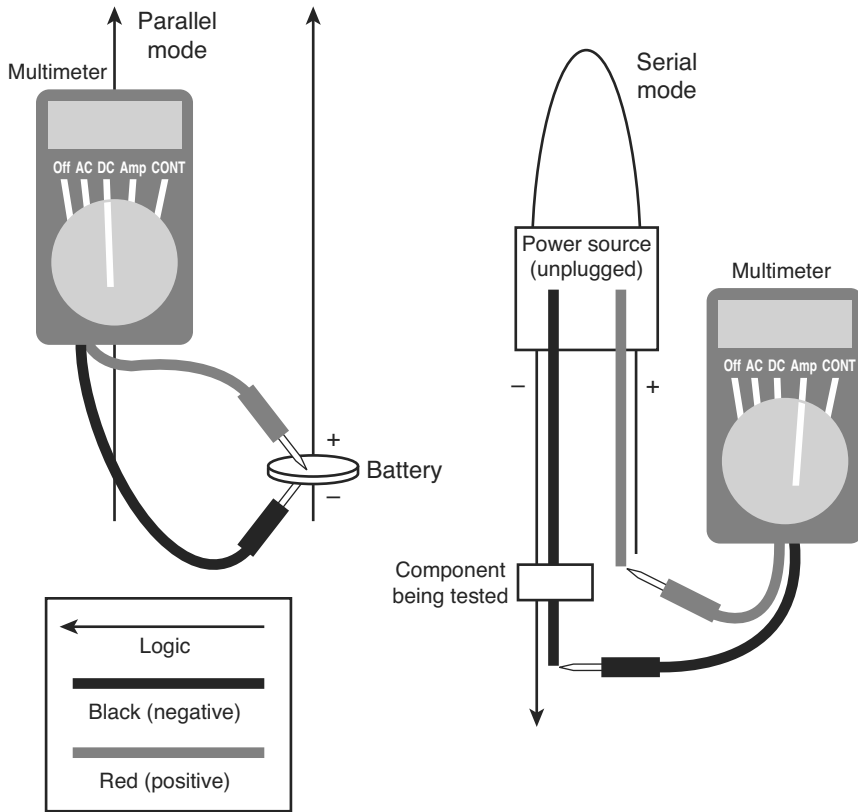


Figure 4-14 A parallel-mode (DC current) test setup (left) and an amperage (current) serial-mode test setup (right).

Table 4-2 Using a Multimeter

Test to Perform	Multimeter Setting	Probe Positions	Procedure
AC voltage (wall outlet)	AC	Red to hot, black to ground.	Read voltage from meter; should be near 115V in North America.
DC voltage (power supply outputs to motherboard, drives, batteries)	DC	Red to hot, black to ground.	Read voltage from meter; compare to default values.

Table 4-2 Continued

Test to Perform	Multimeter Setting	Probe Positions	Procedure
Continuity (cables, fuses)	CONT	Red to lead at one end of cable; black to corresponding lead at other end.	No CONT signal indicates bad cable or bad fuse.
		For a straight-through cable, check the same pin at each end. For other types of cables, consult a cable pinout to select the correct leads.	Double-check leads and retest to be sure.
Resistance (Ohms)	Ohms	Connect one lead to each end of resistor.	Check reading; compare to rating for resistor. A fuse should have no resistance.
Amperage (Ammeter)	Ammeter	Red probe to positive lead of circuit (power disconnected!); black lead to negative lead running through component to be tested.	Check reading; compare to rating for component tested.

You can use a multimeter to find out whether a power supply is properly converting AC power to DC power. Here's how: Measure the DC power going from the power supply to the motherboard. A power supply that does not meet the measurement standards listed in Table 4-3 should be replaced.

If the system monitor functions in the system BIOS do not display voltage levels (refer to Figure 4-10 for an example of a system that does display voltage levels in the BIOS), you can take the voltage measurements directly from the power supply connection to the motherboard. Both 20-pin and 24-pin P1 (ATX) power connectors are designed to be back-probed as shown in Figure 4-15; you can run the red probe through the top of the power connector to take a reading (the black probe uses the power supply enclosure or metal case frame for ground). Some motherboards bring these same voltage levels to a more convenient location on the motherboard for testing.

Key Topic

Table 4-3 Acceptable Voltage Levels

Rated DC Volts	Acceptable Range
+5.0	+4.8–5.2
-5.0	-4.8–5.2
-12.0	-11.4–12.6
+12.0	+11.4–12.6
+3.3	+3.14–3.5
Power Good	+3.0–6.0

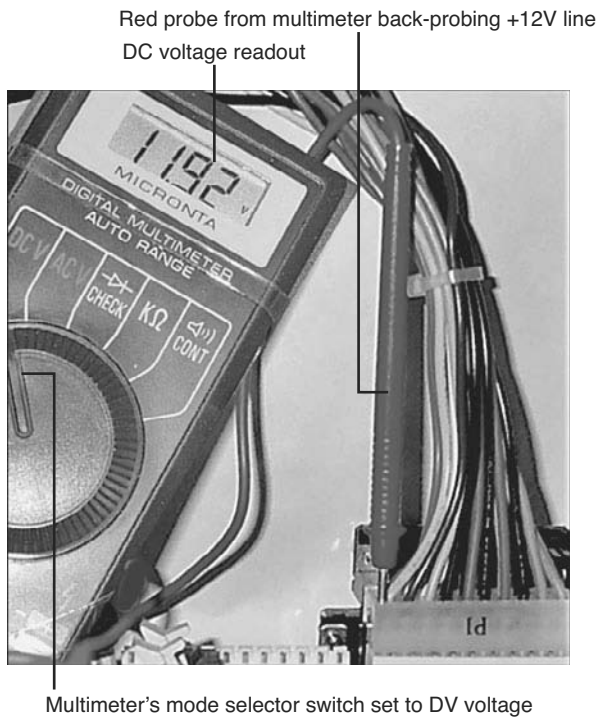


Figure 4-15 Testing the +12V line on an ATX power supply. The voltage level indicated (+11.92V) is well within limits.

If a power supply fails any of these measurements, replace it and retest the new unit.

Avoiding Power Supply Hazards

220-801

Objective:
220-801: 5.2

To avoid shock and fire hazards when working with power supplies, follow these important guidelines:

Key Topic

- **Never disassemble a power supply or push metal tools through the openings in the case**—Long after you shut off the system, the capacitors inside the power supply retain potentially fatal voltage levels. If you want to see the interior of a power supply safely, check the websites of leading power supply vendors such as PC Power and Cooling.
- **If you are replacing the power supply in a Dell desktop computer, determine whether the computer uses a standard ATX or Dell proprietary ATX power supply**—Many Dell computers built from September 1998 to the present use a nonstandard version of the ATX power supply with a different pinout for the power connector. Install a standard power supply on a system built to use a Dell proprietary model, or upgrade from a Dell motherboard that uses the Dell proprietary ATX design to a standard motherboard, and you can literally cause a power supply and system fire!

NOTE The proprietary Dell version of the 20-pin ATX (P1) connector has no 3.3V (orange) lines, and its Power Good (gray wire) line is pin 5, not pin 8 as with a standard ATX power supply. The 3.3V (orange) wires are routed to the 6-pin Dell proprietary auxiliary connector. The proprietary Dell version of the 24-pin ATX (P1) connector also uses pin 5 for Power Good and provides 3.3V power (blue/white) through pins 11, 12, and 23, rather than through 1, 2, 12, and 13 as with a standard 24-pin ATX power supply. Make sure you buy a power supply made specifically for your Dell model.

- **Always use a properly wired and grounded outlet for your computer and its peripherals**—You can use a plug-in wiring tester to quickly determine whether a three-prong outlet is properly wired; signal lights on the tester indicate the outlet's status (see Figure 4-16).



Figure 4-16 An outlet tester like this one can find wiring problems quickly. This outlet is wired correctly.

Power Protection Types

220-801

Objective:

220-801: 5.2

Question. How well can a power supply work if it has poor-quality AC power to work with?

Answer. Not very well. Because computers and many popular computer peripherals run on DC power that has been converted from AC power, it's essential to make sure

that proper levels of AC power flow to the computer and its peripherals. There are four problems you might run into:

- Overvoltages (spikes and surges)
- Undervoltages (brownouts)
- Power failure (blackouts)
- Noisy power (interference)

Extremely high levels of transient or sustained overvoltages can damage the power supply of the computer and peripherals, and voltage that is significantly lower than required will cause the computer and peripherals to shut down. Shutdowns happen immediately when all power fails. A fourth problem with power is interference; “noisy” electrical power can cause subtle damage, and all four types of problems put the most valuable property of any computer, the data stored on the computer, at risk. Protect your computer’s power supply and other components with appropriate devices:

- Surge suppressors, which are also referred to as surge protectors
- Battery backup systems, which are also referred to as uninterruptible power supply (UPS) or standby power supply (SPS) systems
- Power conditioning devices

Surge Suppressors

Key Topic

Stop that surge! While properly designed **surge suppressors** can prevent power surges (chronic overvoltage) and spikes (brief extremely high voltage) from damaging your computer, low-cost ones are often useless because they lack sufficient components to absorb dangerous surges. Surge suppressors range in price from under \$10 to close to \$100 per unit.

Both spikes and surges are overvoltages: voltage levels higher than the normal voltage levels that come out of the wall socket. *Spikes* are momentary overvoltages, whereas surges last longer. Both can damage or destroy equipment and can come through data lines (such as RJ-11 phone or RJ-45 network cables) as well as through power lines. In other words, if you think of your PC as a house, spikes and surges can come in through the back door or the garage as well as through the front door. Better “lock” (protect) all the doors. Many vendors sell data-line surge suppressors.

How can you tell the real surge suppressors from the phonies? Check for a TVSS (transient voltage surge suppressor) rating on the unit. Multi-outlet power strips do not have a TVSS rating.

Beyond the TVSS rating, look for the following features to be useful in preventing power problems:

- A low TVSS let-through voltage level (400V AC or less). This might seem high compared to the 115V standard, but power supplies have been tested to handle up to 800V AC themselves without damage.
- A covered-equipment warranty that includes lightning strikes (one of the biggest causes of surges and spikes).
- A high Joule rating. Joules measure electrical energy, and surge suppressors with higher Joule ratings can dissipate greater levels of surges or spikes.
- Fusing that prevents fatal surges from getting through.
- Protection for data cables such as telephone/fax (RJ-11), network (RJ-45), or coaxial (RG6).
- EMI/RFI noise filtration (a form of line conditioning).
- Site fault wiring indicator (no ground, reversed polarity warnings).
- Fast response time to surges. If the surge suppressor doesn't clamp fast enough, the surge can get through.
- Protection against surges on hot, neutral, and ground lines.

If you use surge protectors with these features, you will minimize power problems. The site-fault wiring indicator will alert you to wiring problems that can negate grounding and can cause serious damage in ordinary use.

A surge suppressor that meets the UL 1449 or ANSI/IEEE C62.41 Category A (formerly IEEE 587 Category A) standards provides protection for your equipment. You might need to check with the vendor to determine whether a particular unit meets one of these standards.

NOTE To learn more about UL 1449 and the other UL standards it incorporates, see <http://ulstandardsinfont.net.ul.com/scopes/scopes.asp?fn=1449.html>.

CAUTION High-quality surge protectors require grounding. If you plug them into an ungrounded electrical outlet, they don't work properly. The two- to three-prong adapter you use to enable grounded equipment to plug into an ungrounded outlet is designed to be attached to a ground such as a metal water pipe (that's what the metal loop on the adapter is for). If you can't ground the adapter, don't use a computer or other electronic device with it. If you do, sooner or later you'll be sorry.

Battery Backup Units (UPS and SPS)

A UPS is another name for a **battery backup** unit. A UPS provides emergency power when a power failure strikes (a blackout) or when power falls below minimum levels (a brownout).

Key Topic

There are two different types of UPS systems: true UPS and SPS systems. A true UPS runs your computer from its battery at all times, isolating the computer and monitor from AC power. There is no switchover time with a true UPS when AC power fails because the battery is already running the computer. A true UPS inherently provides power conditioning (preventing spikes, surges, and brownouts from reaching the computer) because the computer receives only battery power, not the AC power coming from the wall outlet. True UPS units are sometimes referred to as line-interactive battery backup units because the battery backup unit interacts with the AC line, rather than the AC line going directly to the computer and other components.

An SPS is also referred to as a UPS, but its design is quite different. Its battery is used only when AC power fails. A momentary gap in power (about 1ms or less) occurs between the loss of AC power and the start of standby battery power; however, this switchover time is far faster than is required to avoid system shutdown because computers can coast for several milliseconds before shutting down. SPS-type battery backup units are far less expensive than true UPSs but work just as well as true UPSs when properly equipped with power-conditioning features.

NOTE In the rest of this section, the term *UPS* refers to both true UPS or SPS units except as noted, because most backup units on the market technically are SPS but are called UPS units by their vendors. Make sure you understand the differences between these units for the exam.

Battery backup units can be distinguished from each other by differences in the following:

- **Runtimes**—The amount of time a computer will keep running on power from the UPS. A longer runtime unit uses a bigger battery and usually costs more than a unit with a shorter runtime. Fifteen minutes is a minimum recommendation for a UPS for an individual workstation; much larger systems are recommended for servers that might need to complete a lengthy shutdown procedure.
- **Network support**—Battery backup units made for use on networks are shipped with software that broadcasts a message to users about a server shutdown so that users can save open files and close open applications and then shuts down the server automatically before the battery runs down.

- **Automatic shutdown**—Some low-cost UPS units lack this feature, but it is essential for servers or other unattended units. The automatic shutdown feature requires an available USB (or RS-232 serial) port and appropriate software from the UPS maker. If you change operating systems, you need to update the software for your UPS to be supported by the new operating system.
- **Surge suppression features**—Virtually all UPS units today have integrated surge suppression, but the efficiency of integrated surge suppression can vary as much as separate units. Check for UL-1449 and ANSI/IEEE C62.41 Category A ratings to find reliable surge suppression in UPS units.

Figure 4-17 illustrates the rear of a typical UPS unit.

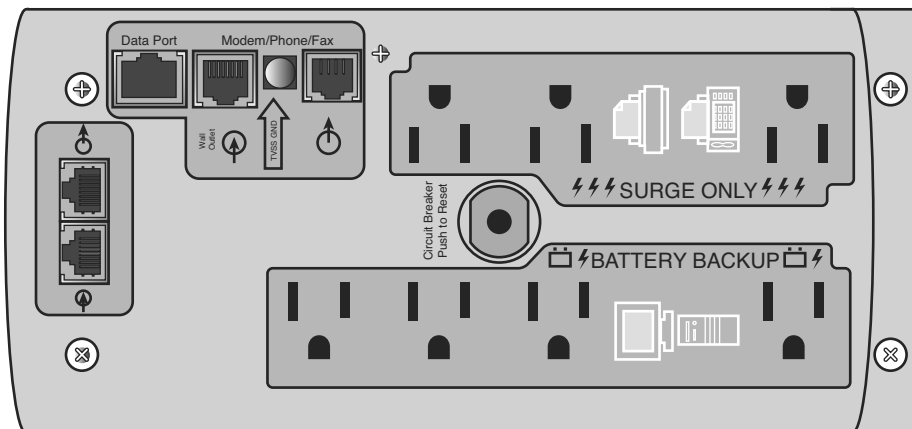


Figure 4-17 A typical UPS with integrated surge suppression for printers and other AC powered devices, 10/100/1000 Ethernet (including VoIP), and conventional telephony devices.

NOTE Always plug a UPS directly into a wall outlet, not into a power strip or surge suppressor.

Buying the Correct-Sized Battery Backup System

Battery backups can't run forever. But then, they're not supposed to. This section describes how you can make sure you get enough time to save your files and shut down your computer. UPS units are rated in VA (volt-amps), and their manufacturers have interactive buying guides you can use online or download to help you select a model with adequate capacity. If you use a UPS with an inadequate VA rating for your equipment, your runtime will be substantially shorter than it should be.

Here's how to do the math: You can calculate the correct VA rating for your equipment by adding up the wattage ratings of your computer and monitor and multiplying the result by 1.4. If your equipment is rated in amperage (amps), multiply the amp rating by 120 (volts) to get the VA rating.

For example, my computer has a 450W power supply, which would require a 630VA-rated UPS (450×1.4) and a 17-inch monitor that is rated in amps, not watts. The monitor draws 0.9A, which would require a 108VA-rated UPS (0.9×120). Add the VA ratings together, and my computer needs a 750VA-rated battery backup unit or larger. Specifying a UPS with a VA rating at least twice what is required by the equipment attached to the UPS (for example, a 1500VA or higher rating, based on a minimum requirement of 750VA) will greatly improve the runtime of the battery.

In this example, a typical 750VA battery backup unit would provide about 5 minutes of runtime when used with my equipment. However, if I used a 1500VA battery backup, I could increase my runtime to more than 15 minutes because my equipment would use only about half the rated capacity of the UPS unit.

If you need a more precise calculation, for example, if you will also power an additional monitor or other external device, use the interactive sizing guides provided by battery backup vendors, such as American Power Conversion (www.apc.com).

CAUTION You should not attach laser printers to the battery-backup outlets on a UPS because their high current draw will cause the runtime of the battery to be very short. If the UPS has some outlets that provide surge protection only, you can use those outlets for a laser printer. In most cases, only the computer and monitor need to be attached to the UPS. However, inkjet printers, external modems, and external USB or FireWire hard disks have low current draw and can be attached to the UPS with little reduction in runtime.

Power-Conditioning Devices

Although power supplies are designed to work with voltages that do not exactly meet the 115V or 230V standards, power that is substantially higher or lower than what the computer is designed for can damage the system. Electrical noise on the power line, even with power at the correct voltage, also causes problems because it disrupts the correct sinewave alternating-current pattern the computer, monitor, and other devices are designed to use.

Better-quality surge protectors often provide power filtration to handle electromagnetic interference (EMI)/radio frequency interference (RFI) noise problems from laser printers and other devices that generate a lot of electrical interference.

However, to deal with voltage that is too high or too low, you need a true power conditioner.

**Key
Topic**

Power-conditioning units take substandard or overstandard power levels and adjust them to the correct range needed by your equipment. Some units also include high-quality surge protection features.

To determine whether you need a power-conditioning unit, you can contact your local electric utility company to see whether it loans or rents power-monitoring devices. Alternatively, you can rent them from power consultants. These units track power level and quality over a set period of time (such as overnight or longer) and provide reports to help you see the overall quality of power on a given line.

Moving surge- and interference-causing devices such as microwaves, vacuum cleaners, refrigerators, freezers, and furnaces to circuits away from the computer circuits helps minimize power problems. However, in older buildings, or during times of peak demand, power conditioning might still be necessary. A true (line-interactive) UPS provides built-in power conditioning by its very nature (see the previous discussion).

System Cooling

220-802**Objective:****220-802: 4.2**

Today's computers often run much hotter than systems of a few years ago, so it's important to understand how to keep the hottest-running components running cooler. The following sections discuss the components that are most in need of cooling and how to cool them (processor cooling is discussed in Chapter 2, "Motherboards and Processors").

Northbridge and Southbridge Chips and Voltage Regulators

Motherboards use a one-chip or two-chip chipset (also referred to as northbridge and southbridge chips) to route data to and from the processor. The northbridge or Memory Controller Hub (MCH) chip, because it carries high-speed data such as memory and video to and from the processor, becomes hot during operation, and, if the component overheats and is damaged, the entire motherboard must be replaced. For this reason, most motherboards feature some type of cooler for the northbridge chip.

Although the southbridge or I/O Controller Hub (ICH) chip carries lower-speed traffic, such as hard disk, audio, and network traffic, it can also become overheated. As a result, most recent motherboards also feature cooling for the southbridge chip. Some chipsets combine both functions into a single chip, which also requires cooling.

**Key
Topic**

Three methods have been used for cooling the motherboard chipset. Passive heat sinks attached directly to the chipset chips are inexpensive but do not provide sufficient cooling for high-performance systems. Active heat sinks provide better cooling than passive heat sinks, but low-quality sleeve-bearing fans often used in these coolers can cause premature fan failure and lead to overheating. The latest trend in chipset and motherboard cooling uses heat pipes, which draw heat away from the chipset or other high-temperature components, such as the voltage regulator for CPU power, and dissipates it through high-performance, very large passive heat sinks located away from the chipset itself. While you can add other types of coolers to chipset chips, heat pipes are factory-installed.

Figure 4-18 illustrates passive and active heat sinks for northbridge and southbridge chips.

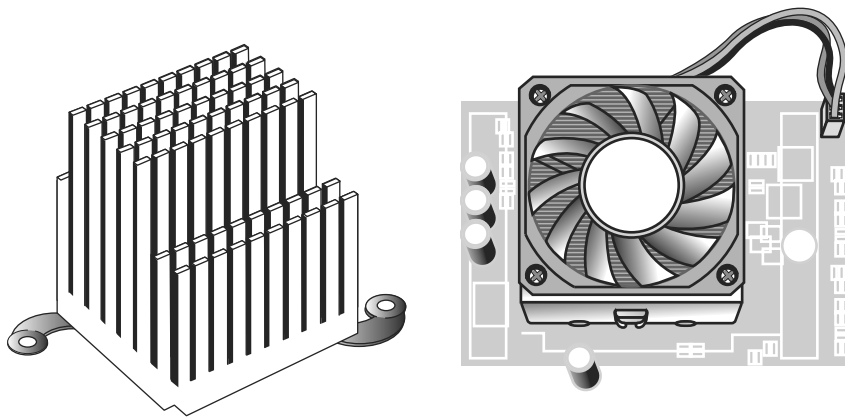


Figure 4-18 Passive and active heat sinks for chipsets.

Figure 4-19 illustrates a motherboard that uses heat pipes for component cooling.

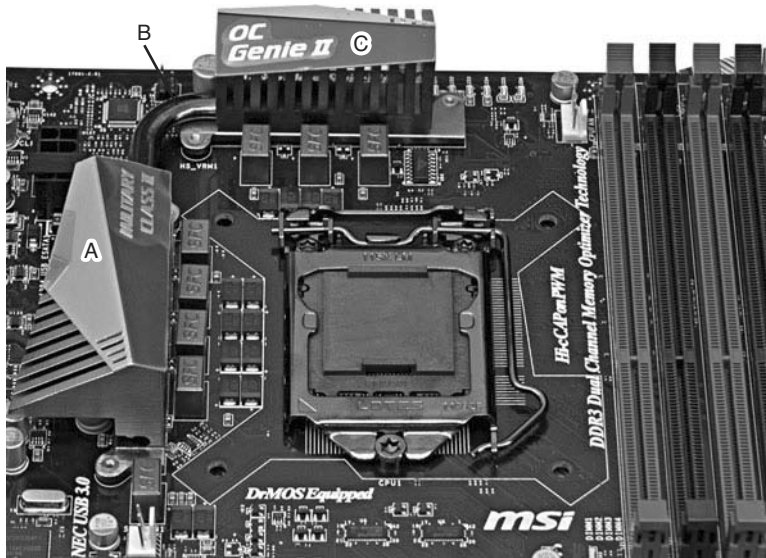


Figure 4-19 Motherboard with heat pipe cooling. Heat is transferred from components under heat sink (A) via heat pipe (B) to be dissipated by radiator at rear of motherboard (C).

Video Card Cooling

Another major heat source in modern systems is the video card's graphics processing unit (GPU) chip, which renders the desktop, graphics, and everything else you see on your computer screen. With the exception of a few low-end video cards, almost all video cards use active heat sinks to blow hot air away from the GPU.

However, the memory chips on a video card can also become very hot. To cool both the GPU and video memory, most recent midrange and high-end video card designs use a fan shroud to cool both components. Fan shrouds often require enough space to prevent the expansion slot next to the video card from being used.

Figure 4-20 illustrates a typical video card with a two-slot fan shroud.

Case Fans

Most ATX chassis have provisions for at least two case fans: one at the front of the system and one at the rear of the system. Case fans can be powered by the motherboard or by using a Y-splitter connected to a four-pin Molex power connector. Case fans at the front of the system should draw air into the system, while case fans at the rear of the system should draw air out of the system.



Figure 4-20 The EVGA GeForce GTX 580 is a high-performance PCI Express x16 video card that requires a two-slot fan shroud. Image courtesy of EVGA Corporation.

Figure 4-21 shows a typical rear case fan. You can plug fans like this into the three-prong chassis fan connection found on many recent motherboards or into the 4-pin Molex drive power connector used by hard drives. If the motherboard power connector is used, the PC Health or hardware monitor function found in many recent system BIOS setup programs can monitor fan speed (refer to Figure 4-10).

NOTE Some case fans that can be powered by a Molex power connector include a special power cable that permits the fan speed to be monitored by the motherboard, even though the motherboard is not used to power the fan.

Case fans are available in various sizes up to 200mm (80, 92, and 120mm are the most common sizes). Measure the opening at the rear of the case to determine which fan size to purchase. Some systems, such as the one shown earlier in Figure 4-11, might feature two rear fans or a rear fan and a top fan.

Thermal Compound

When passive or active heat sinks are installed on a processor, northbridge or southbridge chip, GPU or other component, **thermal compound** (also known as thermal transfer material, thermal grease, or phase change material) must be used to provide the best possible thermal transfer between the component and the heat sink.

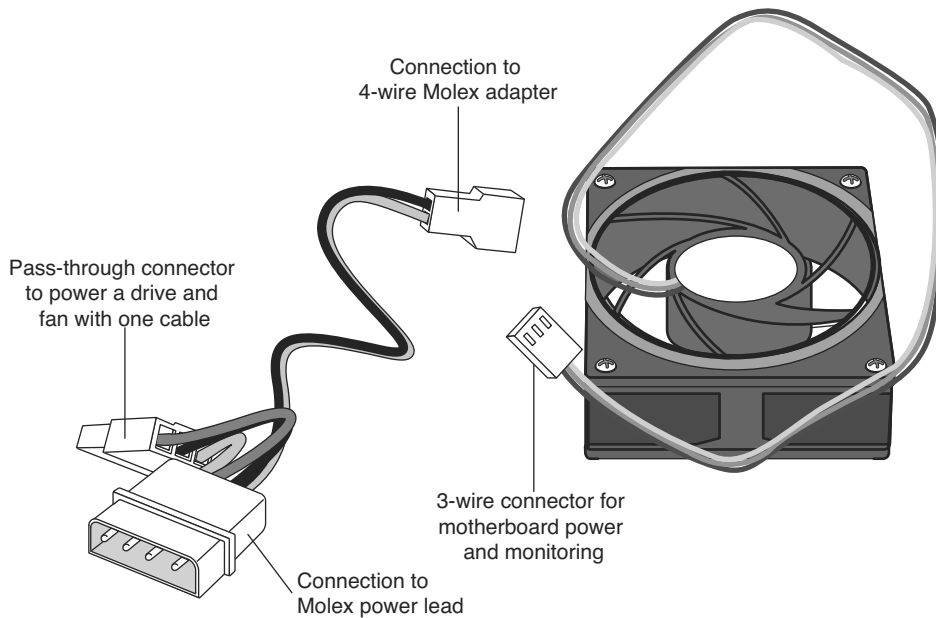


Figure 4-21 A case fan that can be plugged into the motherboard or into a Molex power connector.

Heat sinks supplied with boxed processors might use a preapplied phase-change material on the heat sink, whereas OEM processors with third-party heat sinks usually require the installer to use a paste or thick liquid thermal grease or silver-based compound. Coolers for northbridge or southbridge chips might use thermal grease or a phase-change pad.

If the thermal material is preapplied to the heat sink, make sure you remove the protective tape before you install the heat sink. If a third-party heat sink is used, or if the original heat sink is removed and reinstalled, carefully remove any existing thermal transfer material from the heat sink and processor die surface. Then, apply new thermal transfer material to the processor die before you reinstall the heat sink on the processor. Figure 4-22 illustrates the application of thermal compound to a northbridge chip before attaching a heat sink.

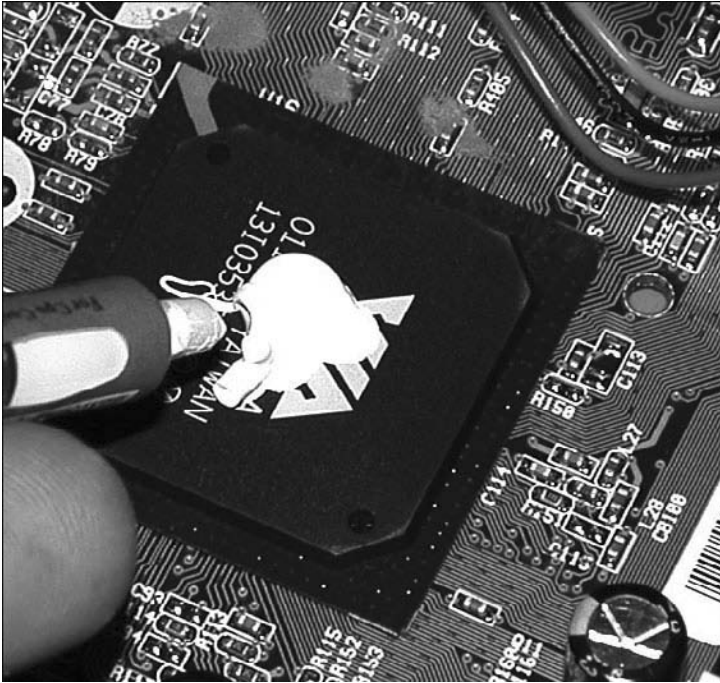


Figure 4-22 Applying thermal grease to the northbridge chip.

Exam Preparation Tasks

Review All the Key Topics

Review the most important topics in the chapter, noted with the key topics icon in the outer margin of the page. Table 4-4 lists a reference of these key topics and the page numbers on which each is found.

**Key
Topic**

Table 4-4 Key Topics for Chapter 4

Key Topic Element	Description	Page Number
Text	Power supply converts AC to DC	130
Text	A typical ATX power supply	130
Figure 4-1	Power supply ratings	131
List	Determining the wattage rating needed for a replacement power supply	132
List	Voltage ranges supported by power supplies	133
Figure 4-4	20-pin, 24-pin, and ATX12V and AUX connectors	136
Figure 4-5	Power supply pinouts	136
Figure 4-6	Power supply connectors for peripheral and modern motherboards	137
List	Steps for removing the power supply	139
List	Symptoms of an overloaded power supply	141
Text	Fan failure indicators	142
List	Causes for a “dead” system	143
List	Diagnosing power supply problems	143
List	Causes of overheating	144
Text	Multimeter test procedures	150
Table 4-3	Acceptable voltage levels	153
List	Power supply hazards	154
Text	Surge suppressors	156
Text	Battery backup units	158
Text	Power conditioning units	161
Text	Cooling motherboard chipsets	162

Complete the Tables and Lists from Memory

Print a copy of Appendix A, “Memory Tables,” (found on the CD), or at least the section for this chapter, and complete the tables and lists from memory. Appendix B, “Memory Tables Answer Key,” also on the CD, includes completed tables and lists to check your work.

Define Key Terms

Define the following key terms from this chapter, and check your answers in the glossary.

power supply, AC, DC, multimeter, surge suppressor, battery backup, thermal compound

Complete Hands-On Lab

Complete the hands-on labs, and then see the answers and explanations at the end of the chapter.

Lab 4-1: Check Power Supply Voltages

Scenario: You are a technician working at a PC repair bench. You need to determine whether the power supply is supplying correct voltage to the motherboard without opening the system.

Procedure: Start the system, open the BIOS setup program, and open the dialog that displays power levels (System Health, PC Health, System Monitor are typical names). Check the voltage levels listed against those listed in Table 4-3.

NOTE If the system does not display voltage levels in the system BIOS, use a multimeter and the information in Figure 4-5, Table 4-2, and Table 4-3 to check voltage levels.

Lab 4-2: Check for Airflow Problems Inside the System

Scenario: You are a technician working at a PC repair bench. You need to determine whether the cable layout inside the system may be causing overheating.

Procedure: Use the procedure for Lab 4-1 to check system temperature after running the system for about a half-hour. Record the current temperature. Shut down the system, unplug it from AC power, and open the system. Compare the

interior of the system to Figures 4-11 and 4-12. If the system resembles Figure 4-11, the system needs better cable organization.

Answer Review Questions

Answer these review questions and then see the answers and explanations at the end of the chapter.

1. Which of the following would you use to keep the power supply working properly? (Choose two.)
 - a. Surge protector
 - b. Extra power supply
 - c. UPS units
 - d. Multimeter

2. Power supplies are rated using which of the following units?
 - a. Amps
 - b. Volts
 - c. Watts
 - d. Output

3. Newer tower-case computers' power supplies typically have which of the following power output ratings?
 - a. 300 watts
 - b. 400 watts
 - c. 250 watts
 - d. 500 watts or higher

4. Most power supplies in use today are designed to handle which two voltage ranges? (Choose two.)
 - a. 115
 - b. 300
 - c. 230
 - d. 450

5. Which of the following are causes of power supply overheating?
 - a. Overloading the power supply.
 - b. Fan failure.
 - c. Dirt or dust.
 - d. All of these options are correct.

6. How many pins are used for the main power connection by recent ATX/BTX motherboards with ATX12V 2.2 power supplies?
 - a. 24
 - b. 48
 - c. 32
 - d. 16

7. What is the four-pin square power connector on the motherboard used for?
 - a. Extra power to PCIe slots
 - b. 5-volt power for fans
 - c. 12-volt power for processors
 - d. 12-volt power for fans

8. What is the six-pin power lead on the power supply used for?
 - a. Extra power to PCIe x16 cards
 - b. Extra power for PCI cards
 - c. Power for case fans
 - d. Power supply diagnostics

9. Which of the following steps would you use to remove a power supply?
 - a. Shut down the computer. If the power supply has an on/off switch, turn it off as well.
 - b. Disconnect the AC power cord from the computer.
 - c. Disconnect power connections from the motherboard, hard drives, and optical drives.
 - d. All of these options are correct.

10. To avoid power supply hazards you must never do which of the following? (Choose two.)
- a. Disassemble the power supply.
 - b. Put metal tools through the openings.
 - c. Switch the voltage to 220.
 - d. Put a smaller power supply in the computer.
11. Which device provides emergency power to a computer in case of a complete power failure?
- a. UTP
 - b. UPS
 - c. Power strip
 - d. Surge protector
12. What is the minimum time recommendation for a UPS to supply power for an individual workstation?
- a. 30 minutes
 - b. 45 minutes
 - c. 1 hour
 - d. 15 minutes
13. Which of the following correctly describe an SPS? (Choose all that apply.)
- a. The battery on an SPS is only used when the AC power fails.
 - b. An SPS is on all the time.
 - c. A momentary gap in power occurs between loss of AC power and when the SPS comes online.
 - d. An SPS is far less expensive than a UPS.
14. When a system is dead and gives no signs of life when you turn on the computer, which of the following might be the cause? (Choose all that apply.)
- a. Defects in AC power to the system
 - b. Power supply failure or misconfiguration
 - c. Temporary short circuits in internal or external components
 - d. Power button or other component failure

15. Processors and other components use a finned metal device to help with cooling. What is this device called? (Choose two.)
 - a. Passive heat sink
 - b. Thermal compound
 - c. Active heat sink
 - d. Chassis heat sink

16. What is the purpose of thermal compound?
 - a. Provides the best possible thermal transfer between a component and its heat sink
 - b. Provides the best possible thermal transfer between a component's heat sink and its fan
 - c. To negate the effects of thermal contraction and expansion in adapter cards
 - d. Provides the best possible thermal transfer between the northbridge and its fan

Answers to Hands-On Lab

Lab 4-1: Check Power Supply Voltages

Answer: If the voltage levels are within limits, the power supply is healthy. If any of the voltage levels are out of range, the power supply should be replaced with a power supply of the same or higher wattage rating.

Lab 4-2: Check for Airflow Problems Inside the System

Answer: Use cable ties and reroute long cables between the drive bays at the back wall of the system or along the edge of the motherboard to reduce snarls and improve airflow. After reassembling the system, reconnecting it to AC power, and booting the system to the BIOS setup program, recheck system temperature after running the system for a half-hour. If the temperature is lower, you have improved airflow inside the system. Even if the system temperature remains the same, you have made it easier to work inside the system in the future.

Answers and Explanations to Review Questions

- 1. A, C.** To keep your power supply up and running and to help prevent damage from power surges, you should use a surge protector. The UPS will supply power for a short period of time to the computer system in case of total power outage.
- 2. C.** Power supplies are rated in watts, and the more watts a power supply provides, the more devices it can safely power.
- 3. D.** Most newer tower computers have 500 watt or larger power supplies in them because of the greater number of drives and expansion cards that are available now.
- 4. A, C.** Standard North American power is 115 volts, and power in most parts of Europe and Asia is 230 volts. Some power supplies have a slider on the back to switch between the two voltages.
- 5. D.** All of the listed reasons can cause damage to the power supply as well as overheating your computer.
- 6. A.** Most of the newer power supplies in use today have 24 pins. Older motherboards have a 20-pin connection.
- 7. C.** This connector is the ATX12V connector, which provides 12V power dedicated to the processor (a voltage regulator on the motherboard reduces 12V to the actual power required by the processor).
- 8. A.** The six-pin (or 6+2 pin) power supply lead provides additional power needed by high-performance PCIe x16 cards, such as those used for SLI or for CrossFire X multi-GPU installations.
- 9. D.** All of the listed answers are correct. You must disconnect from the wall first; then once inside the computer unhook the connection to the motherboard, drives, and other devices.
- 10. A, B.** The capacitors inside the power supply retain potentially fatal voltage levels. To prevent shock you should not disassemble power supplies or stick in a metal object such as a screwdriver.
- 11. B.** A UPS (uninterruptible power supply) will keep a standard desktop up and running in case of a complete power outage.
- 12. D.** UPSs are designed to supply power to a computer long enough for you to complete a formal shutdown.
- 13. A, C, D.** When an SPS is used there is a momentary gap, usually about 1ms or less, between when the power goes off and when the SPS starts supplying power. SPSs are also less expensive and are not used at all times.

14. **A, B, C, D.** When turning on a system that shows no signs of life you must consider all of these as potential problems.
15. **A, C.** All processors require a heat sink. A heat sink is a finned metal device that radiates heat away from the processor. An active heat sink (a heat sink with a fan) is required for adequate processor cooling on current systems. Some older systems used a specially designed duct to direct airflow over a processor with a passive heat sink (a heat sink without a fan). Most motherboards' northbridges use passive heat sinks or heat pipes.
16. **A.** Thermal compound (also known as thermal transfer material, thermal grease, or phase change material) provides for the best possible thermal transfer between a component (for example a CPU) and its heat sink. This prevents CPU damage. The fan and adapter cards should not have thermal compound applied to them.

This page intentionally left blank



Index

Symbols and Numerals

#1-TuffTEST, 569
3-claw parts retrieval tools, 15
3D games, troubleshooting, 300
7 editions (Windows), 608-609
10BASE2 cabling, 806
10BASE5 cabling, 805
10BASE-T networks, 810
32-bit architectures, 73, 620
64-bit architectures, 73, 607, 620
80 PLUS certification standard, 133
100BASE-TX networks, 810
104-key keyboards, 258
115-120V/60Hz-cycle AC, 134
230-240V/50Hz AC, 134
802.11a Ethernet standard, 811
802.11b Ethernet standard, 811
1000BASE-T networks, 810
< > (HTML tags), 793

A

AC (alternating current), 130
outlet safety, 932
power flow problems, 156
power loss restart, 94
voltage testing, 151

Accelerated Graphics Port (AGP)
slots, 38-39, 274
accelerometers, 409
access denied messages, 492
access point security
default administrator passwords,
changing, 890
default SSIDs, changing, 886
DHCP versus static IP addresses, 885
firewalls, 891
firmware, updating, 890
MAC addresses, filtering, 887-890
radio levels, 891
SSID broadcasting, disabling, 886
WAP location, 891
accessing
operating systems, controlling, 892
administrator accounts, 893
auditing, 897-898
components, 896
event logging, 897-898
groups, 894
guest accounts, 893
moving/copying files/folders, 896
permissions, 895-896
principle of least privilege, 895
restricted spaces, 896
UAC, 893-894
user accounts, 893

- shared resources, 836
- WinRE, 741-742
- Acer beep codes website, 111**
- Acronis True Image, 747**
- Action Center (Windows), 691**
- active heat sinks, 75**
- active matrix OLEDs (AMOLEDs), 369**
- add-on cards**
 - modems, 779
 - point of failure, 12
 - USB ports, 214
- Add Printer Wizard, 465-466**
- Add/Remove Programs (Windows control panel), 686**
- addresses**
 - I/O ports, 235
 - IP, 824-826
 - classes, 824-826*
 - Duplicate IP Address error message, 851*
 - octets, 825*
 - static versus DHCP, 885*
 - static versus server-assigned, 819-820*
 - subnet masks, 824*
 - IPv6, 827-829
 - IRQ port, 235
 - MAC, filtering, 846, 887-890
 - unicast, 828
- administration**
 - default passwords, changing, 890
 - operating system access, controlling, 893
 - administrator accounts, 893*
 - auditing, 897-898*
 - components, 896*
 - event logging, 897-898*
 - groups, 894*
 - guest accounts, 893*
 - moving/copying files/folders, 896*
 - permissions, 895-896*
 - principle of least privilege, 895*
 - restricted spaces, 896*
 - UAC, 893-894*
 - user accounts, 893*
- Windows
 - computer management (MMC), 640-641*
 - Performance Monitor, 641-642*
 - print management, 648*
 - services, 642-644*
 - System Monitor, 641-642*
 - Task Manager, 648-649*
 - Task Scheduler, 645-646*
- administrative shares, 834**
- administrative tools (Windows), 618-619**
- ADSL (Asynchronous DSL), 786**
- Advanced Boot Options, 726-729**
- Advanced RISC Machines (ARM) processors, 398**
- Advanced Technology Extended (ATX) motherboards, 31**
- adware, 915**
- Aero/Aero Glass (Windows), 610**
- AGP (Accelerated Graphics Port) slots, 38-39, 274**
- air (environment), 936**
- airflow problems, troubleshooting, 146-147**
- Airplane Mode, 412**
- All Control Panel Items view (Windows control panel), 676**
- alternating current. *See* AC**

AMD processors, 64

Intel, comparison, 58

Sockets

940, 66

AM2, 66-67

AM2+, 67

AM3, 67-68

AM3+, 68

FM1, 69

PGA, 64

website, 70

**AMD Virtualization Technology
and Microsoft Hyper-V System
Compatibility Check Utility web-
site, 326**

**American Megatrend BIOS Support
website, 115**

**American Power Conversion website,
160**

AMI BIOS beep codes website, 111

ammeter (amperage), testing, 152

AMOLEDs (active matrix OLEDs),
369

amperage (ammeter), testing, 152

AMR (audio modem riser) slots, 41-42

analog audio mini-jacks, 249-250

analog connections. *See* dial-up
Internet connections

Android, 404-405

advanced wireless settings, 417

Airplane Mode, 412

antivirus software, 434

applications

sources, 408

turning off, 435

Bluetooth, 418-419

cloud backups, 433

GPS, enabling/disabling, 411

hard resets, 437

Market, 408

Open-Source Project (AOSP), 404

passcodes, setting, 430

POP3 email, configuring, 421-422

remote wipe programs, 432

rooting, 408

screen calibration, 409

screen orientation, locking, 408

synchronizing to PCs, 424-427

updating, 433

versions, 405

Wi-Fi, configuring, 414

**Answers That Work Task List
Programs website, 644**

antistatic bags, 931

antistatic wrist straps, 930

anti-virus programs, 872-873

mobile devices, 434

testing, 913

Windows Defender, 916

anycast addressing, 828

**AOSP (Android Open-Source Project),
404**

**APIPA (Automatic Private IP address),
828**

App Store, 408

Apple iOS, 406

accelerometers, 409

advanced wireless settings, 418

Airplane Mode, 413

antivirus software, 435

applications

sources, 408

turning off, 436

Bluetooth, 420

charging devices, 427

- GPS, enabling/disabling, 411
 - gyroscopes, 409
 - hard resets, 437
 - jailbreaking, 408
 - passcodes, setting, 431
 - POP3 email, configuring, 422-423
 - remote wipe programs, 432
 - screen calibration, 411
 - screen orientation, locking, 408
 - soft resets, 436
 - synchronizing to PCs, 427
 - updating, 434
 - versions, 406
 - Wi-Fi, configuring, 415
 - applications (mobile devices)**
 - screen orientation, 409
 - sources, 408
 - turning off, 435-436
 - ARM (Advanced RISC Machine) processors, 398**
 - Asian power standard voltage, 134**
 - ASR (Automated System Recovery), 718, 739-741**
 - assembly tools, 15**
 - Asynchronous DSL (ADSL), 786**
 - ATA RAID arrays, creating, 528-530**
 - backing up data, 530
 - configuring, 529
 - connecting, 528
 - enabling, 529
 - requirements, 528
 - ATA specifications, 504-505**
 - Attrib command, 737-738**
 - ATX (Advanced Technology Extended) motherboards, 31**
 - audio**
 - BIOS settings, 92
 - connectors, 45
 - editing systems, configuring, 316-317
 - microphones, 333-335
 - MIDI enabled devices, installing, 332
 - modem riser (AMR) slots, 41-42
 - ports, 102, 249-250
 - sound cards
 - audio jacks/cable color standards, 330*
 - configuring, 332*
 - defined, 329*
 - installing, 331-332*
 - auditing**
 - enabling, 874
 - security, 897-898
 - authentication, 871**
 - biometrics, 872
 - multifactor, 872
 - smart cards, 871
 - username/password/PIN, 871
 - Auto Restart Errors, 708-709**
 - Automated System Recovery (ASR), 718, 739-741**
 - Automatic Private IP address (APIPA), 828**
 - automatic shutdown (battery backup units), 159**
 - Automatic Updates (Windows control panel), 688**
 - autoranging digital meters, 149**
 - autorun, disabling, 918**
-
- B**
- backed up print queues, troubleshooting, 489-490**
 - backlight components (laptop displays), 372**
 - Backup and Restore Center (Windows 7), 750-753**

Backup and Restore Center (Vista), 748-750**backups**

ASR, 739

mobile devices, 432-433

security, 877

Windows

*Backup and Restore Center (7), 750-753**Backup and Restore Center (Vista), 748-750**file copy utilities, compared, 753**image (7), 752**image (Vista), 749**image (XP), 747**NTBackup, 745-747**Registry, 724**restoring, 746, 750-752***baiting, 880****banks (memory), 185****bar code readers, 259-260****basic disks, 583****basic input/output system. See BIOS****Basic Rate Interface (BRI), 785****Batch command, 737****batteries**

backup units, 158-160

*automatic shutdown, 159**laser printers, 160**network support, 158**runtimes, 158**size, determining, 159-160**surge suppression features, 159**types, 158*

CMOS, 12, 88-89

iPads, charging, 427

laptops

*replacing, 355-356**troubleshooting, 384*

mobile devices, 399

smartphones, replacing, 401

BD-R (writeable/nonerasable), 532**BD-RE (rewritable/erasable), 532****BD-ROM (read-only, Blu-ray), 532****beep codes, 111****Belarc Advisor, 115, 325, 568****binary to decimal conversions, 825****biometrics, 872, 882-883****BIOS (basic input/output system), 85**

chip failures, 12

configuring

*AC power loss restart, 94**automatically, 95**boot sequence, 92**boot settings/sequence, 98-100**boot-time diagnostic screen, 93**boot virus detection, 94**clock, 92**exiting, 109**floppy drive, 94**hardware monitor, 92, 105**integrated ports/peripherals, 100-103**keyboard, 93**main menu, 96**memory, 92, 106**onboard audio, modem, network, 92**parallel ports, 93**PATA drives, 94**plug-and-play OS, 93**PnP/PCI, 105**power management, 93, 104**primary VGA, 93**processors, 106*

- PS/2 mouse, 92*
- quiet boot, 93*
- S1/S3 standby, 94*
- SATA drives, 94*
- saving changes, 109*
- security features, 108-109*
- serial ports, 93*
- setup passwords, 94*
- setup program, 89-90*
- shadowing, 93*
- Standard Features/Settings menu, 96*
- system information, 98*
- UEFI, 91*
- USB function, 93*
- USB legacy, 93*
- user/power-on password, 94*
- virtualization, 93, 106-107*
- Wake on LAN, 94*
- write-protect boot sector, 94*
- defined, 85
- devices/features supported, 87
- loose chips, 56
- PATA
 - configuring, 508*
 - hard drives, configuring, 519*
- POST
 - beep codes, 111*
 - error messages, 112*
 - hex codes, 112-113*
 - overview, 110*
- SATA hard disk drives, configuring, 516
- security features, 899-900
- settings, 88-89
- setup, 324
- tasks, 87
- time and setting resets, 53
- updates, 114-115
 - failure recovery, 117*
 - Flash, 115-117*
 - replacing, 118-119*
- USB ports, enabling, 215
- video card settings, 282
- BitLocker encryption, 876**
- BlackBerry devices**
 - Desktop Software, 428
 - email, configuring, 423
 - synchronizing to PCs, 428
- blackouts, 933**
- blank screen on bootup, troubleshooting, 54**
- Blu-ray**
 - CDs/DVDs, compared, 531-532
 - drive speeds, 533
 - types, 532
- Blue Screen of Death (BSOD) errors, 706-709**
- Bluetooth**
 - classes, 812
 - laptop connectivity, troubleshooting, 386
 - mobile devices, 418
 - Android, 418-419*
 - iOS, 420*
 - troubleshooting, 420-421*
 - networks, 812
 - printers, 469-470
- boot failures, troubleshooting, 547**
- boot.ini files, re-creating, 713**
- boot sequence settings, configuring, 92**
- boot virus detection settings, 94**
- Bootcfg command, 737**

bootup

- 3TB hard drives, 659
- Advanced Options, 726-729
- BIOS settings, configuring, 98-100
- blank screens, troubleshooting, 54
- clean, 714
- diagnostic screen, configuring, 93
- failures, 709
 - GUI not loading*, 714
 - missing GUI*, 714
 - Missing Operating System*, 713
 - Vista/7*, 710-711
 - XP*, 712-713
- multiboot configurations, 711
- operating system not found, troubleshooting, 548
- POST code beeps, troubleshooting, 54
- quiet, configuring, 93
- sequence, 98-100
- Windows installation, 570
- WinRE Startup Repair option, 743

BRI (Basic Rate Interface), 785**bridges, 776****broadband Internet services, 786**

- cable, 788-789
- DSL, 786-787
- satellite, 789-790

brownouts, 933**BSOD (Blue Screen of Death) errors, 706-709****BTX motherboards, 32****buffer size (hard drives), 513****burning smells, troubleshooting, 55****bus**

- powered hubs, 214
- speeds, 71
- topologies, 774

Business edition (Windows Vista), 608**C****cable Internet service, 788-789****cables. *See also* connectors**

- component video, 289
- composite, 289
- DisplayPort, 288
- DVI, 286
- Ethernet color coding diagram website, 803
- front panel failures, 12
- HDMI, 286-288
- header, 213
- IEEE 1394, 218
- lengths, 211
- managing, 935
- networks
 - coaxial*, 805-806
 - connectors*, 806-807
 - fiber-optic*, 805
 - municipality rules/regulations*, 808
 - parallel (LPT) crossover*, 801
 - plenum*, 806
 - PVC*, 806
 - serial (RS-232) null modem*, 801
 - STP*, 801-803
 - types*, 801
 - UTP*, 801-803
- parallel ports
 - connectors*, 240-241
 - pinout*, 241-242
 - types*, 244-245
- PATA, 506, 517
- patch, 809
- PC Cards, 349
- power supplies, testing, 152
- RGB, 289

- RJ-11, troubleshooting, 782
- S-video, 289
- SATA, 508-510, 515
- SCSI, 225-227
- serial, 235
 - troubleshooting*, 239
 - types*, 235
- testing tools, 808
- USB
 - 1.1/2.0*, 210
 - 3.0*, 211
 - length*, 212
- cache memory, 70-71, 195**
- CAD/CAM design configurations, 314-315**
- calculating power supply requirements, 132-133**
- calibrating**
 - inkjet printers, 458, 480
 - laser printers, 479
 - mobile device screens, 409-411
- CardBus cards, 348-350**
 - ExpressCards, compared, 350
 - inserting, 349
 - installing, 816
 - removing, 349
- cardkey systems, 882**
- cards**
 - add-on
 - point of failure*, 12
 - USB ports*, 214
 - CardBus, 348
 - ExpressCards, compared*, 350
 - inserting*, 349
 - installing*, 816
 - removing*, 349
 - combo, 817
 - Express failures, 13
 - ExpressCards, 350-352
 - CardBus cards, compared*, 350
 - inserting*, 350
 - media remote controls*, 352
 - performance*, 350
 - removable adapters*, 350
 - removing*, 351
 - types*, 350
 - flash memory
 - CompactFlash*, 521
 - laptops*, 352
 - memory sticks*, 521-522
 - microSD*, 522
 - microSDHC*, 522
 - miniSD*, 522
 - miniSDHC*, 522
 - MultiMedia*, 521
 - readers*, 523-524
 - Secure Digital*, 522
 - Secure Digital Extended Capacity*, 522
 - Secure Digital High Capacity*, 522
 - SmartMedia*, 521
 - types*, 520-523
 - xD-Picture Cards*, 523
 - IEEE 1394, 220
 - memory, 400-403
 - mini-PCI, 363
 - Mini-PCIe, 364
 - network interface
 - configuring*, 816-819
 - installing*, 815-816
 - PC, 346, 349-350
 - cables*, 349
 - CardBus support*, 348
 - combo*, 349

- dongles*, 348
- failures*, 13
- inserting*, 349
- removing*, 349
- types*, 346-347
- ZV support*, 349
- POST, 113
- SCSI, 228
- smart, 871, 882
- sound
 - audio jacks/cable color standards*, 330
 - configuring*, 332
 - defined*, 329
 - installing*, 331-332
- SVGA, 286
- TV tuner, 336
- VGA, 285
- video
 - 3D game problems*, 300
 - AGP slots*, 274
 - BIOS configuration*, 282
 - capture*, 335-336
 - cooling*, 163, 275-276
 - defined*, 274
 - driver installation*, 282-284
 - driver problems*, 300
 - GPUs*, 275
 - no picture after replacing*, 301
 - PCI Express x16*, 274
 - physical installation*, 282-284
 - troubleshooting*, 300-302
 - types*, 274
 - video connectors*. See *video, connectors*
- wireless, removing from laptops, 362-365
- ZV (Zoomed Video), 349
- Carrier Sense Multiple Access/
Collision Detect (CSMA/CD)**, 810
- case fans, 163-164
- Category view (Windows control panel), 674
- Cathode Ray Tube (CRT) monitors, 277
- CD command, 623, 629
- CDs
 - autorun, disabling, 918
 - drive speeds, 533
 - DVDs/Blu-ray, compared, 531-532
 - erasing data, 534
 - recordable (R)/rewriteable (RW), 531
 - recording data
 - third-party programs*, 536-537
 - Windows Vista/7*, 535-536
 - Windows XP*, 533-534
- cellular networks, 790, 813
- CF (CompactFlash) cards, 521
- chain of custody, 939
- charging iPads, 427
- ChDir command, 737
- Cheapernet, 806
- chemical safety, 936-938
- chips
 - BIOS, 12, 56
 - creep, 56
 - memory, 179
 - northbridge/southbridge, 161-162
- chipsets, 42-44
- Chkdsk utility, 737, 754-755
- classes
 - Bluetooth, 812
 - IP addresses, 826
 - listing of*, 824
 - subnet masks*, 825
- clean boots, 714

clean Windows install, 571-573**cleaning**

- desktops, 148
- floppy drives, 540
- heating elements (thermal printers), 482
- keyboards, 259
- laser printers, 454, 479-480
- mobile device screens, 411

clearing print queues, 490**client/server networks, 770-772****client-side virtualization, 692****clients**

- client/server networks, 772
- network configuration, 834-836
- thick, 322
- thin, 323
- wireless, configuring, 904
 - troubleshooting, 909-910*
 - Windows 7, 908-909*
 - Windows Vista, 908*
 - Windows XP SP2/SP3, 905-908*

clock settings, configuring, 92**cloning laptop displays to secondary displays, 377-378****closed-source software. See Apple iOS****Cls command, 737****CLS command, 623****CMD utility, 661****CMOS**

- batteries, 12, 88-89
- BIOS settings, storing, 88-89
- Checksum errors, 119
- configuring
 - automatically, 95*
 - boot settings/sequence, 98-100*
 - hardware monitor, 105*
 - integrated ports/peripherals, 100-103*

*main menu, 96**memory, 106**PnP/PCI, 105**power management, 104**processors, 106**security features, 108-109**Standard Features/Settings menu, 96**system information, 98**virtualization, 106-107*

memory, 88-89

POST*error messages, 112**hex codes, 112-113***settings***AC power loss restart, 94**boot sequence, 92**boot-time diagnostic screen, 93**boot virus detection, 94**clock, 92**floppy drive, 94**hardware monitor, 92**keyboard, 93**memory, 92**onboard audio, modem, or network, 92**parallel ports, 93**PATA, drives, 94**plug-and-play OS, 93**power management, 93**primary VGA, 93**PS/2 mouse, 92**quiet boot, 93**S1/S3 standby, 94**SATA drives, 94**serial ports, 93**setup passwords, 94**shadowing, 93**USB 3.0 function, 93*

USB function, 93

USB legacy, 93

user/power-on password, 94

virtualization, 93

Wake on LAN, 94

write-protect boot sector, 94

**CNR (communications network riser)
slots, 41-42**

coaxial cabling, 805-806

color

3D games, troubleshooting, 300

display quality, configuring, 295-296

flickers, troubleshooting, 301

fringes around text/graphics, trouble-
shooting, 301

laser printers, 454

printed pages, troubleshooting, 492

projectors, 302

PS/2 ports, 249

quality, 301

screen/printer not matching, 300

**COM 4 I/O port conflicts, trouble-
shooting, 238**

COM ports. *See* serial ports

combo cards, 349, 817

command-line tools

networks

IPconfig, 849

NBTSTAT, 850

Net, 847

netstat, 849

NSLookup, 849

Ping, 847-848

Tracert, 848

Windows

CD command, 629

command prompts, starting, 621-622

COPY command, 624-625

DEL command, 635-636

Diskpart, 633-635

Format command, 629-630

FORMAT.EXE, 631-632

internal commands, 622-623

MD command, 629

RD command, 629

ROBOCOPY.EXE, 627-628

Taskkill utility, 638-640

Tasklist.exe, 636-638

wildcards, 624

XCOPY command, 625-627

Command Prompt (Windows), 744

command prompts, starting, 621-622

commands. *See also* utilities

CD, 623, 629

CLS, 623

COPY, 622-625

DATE, 622

DEL, 622, 635-636

DIR, 623

ECHO, 623

ERASE, 623

Format, 629-630

IPconfig, 849

MD, 623, 629

NBTSTAT, 850

Net, 847

netstat, 849

NSLookup, 849

PATH, 623

Ping, 847-848

PROMPT, 623

RD, 623, 629

Recovery Console, 737-739

RENAME, 623

SET, 623

- TIME, 622
- Tracert, 848
- TYPE, 623
- VER, 623
- VOL, 623
- XCOPY, 625-627
- Common Tasks View (Windows Explorer), 664-665**
- communication (customers), 939-941**
- communications network riser (AMR) slots, 41-42**
- CompactFlash (CF) cards, 521**
- compatibility**
 - addresses, 828
 - errors, 716
 - RAM, 192
- compatibility mode (Windows), 615-617**
- component video connectors, 289**
- composite video connectors, 289**
- compressed air, 18**
- compromised mobile device protection, 432-435**
 - antivirus software, 434
 - backups, 432-433
 - operating system updates, 433
- CompTIA A+ certification website, 18**
- computer management (MMC), 640-641**
- Computer Protection Program website, 874**
- computer safety**
 - electricity, 932-934
 - AC outlets, 932*
 - blackouts, 933*
 - brownouts, 933*
 - dirty power, 933*
 - fires, 934*
 - power surges, 933*
 - sags, 933*
 - surge suppressors, 933*
 - ESD, preventing, 930-932
 - personal physical, 934-935
- computers**
 - assembly/disassembly tools, 15
 - components
 - general system information, 324*
 - processor information, 326*
 - cooling
 - case fans, 163-164*
 - motherboards, 161-162*
 - thermal compound, 164*
 - video cards, 163*
 - desktops
 - components, 4-9*
 - front/rear views, 5*
 - points of failure, 12-13*
 - destruction/disposal methods, 898-899
 - firmware, 11
 - hardware, 10
 - laptops. *See laptops*
 - locking, 878-879
 - safety. *See computer safety*
 - software, 10-11
 - synchronizing
 - Android devices, 424-427*
 - BlackBerry devices, 428*
 - iOS devices, 427*
 - Windows CE/Mobile devices, 428*
- conditioning (laser printers EP process), 453**
- configuring**
 - ATA/SATA RAID arrays, 529
 - BIOS
 - AC power loss restart, 94*
 - automatically, 95*

- boot sequence*, 92
- boot settings/sequence*, 98-100
- boot-time diagnostic screen*, 93
- boot virus detection*, 94
- clock*, 92
- floppy drive*, 94
- hardware monitor*, 92, 105
- integrated ports/peripherals*, 100, 103
- keyboard*, 93
- main menu*, 96
- memory*, 92, 106
- onboard audio, modem, network*, 92
- parallel ports*, 93
- PATA, drives*, 94
- plug-and-play OS*, 93
- PnP/PCI*, 105
- power management*, 93, 104
- primary VGA*, 93
- processors*, 106
- PS/2 mouse*, 92
- quiet boot*, 93
- S1/S3 standby*, 94
- SATA drives*, 94
- security features*, 108-109, 899-900
- serial ports*, 93
- settings*, 88
- setup passwords*, 94
- setup program*, 89-90
- shadowing*, 93
- Standard Features/Settings menu*, 96
- system information*, 98
- UEFI*, 91
- USB 3.0 function*, 93
- USB function*, 93
- USB legacy*, 93
- user/power-on password*, 94
- video cards*, 282
- virtualization*, 93, 106-107
- Wake on LAN*, 94
- write-protect boot sector*, 94
- Bluetooth, 419
 - Android devices*, 418-419
 - iOS devices*, 420
 - troubleshooting*, 420-421
- displays
 - color quality*, 295-296
 - control panel*, 678
 - refresh rates*, 296-297
 - resolution*, 292-295
- DMA/UDMA transfers, 545
- DNS, 827
- email for mobile devices
 - BlackBerry*, 423
 - IMAP*, 423
 - POP3*, 421-423
 - troubleshooting*, 423
 - web-based*, 421
- exceptions, 902-903
- file/printer sharing, 829
- floppy drive hardware, 539-540
- hard drives. *See* disk management
- hardware monitor, 105
- ISDN connections, 785
- mobile device displays, 408-411
 - calibration*, 409-411
 - screen orientation*, 408-409
- multifunction network devices, 845
 - DMZ*, 846
 - MAC address filtering*, 846
 - NAT*, 845
 - port forwarding*, 845
- network interface cards, 816-819
 - full-duplex/half-duplex modes*, 817
 - hardware resources*, 816

- media types*, 817
- WLANs*, 818-819
- parallel ports, 243-246
- PATA
 - BIOS*, 508
 - hard drives*, 519
 - jumper blocks*, 507
- printers, 472-474
 - preferences*, 473
 - properties sheets, accessing*, 472-473
 - properties versus preferences*, 474
 - saving changes*, 475
- processors, 106
- SATA hard disk drives, 516
- SCSI device IDs, 223-224
- serial ports, 236-237
- shared resources, 829
 - access*, 836
 - administrative shares*, 834
 - clients*, 834-836
 - drive mapping*, 840-841
 - file/printer sharing*, 829
 - folders/drives*, 830-834
 - FQDNs*, 840
 - identifying*, 836
 - offline*, 839
 - printers*, 834
 - UNC*, 838-839
- software firewalls, 900-901
- SOHO. *See* SOHO
- sound cards, 332
- System Restore, 759
- systems
 - audio/video editing*, 316-317
 - gaming*, 319-320
 - graphic/CAD/CAM design*, 314-315
 - home servers*, 323-324
 - home theaters*, 321-322
 - thick clients*, 322
 - thin clients*, 323
 - virtualization*, 318-319
- TCP/IP, 819
 - advanced settings*, 822
 - alternate configuration*, 821
 - DHCP servers*, 821
 - DNS*, 827
 - gateways*, 826
 - IP addressing*, 824-826
 - manually*, 822
 - static versus server-assigned IP addressing*, 819-820
 - subnet masks*, 824
 - Windows*, 820
 - WINS*, 826
- TV tuner cards, 336
- web browsers, 841-842
 - Internet connections*, 842-843
 - script settings, enabling/disabling*, 843
 - security*, 844-845
- webcams, 327
- Wi-Fi for mobile devices
 - Android*, 414
 - iOS*, 415
 - tethering*, 416
- WINS, 826
- wireless clients, 904
 - Windows 7*, 908-909
 - Windows Vista*, 908
 - Windows XP SP2/SP3*, 905-908
- WLANs, 818-819
- connections**
 - ATA/SATA RAID arrays, 528
 - Bluetooth, 386

Internet

broadband, 786-787
cable, 788-789
cellular, 790
dial-up, 778-784
downstream/upstream, 786
fiber-optic, 790
ISDN, 784-785
LANs, 791
satellite, 789-790
WiMAX, 791

mobile device network, 424

Bluetooth, 418-421
GSM, 412-413
Wi-Fi, 414-418

networks, 853

PATA hard drives to motherboards, 518

PCs to mobile devices

Android, 424-427
BlackBerry devices, 428
iOS, 427
Windows CE/Mobile, 428

printers, 488

projectors to laptops, 379

SATA hard disk drives to motherboards, 516

wireless, 386, 910-912

connectors. See also cables

Narrow SCSI, 226
network cables, 803, 806-807
parallel ports, 240-241
PATA hard drives power, 517
power supplies, 135-138
serial ports, 239

content view (Windows Explorer), 667

continuous reboots, 53

control panel (Windows)

Action Center, 691
Add/Remove Programs, 686
All Control Panel Items view, 676
Automatic Updates, 688
Category view, 674
Devices and Printers, 689
display settings, configuring, 678
features, 673-674
folder options, 679
function access via property sheets, 678
HomeGroup, 690
Pen and Input Devices, 689
power options, 682
Windows Vista/7, 685-686
Windows XP, 683-684
Problem Reports and Solutions, 689
Programs and Features, 687
starting, 674
switching views, 676
System properties sheet, 680-682
Tablet PC Settings, 688

CONVERT.EXE, 660**converting numbers, 825****cooling**

case fans, 163-164
motherboards, 161-162
negative pressure, 148
processors, 74
heat sinks, 75
liquid, 76
thermal compound, 164
video cards, 163, 275-276

Copy command, 622-625, 737

copying files/folders, 896

CPUs. See processors

CPU-Z website, 326

crimpers, 18**CRT (Cathode Ray Tube) monitors, 277****CSMA/CD (Carrier Sense Multiple Access/Collision Detect), 810****customers**

- interaction, 939-941
- property, respecting, 941

customizing**computers**

- audio/video editing, 316-317*
- gaming, 319-320*
- graphics/CAD/CAM design, 314-315*
- home servers, 323-324*
- home theaters, 321-322*
- thick clients, 322*
- thin clients, 323*
- virtualization, 318-319*

- power connectors, 137

cutting tools, 808**D****daisy-chaining (SCSI)**

- creating, 227
- maximum length, 229
- overview, 222
- termination methods, 229

damaged mobile device protection, 432-435

- antivirus software, 434
- backups, 432-433
- operating system updates, 433

data

- migrating, 877
- mobile devices, protecting, 429
 - antivirus software, 434*
 - backups, 432-433*

compromised/damaged devices, 432-435

lost/stolen, 432

operating system updates, 433

passcode locking, 429, 432

projectors, 280-281**recovery**

EFS files, 875

external drive docks, 550

external drive enclosures, 550

hard disk diagnostic programs, 551

software, 552

Windows-based disk tools, 551

security

backups, 877

destruction/disposal methods, 898-899

encryption, 875-876

incident reporting, 879

local security policies, 874

locking computers, 878-879

migration, 877

passwords, 878

physical protection, 883

remnant removal, 877

social engineering, 880-881

transferring, 589

USMT, 590-591

Windows Easy Transfer, 590

DATE command, 622**dates and times**

BIOS resets, 53

clock, setting, 92

DC (direct current), 130, 151**DDR SDRAM (double-data-rate SDRAM), 181****DDR2 SDRAM (double double-data-rate SDRAM), 182****DDR3 SDRAM (double-data-rate 3 SDRAM), 182**

dead shorts, troubleshooting, 57

dead systems, troubleshooting, 143-144

decimal to binary conversions, 825

defective power supplies, 149-152

AC to DC conversions, 152

AC voltage, 151

acceptable voltage levels, 152

amperage, 152

cables, 152

DC voltage, 151

resistance, 152

Defrag utility, 718, 755

defragmenting hard drives, 755

DEL command, 622, 635-636

Delete command, 737

deleting data from optical discs, 534

Dell

beep codes website, 111

power supplies, 137, 154

demilitarized zone (DMZ), 846

Depot International website, 479

desktops. See also computers

cleaning, 148

components, 4-5, 8-9

firmware, 11

hardware, 10

laptops, compared, 345

memory modules comparison, 185

points of failure, 12-13

software, 10-11

destruction (computers), 898-899

details view (Windows Explorer), 667

developing (laser printers EP process), 453

Device Manager, 718, 729-735

categories, viewing, 729

device property sheets, opening, 730

disabling devices, 731, 734-735

error codes, 733-734

malfunctioning devices, 731-733

problems, troubleshooting, 732

removing devices, 735

starting, 729

devices

BIOS support, 87

Control Panel settings, 689

disabling, 734-735

drivers, installing, 216

failures, 715

IEEE 1394

overview, 219

troubleshooting, 221

networks, 775

bridges, 776

firewalls, 777

hubs, 775

Internet appliances, 777

modems, 776

multifunction, configuring, 845-846

NAS, 776

repeaters, 776

routers, 777

switches, 775

VoIP phones, 777

WAPs, 776

property sheets, opening, 730

removing, 735

SCSI

cables, 225-227

daisy chaining, 222, 227-229

IDs, configuring, 223-224

signaling types, 227

standards, 225

terminating, 229

troubleshooting, 230-231

serial port supported, 231

storage. *See* storage devices

Devices and Printers (Windows Control Panel), 689

DHCP (Dynamic Host Configuration Protocol), 796

TCP/IP, configuring, 821

versus static IP addresses, 885

diagnostic and repair tools, 717-719

Advanced Boot Options, 726-729

Automated System Recovery, 718, 739-741

Defrag, 718

Device Manager, 718, 729-735

Event Viewer, 718, 724

Fixboot, 718

Fixmbr, 718

MSConfig, 718-721

Recovery Console, 718, 735-739

REGEDIT, 718, 722-724

REGSVR32, 718, 721

Repair Discs, 719

Safe Mode, 718

System File Checker, 718-719

WinRE, 718, 741-744

dialog boxes

Display Settings, 293, 690

Hardware Monitor, 106

Map Network Drive, 841

Mouse properties, 690

Network, 836

Offline Files, 839

PnP/PCI Configuration, 105

Power Options, 686

Services, 643

Speech Recognition, 335

Virtual Memory, 682

dial-up Internet connections, 778

creating, 783

modems

installing, 781-783

serial port similarities, 778

standards, 781

types, 779

requirements, 784

service providers, 783

digital audio mini-jacks, 250

digital cameras, 328-329

digital micromirror devices (DMDs), 281

digital TV vendor websites, 322

dim displays, troubleshooting, 383

DIMM (Dual Inline Memory Module), 184

Dir command, 623, 737

direct current (DC), 130, 151

direct thermal printing, 460

DirectX diagnostics, 661, 672

dirt/dust (power supplies), 148

dirty power, 933

Disable command, 737

disabling

autorun, 918

Bluetooth

Android devices, 419

iOS devices, 420

devices, 734-735

GPS (mobile devices), 411

Internet scripts, 843

SSID broadcasting, 886

disassembling laptops, 353

disassembly tools, 15

disk cloning Windows, 577-579

Disk Management, 650

configuration options

- active partitions, 652*
- converting basic disks to dynamic, 652*
- creating logical drives, 655*
- creating partitions, 652, 655*
- creating volumes, 655*
- drive arrays, creating, 653*
- extending partitions, 651-653*
- formatting partitions, 651-652*
- initializing disks, 651*
- logical drives, creating, 651*
- primary partitions, creating, 651*

disk arrays supported, 653

disk status, viewing, 655

file systems

- converting, 660*
- defined, 657*
- FAT32, 657*
- FAT64, 658*
- NTFS, 658-660*

mounting drives, 655-656

“Disk Status Descriptions” website, 655

Diskpart utility, 633-635, 737

disks

- basic, 583
- dynamic, 583
- encrypting, 876

Display Settings dialog box, 293, 690

displaying objects in Windows Explorer

- Windows Vista/7, 667
- Windows XP, 666

DisplayPort connectors, 288

displays

- control panel settings, 678
- CRT monitors, 277

data projectors, 280-281

installing, 289-291

laptops

- backlight components, 372*
- dual, 375-379*
- failures, 13*
- inverters, 372-373*
- LCDs, 369*
- LEDs, 369*
- nonnative resolutions, 371*
- OLEDs, 369*
- plasma, 370*
- quality factors, 370-371*
- replacing, 365-366*
- resolutions, 370*
- troubleshooting, 382-384*
- Wi-Fi antennas, 373*
- windowboxing, 372*

LCD, 278-280, 369

LED, 279, 369

mobile devices, 399

- adjusting, 408-411*
- calibration, 409-411*
- screen orientation, locking, 408-409*
- troubleshooting screen calibration problems, 411*

multitouch touch screens, 398

OLED, 281

plasma, 279

settings

- color quality, 295-296*
- refresh rates, 296-297*
- resolution, 292-295*

touch screen, 260-261

- installing, 262*
- interfacing, 261*

- surface treatments*, 261
- troubleshooting*, 262-263
- troubleshooting
 - 3D games*, 300
 - color fringes around text/graphics*, 301
 - color quality*, 301
 - flickers*, 300-301
 - icon size*, 300
 - monitors/projectors*, 300-302
 - mouse pointers*, 300
 - no picture with replacement video cards*, 301
 - picture quality*, 298-301
 - picture size changes*, 301
 - projectors*, 301-302
 - refresh rates*, 301
 - resolution*, 301
 - screen/printer colors not matching*, 300
 - text size*, 300
 - video cards*, 300-302
 - wavy lines*, 301
- types, 276
- video cards
 - AGP slots*, 274
 - BIOS configuration*, 282
 - cooling*, 275-276
 - defined*, 274
 - driver installation*, 282-284
 - GPUs*, 275
 - PCI Express x16 slots*, 274
 - physical installation*, 282-284
 - types*, 274
- video connectors
 - component*, 289
 - composite*, 289
 - DisplayPort*, 288
 - DVI*, 286
 - HDMI*, 286-288
 - RGB*, 289
 - SVGA*, 286
 - S-video*, 289
 - VGA*, 285
- disposal (computers)**, 898-899
- DLL (dynamic link library)**, 715
- DLL messages, missing**, 715
- DLP projectors**, 280
- DMA/UDMA transfers, configuring**, 545
- DMDs (digital micromirror devices)**, 281
- DMZ (demilitarized zone)**, 846
- DNS (Domain Name System)**, 795-796, 827
- docking stations (laptops)**, 380-381
- dongles (PC Cards)**, 348
- door security**, 881-882
- dot matrix printers**
 - paper, replacing, 483
 - printheads, 463, 483
 - printing process, 462
 - ribbons, replacing, 483
- double-data-rate (DDR) SDRAM**, 181
- double-data-rate 3 (DDR3) SDRAM**, 182
- double double-data-rate (DDR2) SDRAM**, 182
- double-sided memory**, 188
- downloading applications**, 408
- downstream**, 786
- DRAM (dynamic RAM)**, 180-181
- drivers**
 - devices, 216
 - printers, 464-467
 - third-party, 588

video cards
installing, 282-284
troubleshooting, 300

drives

arrays, creating, 653

Blu-ray

CD/DVD drives, compared, 531-532
media types supported, 532
speeds, 533

CD

DVD/Blu-ray drives, compared, 531-532
erasing data in Windows XP, 534
recording data, 533-537
speeds, 533

data recovery tools

data recovery software, 552
external drive docks, 550
external drive enclosures, 550
hard disk diagnostic programs, 551
Windows-based disk tools, 551

DMA/UDMA transfers, configuring, 545

DVD

CD/Blu-ray drives, compared, 531-532
erasing data in Windows XP, 534
media types supported, 532
recording data, 533-537
speeds, 533
SuperMulti DVD, 532

eSATA, 519

failures, 13

floppy, 538

capacities, 538
cleaning, 540
defined, 538
external, 540

hardware configuration, 539-540
maintenance, 540-541

hard. *See* hard drives

hybrid, 513

interfaces, 502

external, 502
hot-swappable, 511
internal, 502
overview, 503
PATA BIOS configuration, 508
PATA cabling, 506
PATA jumper block configuration, 507
PATA/SATA standards, 504-505
SATA cabling, 508-510
SCSI, 510

logical, 651, 655

loud noises, troubleshooting, 546

mapping, 840-841

mounting, 655-656

optical

Blu-ray media types, 532
comparing, 531-532
DVD media types, 532
erasing data in Windows XP, 534
recording data, 533-537
speeds, 533
types, 531

PATA, 517-519

BIOS settings, configuring, 97
cabling, 506
configuring, 100, 507-508
installing, 517-519
settings, 94
standards, 504-505

point of failure, 12

- RAID, 526
 - ATA/SATA arrays, creating, 528-530*
 - levels, 526-527*
 - recognition problems, troubleshooting, 548
 - SATA
 - BIOS settings, configuring, 97*
 - cabling, 508-510*
 - host adapters, 517*
 - installing, 515-517*
 - ports, configuring, 100*
 - RAID arrays, creating, 528-530*
 - settings, 94*
 - standards, 504-505*
 - sharing, 830-834
 - access, 836*
 - drive mapping, 840-841*
 - FQDNs, 840*
 - identification, 836*
 - offline, 839*
 - simple file sharing, 831*
 - UNC, 838-839*
 - user/group permissions, 832-834*
 - tape, 541-542
 - USB flash memory, 524
 - viewing with Windows Explorer, 664
 - DSL, 786-787**
 - dual-channel memory, 180**
 - dual displays (laptops), 375**
 - cloning to secondary display, 377-378
 - Extended Desktop, enabling
 - Windows 7, 376-377*
 - Windows XP/Vista, 375-376*
 - projectors, connecting, 379
 - troubleshooting, 383
 - Dual Inline Memory Module (DIMM), 184**
 - DualView, 375-377**
 - duplexing assemblies (laser printers), 450**
 - Duplicate Computer Name error messages, 851**
 - Duplicate IP Address error message, 851**
 - DVDs**
 - autorun, disabling, 918
 - CDs/Blu-ray, comparing, 531-532
 - drive speeds, 533
 - erasing data, 534
 - recording data
 - third-party programs, 536-537*
 - Windows Vista/7, 535-536*
 - Windows XP, 533-534*
 - rewriteable/erasable (RW), 532
 - SuperMulti drives, 532
 - types, 532
 - writeable/nonerasable (R), 532
 - DVI connectors, 286**
 - DXDiag utility, 661, 672**
 - dye-sublimation printing, 460**
 - dynamic disks, 583**
 - Dynamic Host Configuration Protocol. See DHCP**
 - dynamic link library (DLL), 715**
 - dynamic RAM (DRAM), 180-181**
-
- ## E
- ECC memory (error-correcting code), 179, 187**
 - ECHO command, 623**
 - Ecova Plug Load Solutions website, 133**
 - efficiency (power supplies), 133**
 - EFI (Extensible Firmware Interface), 659**
 - EFS (Encrypted File System), 870, 875**

EIA-568B standard, 803

The Elder Geek's Windows Services Guide website, 644

electricity. *See also* power

safety, 932-934

AC outlets, 932

blackouts, 933

brownouts, 933

dirty power, 933

fires, 934

power surges, 933

sags, 933

surge suppressors, 933

testing tools, 16

electrophotographic (EP) process, 453

electrostatic discharge (ESD), preventing, 930-932

Elston Systems website, 113

email

mobile devices, configuring

BlackBerry, 423

IMAP, 423

POP3, 421-423

troubleshooting, 423

web-based, 421

protocols, 797-798

spam, 915

emulator requirements virtualization, 693

Enable Boot Logging option, 728

Enable command, 737

Enable low-resolution video option, 728

Enable VGA Mode, 728

enabling

Airplane Mode (smartphones), 412

ATA/SATA RAID arrays, 529

auditing, 874

Bluetooth

Android devices, 418

iOS devices, 420

Extended Desktop

Windows 7, 376-377

Windows XP/Vista, 375-376

GPS (mobile devices), 411

Internet scripts, 843

USB ports in BIOS, 215

Encrypted File System (EFS), 870, 875

encryption, 875-876

Enterprise edition

Windows 7, 609

Windows Vista, 608

environmental controls, 936-938

EP (electrophotographic) process, 451

cleaning, 454

conditioning, 453

developing, 453

exposing, 453

fusing, 454

prerequisites, 452

processing, 453

transferring, 453

ERASE command, 623

error codes (Device Manager), 733-734

error-correcting code (ECC) memory, 179, 187

error messages (POST), 112

eSATA hard drives, 519

ESD (electrostatic discharge), preventing, 16, 930-932

eSupport website, 115

Ethernet

cable color coding diagram, 803

networks

hubs, 814

switches, 814

wired, 810

wireless, 811-812

ports, configuring, 102

printers, 469-470

European power standard voltage, 134

evaluating onboard components

general system information, 324

processor information, 326

event logging, 897-898

Event Viewer, 718, 724

exceptions, configuring, 902-903

exFAT file systems, 658

Exit command, 737

Expand command, 738

expansion options

laptops, 346

CardBus cards, 348

ExpressCards, 350-352

flash memory cards, 352

memory, 352

PC Cards, 346-350

USB, 350-352

ZV cards, 349

motherboards, 31, 36-42

AGP, 38-39

AMR, 41-42

CNR, 41-42

comparison, 40

PCI, 36

PCI-E, 39

PCI-X, 37

Explorer (Windows), 661-662

Common Tasks view, 664-665

display options, 666-667

drives, viewing, 664

Favorite Links view, 665

libraries, 668

My Computer window, 669

starting, 662

Windows 7 view, 665

exposing (laser printers EP process), 453

ExpressCards, 350-351

CardBus cards, compared, 350

failures, 13

inserting, 350

media remote controls, 352

performance, 350

removable adapters, 350

removing, 351

types, 350

Extended Desktop, enabling

Windows 7, 376-377

Windows XP/Vista, 375-376

Extended Graphics Array (XGA), 370

extended partitions, 582, 651-653

Extensible Firmware Interface (EFI), 659

external drives

docks, 550

enclosures, 550

eSATA, 519

floppy, 540

interfaces, 502

external modems, 779

extra large icons (Windows Explorer), 667

eyebrow tweezers, 15

F

faded prints, troubleshooting, 485-486

fans

case, 163-164

connectors, 44

- laptops, removing, 366
- power supplies, troubleshooting, 145, 149
- FAST (Files and Settings Transfer Wizard), 590**
- Fast SCSI, 225**
- Fast-Wide SCSI, 225**
- FAT16 file systems, 587**
- FAT32 file systems, 587, 657**
 - converting to NTFS, 912
 - NTFS, compared, 658
- FAT64 file systems, 658**
- fatal errors, 110**
- Favorite Links View (Windows Explorer), 665**
- fiber-optic cabling, 805**
- fiber-optic Internet services, 790**
- file systems, 586-588**
 - 32-bit versus 64-bit, 620
 - converting, 660
 - defined, 657
 - determining, 659
 - FAT32, 657
 - converting to NTFS, 912*
 - NTFS, compared, 658*
 - FAT64, 658
 - NTFS, 658-660
 - security, 870
 - Windows Vista, 620
 - Windows 7, 620
 - Window XP, 620
- File Transfer Protocol (FTP), 794**
- files**
 - boot.ini, re-creating, 713
 - copy utilities, 753
 - decrypting, 875
 - displaying in Windows Explorer, 666-667
 - encrypting, 875
 - erasing from CDs/DVDs, 534
 - moving/copying permissions, 896
 - not opening, 717
 - NTDETECT.COM, 712
 - NTLDR, 712
 - Ntoskrnl.exe, reinstalling, 713
 - recording to CDs/DVDs
 - third-party programs, 536-537*
 - Windows Vista/7, 535-536*
 - Windows XP, 533-534*
 - sharing, 830-834
 - access, 836*
 - configuring, 829*
 - drive mapping, 840-841*
 - FQDNs, 840*
 - identification, 836*
 - offline, 839*
 - simple file sharing, 831*
 - UNC, 838-839*
 - user/group permissions, 832-834*
- Files and Settings Transfer (FAST) Wizard, 590**
- FileZilla, 794**
- filmstrip view (Windows Explorer), 667**
- filtering MAC addresses, 846, 887-890**
- fire protection, 934**
- firewalls, 777**
 - network access point security, 891
 - software, 873
 - configuring, 900-901*
 - troubleshooting, 903-904*
- FireWire, 218-220**
 - 400, 218
 - 800, 218
 - cables, 218
 - cards, installing, 220

- compatible devices, 219
- configuring, 102
- printers, 470
- troubleshooting, 220-221
- versions, 218
- firmware, 11**
 - first responses, 938
 - printers, upgrading, 469
 - updates (Windows), 760
- five-wire resistive technology, 261**
- Fixboot command, 718, 738-739**
- Fixmbr command, 718, 738-739**
- Flash BIOS updates, 115-117**
- flash memory, 520**
 - cards
 - CompactFlash*, 521
 - laptops*, 352
 - microSD*, 522
 - microSDHC*, 522
 - miniSD*, 522
 - miniSDHC*, 522
 - MultiMedia*, 521
 - readers*, 523-524
 - Secure Digital*, 522
 - SmartMedia*, 521
 - types*, 520-523
 - xD-Picture Cards*, 523
 - SSDs, 525-526
 - USB drives, 524
- Flash recovery jumpers, 117**
- FlexATX motherboards, 32**
- flicker-free refresh rates, 296**
- flickers (displays), troubleshooting, 300-301, 383**
- floppy drives, 538**
 - BIOS settings, configuring, 94, 97
 - capacities, 538
 - cleaning, 540
 - defined, 538
 - external, 540
 - hardware configuration, 539-540
 - maintenance, 540-541
- Fn key (laptops), 374-375**
- folders**
 - control panel options, 679
 - displaying in Windows Explorer, 666-667
 - moving/copying permissions, 896
 - sharing, 830-834
 - access*, 836
 - drive mapping*, 840-841
 - FQDNs*, 840
 - identification*, 836
 - offline*, 839
 - simple file sharing*, 831
 - UNC*, 838-839
 - user/group permissions*, 832-834
- Format command, 629-632, 738**
- form factors (motherboards), 31-32**
- forwarding ports, 845**
- four-wire resistive technology, 261**
- FQDNs (Fully Qualified Domain Names), 840**
- front panel cable failures, 12**
- front panel connectors, 46**
- front view (desktops), 5**
- FTP (File Transfer Protocol), 794**
- full-duplex mode (networks), 817**
- Fully Qualified Domain Names (FQDNs), 840**
- function keys (laptops), 374-375**
- fuser assemblies (laser printers), 450**
- fusing (laser printers EP process), 454**
- FXO ports, 814**

G

G-Sensor calibration, 409

gadgets (Windows), 611

gaming systems, configuring, 319-320

garbled characters (printers), troubleshooting, 488

gateways

- router alternatives, 791
- TCP/IP, configuring, 826

general packet radio service (GPRS), 412

generic hubs (USB), 214

geotracking, 412

ghost cursors, troubleshooting, 384

ghost images, troubleshooting, 486

Gibson Research Corporation

- Perfect Passwords, 884
- SecurAble, 326

Global Positioning System (GPS), 411

Global System for Mobile Communications (GSM), 412-413

global unicast addresses, 828

GoldMemory, 196

Google

- Open Handset Alliance, 404
- Play, 408

GPRS (general packet radio service), 412

GPS (Global Positioning System), 411

GPUs (graphics processing units), 275

graphical user interfaces (GUIs), 714

graphics

- AGP slots, 38-39
- cards. *See* video, cards
- color fringes, troubleshooting, 301
- design configurations, 314-315
- primary VGA BIOS, configuring, 93

- processing units (GPUs), 275
- quality, troubleshooting, 301
- sizes, 301
- Windows requirements, 567

grayware, 915

GSM (Global System for Mobile Communications), 412-413

guest accounts, 893

GUIs (graphical user interfaces), 714

gyroscopes, 409

H

half-duplex mode (networks), 817

hard drives, 512

- 3TB, booting, 659
- arrays, creating, 653
- configuring. *See* Disk Management
- data recovery software, 552
- defragmenting, 755
- diagnostic programs, 551
- dynamic conversions, 652
- error checking, 754-755
- eSATA, 519
- external, 519
- initializing, 651
- internal, installation, 513-519
- laptops, replacing, 358-359
- mounting, 655-656
- overview, 512
- partitions, 580
 - active*, 652
 - creating*, 652, 655
 - creating during Windows Vista/7 installation*, 584-586
 - creating during Windows XP installation*, 583-584
 - dynamic/basic disks*, 583

- extended*, 582, 651-653
- formatting*, 651-652
- primary*, 581-582, 651
- PATA, 517-519
 - BIOS configuration*, 519
 - cables*, 517
 - motherboard connection*, 518
 - power connectors*, 517
- performance, 512-513
- restoring
 - external drive docks*, 550
 - external drive enclosures*, 550
 - Windows-based tools*, 551
- SATA, 515-517
 - BIOS configuration*, 516
 - cables*, 515
 - host adapters*, 517
 - motherboard connection*, 516
- status, viewing, 655
- troubleshooting
 - boot failures*, 547
 - drive-recognition problems*, 548
 - loud noises*, 546
 - operating system not found*, 548
 - RAID*, 549
 - read/write failures*, 543
 - slow performance*, 543-545
- as virtual memory, 178
- hard resets (mobile devices)**, 437
- hardware**, 10
 - assisted virtualization, 326
 - floppy drives, configuring, 539-540
 - ISDN connections, 785
 - laptops, replacing, 354
 - batteries*, 355-356
 - hard drives*, 358-359
 - inverters*, 373
 - keyboards*, 356-357
 - memory*, 360-361
 - optical drives*, 362
 - processors*, 368
 - screens*, 365-366
 - speakers*, 358
 - touchpads*, 357-358
 - wireless cards*, 362-365
 - mobile devices, 398-404
 - ARM processors*, 398
 - batteries*, 399
 - Micro-USB ports*, 399
 - multitouch touch screens*, 398-399
 - tablets versus laptops*, 399-400
 - monitor, configuring, 92, 105
 - network interface card resources, 816
 - profiles, 681
 - Windows requirements, 566-569
 - compatibility, verifying*, 568-569
 - minimum*, 567, 606-607
 - Windows 7*, 567
- Hardware Monitor BIOS dialog box**, 106
- hazards (power supplies)**, 154
- HDMI (High-Definition Multimedia Interface)**, 286-288
- header cables**, 213
- heat sinks**, 164
 - laptops, removing, 367
 - processors, 75
- heating elements (thermal printers), cleaning**, 482
- Help command**, 738
- hemostat clamps**, 15
- hex codes (POST)**, 112-113
- hex drivers**, 15
- Hi-Speed USB**, 209

- High-Definition Multimedia Interface (HDMI), 286-288
 - Hitachi Feature Tool, 547
 - Home Basic edition (Windows Vista), 607
 - Home edition (Windows XP), 607
 - HomeGroup feature (Windows Control Panel), 690
 - Home Premium edition (Windows 7/ Vista), 608
 - home server systems, configuring, 323-324
 - home theater systems, configuring, 321-322
 - host/guest virtualization, 692
 - host signal processing (HSP), 779
 - hotfixes, 595
 - hot-swappable drive interfaces, 511
 - HP**
 - LaserJet error codes, 492-493
 - MSDS documents website, 937
 - HSP (host signal processing), 779
 - HT technology (hyperthreading), 70
 - HTC Sync, 425
 - HTML (Hypertext Markup Language), 793-794
 - HTTP (Hypertext Transfer Protocol), 792
 - HTTPS (Hypertext Transfer Protocol Secure), 792
 - hubs, 775, 814
 - humidity (environment), 936
 - hybrid drives, 513
 - Hypertext Markup Language (HTML), 793-794
 - Hypertext Transfer Protocol (HTTP), 792
 - Hypertext Transfer Protocol Secure (HTTPS), 792
 - hyperthreading (HT technology), 70
 - hypervisor-based virtualization, 692
-
- IBM beep codes website, 111**
 - icons**
 - size, 300
 - Wi-Fi, 415
 - Windows Explorer, 666
 - identifying shared resources, 836**
 - IEEE 802.11, 811-812**
 - IEEE 1394, 218-220**
 - cables, 218
 - cards, installing, 220
 - compatible devices, 219
 - configuring, 102
 - printers, 470
 - troubleshooting, 220-221
 - versions, 218
 - IEEE 1394a, 218**
 - IEEE 1394b, 218**
 - IEEE-1394 iLINK, 218**
 - image backups, creating**
 - Vista, 749
 - XP, 747
 - image deployment Windows installation, 577-579**
 - imaging drums (laser printers), 450**
 - IMAP (Internet Message Access Protocol), 423, 798**
 - impact printers**
 - defined, 461
 - dot-matrix printers, 462-463
 - maintenance, 483
 - paper, 464
 - printer ribbons, 463

- troubleshooting
 - faded prints*, 486
 - streaks/smudges*, 485
- improper shutdowns**, 714
- incident reporting**, 879
- incident responses**
 - chain of custody, 939
 - documentation, 938
 - first responses, 938
- infrared (networks)**, 813
- Infrared Data Association (IrDA)**, 813
- infrared printers**, 469-471
- inheritance (permissions)**, 895
- initializing disks**, 651
- ink**
 - jet cartridges, 457-458
 - clogged/damaged*, 457
 - ink dot creation methods*, 458
 - printheads*, 457
 - replacing*, 480
 - toner cartridges, 450-451, 456
 - installing*, 451
 - recycled*, 451
 - replacing*, 478
 - toner not fused to paper, troubleshoot-
ing, 486
- inkjet printers**
 - calibrating, 458, 480
 - components, 456
 - ink cartridges, 457-458
 - clogged/damaged*, 457
 - ink dot creation methods*, 458
 - printheads*, 457
 - maintenance, 480
 - calibration*, 480
 - ink cartridges, replacing*, 480
 - nozzle check routines*, 481
 - overview, 455
 - troubleshooting
 - faded prints*, 486
 - streaks/smudges*, 484
 - turning on/off, 457
- installing**
 - digital cameras, 328-329
 - displays, 289-291
 - ExpressCards, 350
 - file/printer sharing, 829
 - hard drives, 513-519
 - IEEE 1394 cards, 220
 - laser printer maintenance kits, 478
 - memory
 - modules*, 189-191
 - printers*, 467-468
 - microphones, 333
 - MIDI enabled devices, 332
 - modems, 781-783
 - motherboards, 50-52
 - networks
 - client software*, 835
 - interface cards*, 815-816
 - printers*, 835-836
 - parallel ports, 247
 - PATA hard disk drives, 517-519
 - BIOS configuration*, 519
 - cables*, 517
 - motherboard connection*, 518
 - power connectors*, 517
 - PC Cards, 349
 - power supplies, 140
 - printers, 465
 - Add Printer Wizard*, 465-466
 - troubleshooting*, 492
 - vendor-supplied drivers*, 467

- SATA drives, 515-517
 - BIOS configuration*, 516
 - cables*, 515
 - motherboard connection*, 516
- SCSI cards, 228
- service packs, 593-595
- sound cards, 331-332
- toner cartridges, 451
- touch tablets, 253, 262
- USB ports, 213-214
- utilities (Add/Remove Programs), 686
- video cards, 335-336
 - BIOS configuration*, 282
 - drivers*, 282-284
 - physical*, 282-284
- webcams, 327
- Windows
 - boot methods*, 570
 - clean*, 571-573
 - file systems*, 586-588
 - hard drive partitions, creating*. See *hard drives, partitions*
 - hardware requirements*, 566-569
 - image deployment*, 577-579
 - multiboot*, 573
 - remote network*, 577
 - repair*, 574-575
 - third-party drivers*, 588
 - time/date/language/region settings*, 579
 - types*, 570
 - unattended*, 576
 - upgrade installations*, 571
 - without DVD drive*, 570
 - workgroups versus domain setup*, 589
- WinRE, 742
- integrated GPU(s) (processors), 74**
- integrated I/O ports (motherboards), 33-35**
- integrated ports, BIOS, configuring, 100-103**
 - audio, 102
 - Ethernet, 102
 - IEEE-1394, 102
 - I/O devices, 103
 - PATA/IDE, 100
 - SATA, 100
 - USB host adapters, 102
- Integrated Services Digital Network (ISDN), 784-785**
- Intel processors, 58**
 - AMD, comparison, 58
 - Identification Utility website, 326
 - LGA, 59
 - LGA 775, 61
 - LGA 1155, 63-64
 - LGA 1156, 62-63
 - LGA 1366, 62
 - website, 70
- interacting with customers, 939-941**
- interfaces**
 - drive, 502
 - external*, 502
 - hot-swappable*, 511
 - internal*, 502
 - overview*, 503
 - PATA/SATA*, 504-510
 - SCSI*, 510
 - printers, 469-471
 - touch screen monitors, 261
- internal commands (Windows), 622-623**
- internal drive interfaces, 502**

Internet

- Appliances, 777
- broadband, 786
 - cable*, 788-789
 - DSL*, 786-787
 - satellite*, 789-790
- cellular connections, 790
- dial-up connections, 778
 - creating*, 783
 - modem installation*, 781-783
 - modem standards*, 781
 - modem types*, 779
 - modems*, 778
 - requirements*, 784
 - service providers*, 783
- downstream/upstream, 786
- fiber-optic connections, 790
- ISDN connections
 - configuring*, 785
 - hardware*, 785
 - overview*, 784
- LAN connections, 791
- Message Access Protocol (IMAP), 423, 798
- pass-through, 416
- service providers (ISPs), 783
- web browsers
 - configuring*, 841-842
 - Internet connections, configuring*, 842-843
 - script settings, enabling/disabling*, 843
 - security*, 844-845
 - web pages not displaying*, 854
- WiMAX, 791

inverters (laptop displays), 372-373**I/O**

- bar code readers, 259-260
- BIOS settings, configuring, 103

- keyboards, 258-259
- KVM switches, 263
- mice, 251
 - hardware resources*, 252
 - maintenance*, 257
 - troubleshooting*, 253-254
- motherboard ports, 31-35
- touch screen monitors, 260-261
 - installing*, 262
 - interfacing*, 261
 - surface treatments*, 261
 - troubleshooting*, 262-263

I/O ports

- addresses, 235
- audio
 - analog*, 249-250
 - digital*, 250
- IEEE 1394, 218
 - cards, installing*, 220
 - compatible devices*, 219
 - ports and cables*, 218
 - troubleshooting*, 220-221
 - versions*, 218
- legacy, 208
- mice, troubleshooting, 256
- overview, 208
- parallel
 - adding*, 247
 - cable types*, 244-245
 - configuring*, 243-246
 - connectors*, 240-241
 - defined*, 240
 - ECP or EPP/ECP configurations*, 245
 - loopback plugs*, 248
 - LPT1/LPT2/LTP3 configurations*, 245
 - PCI/PCI Express configurations*, 245
 - pinout*, 241-242

- serial ports, compared, 232*
- testing, 248*
- troubleshooting, 247*
- PS/2, 249
- SCSI
 - cables, 225-227*
 - cards, installing, 228*
 - defined, 221*
 - device IDs, configuring, 223-224*
 - multiple device support, 222, 227-229*
 - Narrow host adapters, 222*
 - signaling types, 227*
 - standards, 225*
 - termination methods, 229*
 - troubleshooting, 230-231*
- serial, 231
 - adding, 238*
 - cables, 235*
 - configuring, 236*
 - devices, 231*
 - loopback plugs, 248*
 - parallel ports, compared, 232*
 - pinouts, 233-234*
 - software, configuring, 236-237*
 - troubleshooting, 238-239*
 - types, 232*
- USB
 - 1.1/2.0, 210*
 - 2.0 devices not operating at maximum speed, 217*
 - 3.0, 211*
 - adding, 213-214*
 - black exclamation point on yellow field error, 217*
 - cable length, 212*
 - defined, 209*
 - device drivers not installed, 216*
 - enabling in BIOS, 215*
 - generic hubs, 214*
 - improper designs, 215*
 - logos, 212*
 - power problems, 216-217*
 - root hubs, 212*
 - speeds, 211*
 - standards, 209*
 - too many connected devices, 217*
- iOS, 406**
 - accelerometers, 409
 - advanced wireless settings, 418
 - Airplane Mode, 413
 - antivirus software, 435
 - application sources, 408
 - applications, turning off, 436
 - Bluetooth headsets, configuring, 420
 - charging devices, 427
 - GPS, enabling/disabling, 411
 - gyroscopes, 409
 - hard resets, 437
 - jailbreaking, 408
 - passcodes, setting, 431
 - POP3 email, configuring, 422-423
 - remote wipe programs, 432
 - screen calibration, 411
 - screen orientation, locking, 408
 - soft resets, 436
 - synchronizing to PCs, 427
 - updating, 434
 - versions, 406
 - Wi-Fi, configuring, 415
- IP addressing, 824-826**
 - classes, 826
 - listing of, 824*
 - subnet masks, 825*
 - Duplicate IP Address error message, 851

- octets, 825
- static versus server-assigned, 819-820
- static versus DHCP, 885
- subnet masks, 824

iPad2

- ARM processor, 398
- battery, 399
- Bluetooth, enabling, 420
- charging, 427
- multitouch touch screen, 398
- POP3 email, configuring, 422-423
- synchronizing to PCs, 427

iPads

- Airplane Mode, 413
- passcodes, setting, 431
- screen orientation, locking, 408
- Wi-Fi, configuring, 415

IPconfig command, 849**IPv6 addressing, 827-829****IrDA (Infrared Data Association), 813****IRQ port addresses, 235****ISDN (Integrated Services Digital Network), 784**

- configuring, 785
- hardware, 785
- overview, 784

ISPs (Internet Service Providers), 783**ITX motherboards, 32****J**

jailbreaking mobile devices, 408**jeweler's screwdrivers, 15****jumper blocks, 44****jumpers, 44****K**

Kernel memory dumps, 709**keyboards, 258**

- 104-key layout, 258
- BIOS settings, configuring, 93
- keytops, removing, 259
- laptops
 - function keys, 374-375*
 - replacing, 356-357*
 - troubleshooting, 385*
- maintenance, 259
- troubleshooting, 258

KVM (keyboard-video-mouse), 263**L**

land grid array. See LGA processors**languages (Windows installation), 579****LANs (local area networks), 769, 773**

- defined, 769
- Internet connections, 791

Laplink PC Mover, 571**laptops**

- batteries
 - replacing, 355-356*
 - troubleshooting, 384*
- Bluetooth connectivity, 386
- components, 7
- desktops, compared, 345
- disassembling, 353
- displays
 - backlight components, 372*
 - failures, 13*
 - inverters, 372-373*
 - LCDs, 369*
 - LEDs, 369*
 - nonnative resolutions, 371*

- OLEDs*, 369
- plasma*, 370
- quality factors*, 370-371
- resolutions*, 370
- screens, replacing*, 365-366
- troubleshooting*, 382-384
- Wi-Fi antennas*, 373
- windowboxing*, 372
- docking stations, 380-381
- dual displays, 375
 - cloning to secondary display*, 377-378
 - Extended Desktop, enabling in Windows 7*, 376-377
 - Extended Desktop, enabling in Windows XP/Vista*, 375-376
 - projectors, connecting*, 379
- expansion options, 346
 - ExpressCards*, 350-352
 - flash memory cards*, 352
 - memory*, 352
 - PC Cards*, 346-350
 - USB Implementers Forum*, 350
 - USB ports*, 352
- firmware, 11
- function keys, 374-375
- hard drives, 358-359
- hardware, 10
- hardware, replacing, 354
 - batteries*, 355-356
 - hard drives*, 358-359
 - inverters*, 373
 - keyboards*, 356-357
 - memory*, 360-361
 - optical drives*, 362
 - processors*, 368
 - screens*, 365-366
 - speakers*, 358
 - touchpads*, 357-358
 - wireless cards*, 362-365
- keyboards
 - function keys*, 374-375
 - replacing*, 356-357
 - troubleshooting*, 385
- Laptop Repair Help website, 353
- memory
 - expansion slots*, 352
 - upgrading*, 360-361
- optical drives, replacing, 362
- points of failure, 13
- power, troubleshooting, 384-385
- processors, replacing, 366-368
- security, 381
- software, 10-11
- speakers, 358
- tablets, 399-400
- touchpads, 357-358
- troubleshooting
 - Bluetooth connectivity*, 386
 - displays*, 382-384
 - keyboards*, 385
 - power problems*, 384-385
 - Wi-Fi connectivity*, 386
 - wireless cards, removing, 362-365
- large icons view (Windows Explorer), 667**
- laser printers**
 - battery backup units, 160
 - calibrating, 479
 - cleaning, 479-480
 - color versus monochrome, 454
 - components, 450
 - defined, 450
 - EP process, 451
 - cleaning*, 454
 - conditioning*, 453

- developing*, 453
- exposing*, 453
- fusing*, 454
- prerequisites*, 452
- processing*, 453
- transferring*, 453
- maintenance, 478
 - calibration*, 479
 - cleaning*, 479-480
 - kits, installing*, 478
 - paper counts, resetting*, 479
 - toner cartridges, replacing*, 478
- toner cartridges, 450-451
- troubleshooting
 - faded prints*, 486
 - streaks/smudges*, 484
- Last Known Good Configuration**, 728
- LCD (liquid crystal display) monitors**, 278-280, 369
- LDAP (Lightweight Directory Access Protocol)**, 799
- LED (light-emitting diode) monitors**, 279, 369
- legacy ports, 208
- LGA (land grid array) processors**, 59
 - 775, 61
 - 1155, 63-64
 - 1156, 62-63
 - 1366, 62
- libraries (Windows Explorer)**, 668
- Lightweight Directory Access Protocol (LDAP)**, 799
- link-local addresses, 828
- liquid cooling systems (processors)**, 76
- liquid crystal displays (LCD monitors)**, 278-280, 369
- list view (Windows Explorer), 666
- Listsvc command**, 738

- lithium-ion polymer batteries**, 399
- Live File System (UDF)**, 535
- local area networks**. *See* LANs
- local security policies**, 874
- locking**
 - computers, 878-879
 - mobile devices (passcodes), 429, 432
- logging events**, 897-898
- logical drives**, 651, 655
- Logon command**, 738
- logos (USB)**, 212
- LoJack for Laptops website**, 109
- loopback plugs**, 16-17
- lost mobile device protection**, 432
- loud noises, troubleshooting**
 - drives, 546
 - power supplies, 142
- low printer memory errors, troubleshooting**, 490-491
- LPT**. *See* parallel ports

M

- MAC addresses, filtering**, 846, 887-890
- magnetic storage devices**, 178
- magnifiers**, 15
- maintenance**
 - activities, monitoring, 914
 - cleaning
 - desktops*, 148
 - floppy drives*, 540
 - heating elements (thermal printers)*, 482
 - keyboards*, 259
 - laser printers*, 454, 479-480
 - mobile device screens*, 411
 - displays, 302-303
 - floppy drives, 540-541

keyboards, 259
 memory, 196
 mice/pointing devices, 257
 mobile device screens, 411
 printers, 18
 impact, 483
 inkjet, 480-481
 laser, 478-480
 thermal, 482-483
 Windows, 744
 backed up files, restoring, 746
 Backup and Restore Center (?),
 750-753
 Backup and Restore Center (Vista),
 748-750
 backups, creating, 745-747
 disk defragmentation, 755
 disk drive errors, checking, 754-755
 firmware updates, 760
 image backups, creating, 747-749
 images, creating, 752
 System Restore, 756-760

malware

protection, 872-873, 913
 recovery, 916
 removing, 916-917
 rootkits, 915
 spyware, 915
 Trojan horses, 915
 types, 914-915
 user education, 917-918
 viruses, 914
 Windows Defender, 916
 worms, 914

managing

cables, 935
 Disk Management. *See* Disk
 Management

power, 104
 printers, 648
 tasks (Windows), 648-649
MANs (metropolitan area networks),
773

mantraps, 882

Map command, 738

Map Network Drive dialog, 841

mapping drives, 840-841

Material Safety Data Sheet (MSDS),
936-938

MaximumPC website, 193

MD command, 623, 629

MDM (Mobile Device Management)
suites, 435

Media Center Edition (XP MCE)
(Windows XP), 607

medium icons view (Windows
Explorer), 667

memory

adding, 178
 banks, 185
 BIOS settings, 92, 106
 cache, 70-71
 chips, 179
 CMOS, 88-89
 DDR comparisons website, 185
 dual-channel, 180
 ECC, 179, 187
 flash, 520
 cards, 352, 520-524
 SSDs, 525-526, 546
 USB drives, 524
 hard disk substitute, 178
 installing, 189-191
 Kernel memory dumps, 709

- laptops, 352
 - expansion slots*, 352
 - upgrading*, 360-361
- magnetic storage, compared, 178
- modules
 - comparison*, 183-184
 - DDR SDRAM*, 181
 - DDR2 SDRAM*, 182
 - DDR3 SDRAM*, 182
 - desktop comparisons*, 185
 - DRAM*, 180
 - loose/missing, troubleshooting*, 56
 - number of*, 180
 - per bank requirements*, 179
 - point of failure*, 12
 - Rambus Direct RAM (RDRAM)*, 183
 - SDRAM*, 181
 - SRAM*, 181
 - types*, 178
 - widths*, 185
- motherboard slots, 31, 35
- parity checking, 186-187
- preventative maintenance, 196
- printers
 - errors, troubleshooting*, 490-491
 - installing*, 467-468
 - size, verifying*, 473
- RAM versus ROM, 177
- registered, 188
- reliability, 185, 188
- single-sided/double-sided, 188
- sizes, 179
- smartphone cards, replacing, 400-403
- speed, 179
- testing programs, 196
- triple-channel, 180
- troubleshooting
 - cache RAM*, 195
 - compatibility*, 192
 - overclocking*, 192-193
 - parity errors*, 194
 - sizing errors*, 194
 - speed mismatches*, 193-194
- types, 177
- unbuffered, 188
- virtual, 178, 681-682
- Windows
 - Memory Diagnostic Tool*, 744
 - requirements*, 567
- Memory Stick PRO Duo cards**, 522
- memory sticks**, 521
- MemTest86**, 196
- mesh topologies**, 775
- metropolitan area network (MANs)**, 773
- mice**, 251
 - hardware resources, 252
 - maintenance, 257
 - troubleshooting, 253-256
 - double-clicking icons*, 256
 - jerky pointer movement*, 256
 - pointer doesn't move*, 254-256
- microATX motherboards**, 32
- microphones**, 333
 - installing, 333
 - testing, 334-335
 - volume, 333
- microSD cards**, 522
- microSDHC cards**, 522
- Microsoft**
 - Help and Support website, 18
 - ImageX utility, 578
 - Management Console (MMC), 640-641, 661

- support website, 53
- System Configuration Utility (MSConfig), 661, 718-721
- TechNet website, 18
- Micro-USB ports, 399**
- MIDI enabled devices, installing, 332**
- migrating data, 589**
 - security, 877
 - USMT, 590-591
 - Windows Easy Transfer, 590
- mini-ATX motherboards, 32**
- Mini-DIN ports, 249**
- Mini-ITX motherboards, 32**
- mini-PCI card**
 - modems, 779
 - types, 363
- mini-PCIe cards, 364, 779**
- miniSD cards, 522**
- miniSDHC cards, 522**
- mirrored arrays, 653**
- Missing Operating System errors, 713**
- Mkdir command, 738**
- MLC (multilevel cell) SSDs, 526**
- MMC (Microsoft Management Console), 640-641, 661**
- MMC (MultiMedia) cards, 521**
- Mobile Device Management (MDM) suites, 435**
- mobile devices**
 - applications
 - sources*, 408
 - turning off*, 435-436
 - displays, adjusting, 408-411
 - email configurations
 - BlackBerry*, 423
 - IMAP*, 423
 - POP3*, 421-423
 - troubleshooting*, 423
 - web-based*, 421
 - geotracking, 412
 - GPS, 411
 - hardware, 398-399, 403-404
 - ARM processors*, 398
 - batteries*, 399
 - Micro-USB ports*, 399
 - multitouch touch screens*, 398-399
 - tablets versus laptops*, 399-400
 - network connectivity, 424
 - Bluetooth*, 418-421
 - GSM*, 412-413
 - Wi-Fi*, 414-418
 - operating systems, 404
 - Android*, 404-405
 - application sources*, 408
 - displays, adjusting*, 408-411
 - geotracking*, 412
 - GPS*, 411
 - iOS*, 406
 - jailbreaking*, 408
 - rooting*, 408
 - updating*, 433
 - resetting
 - hard resets*, 437
 - soft resets*, 436
 - screens
 - calibration*, 409-411
 - cleaning/protecting*, 411
 - orientation, locking*, 408-409
 - security
 - antivirus software*, 434
 - backups*, 432-433
 - compromised/damaged devices*, 432-435
 - data protection*, 429
 - hard resets*, 437

- lost/stolen, 432*
- operating system updates, 433*
- passcode locking, 429, 432*
- soft resets, 436*
- turning off applications, 435-436*

smartphones

- batteries, replacing, 401*
- memory cards, replacing, 400-403*

synchronization, 429

- Android devices to PCs, 424-427*
- BlackBerry devices to PCs, 428*
- iOS devices to PCs, 427*
- Windows CE/Mobile devices to PCs, 428*

troubleshooting

- hard resets, 437*
- screen calibration problems, 411*
- soft resets, 436*
- Wi-Fi, 416, 418*

Mobility Center, 379

models (networks), 770-772

modems

- BIOS settings, 92
- cables, 235
- defined, 776
- DSL, 787
- installing, 781-783
- serial port similarities, 778
- standards, 781
- types, 779

modular power connectors, 137

modules (memory)

- chips, 179
- comparison, 183-184
- DDR SDRAM, 181
- DDR2 SDRAM, 182
- DDR3 SDRAM, 182

- desktop comparisons, 185
- DRAM, 180
- installing, 189-191
- loose/missing, troubleshooting, 56
- number available, 180
- per bank requirements, 179
- point of failure, 12
- Rambus Direct RAM (RDRAM), 183
- SDRAM, 181
- sizes, 179
- speed, 179
- SRAM, 181
- types, 178
- widths, 185

monitoring maintenance activities, 914

monitors. See displays

monochrome laser printers, 454

More command, 738

motherboards

- audio connectors, 45
- chipsets, 42-44
- CMOS batteries, 88-89
- components, 30
- cooling, 161-162
- defined, 30
- expansion slots, 31, 36-42
 - AGP, 38-39*
 - AMR, 41-42*
 - CNR, 41-42*
 - comparison, 40*
 - PCI, 36*
 - PCIe, 39*
 - PCI-X, 37*
- fan connectors, 44
- form factors, 31-32
 - ATX, 31*
 - BTX, 32*
 - ITX, 32*

- front panel connectors, 46
- header cables, 213
- installing
 - preparations, 50*
 - step-by-step instructions, 51-52*
- integrated I/O ports, 31-35
- integrated modems, 779
- jumpers, 44
- make and model, determining, 115
- memory slots, 31, 35
- mounting holes, 48
- PATA hard drives, connecting, 518
- point of failure, 12
- power connectors, 135
- removing, 48-50
- SATA hard disk drives, connecting, 516
- troubleshooting
 - BIOS time and settings resets, 53*
 - blank screen on bootup, 54*
 - continuous reboots, 53*
 - POST code beeps at startup, 54*
 - smoke/burning smells, 55*
 - system lockups, 54*
 - system not starting, 55-58*
 - unexpected shutdowns, 52*
- mounting drives, 655-656**
- mounting holes (motherboards), 48**
- mouse pointers, troubleshooting, 300**
- Mouse properties dialog box, 690**
- moving files/folders, 896**
- MSConfig (Microsoft System Configuration Utility), 661, 718-721**
- MSDS (Material Safety Data Sheet), 936-938**
- MSInfo32 utility, 661, 670**
- multiboot**
 - configurations, 711
 - Windows install, 573
- multicasting, 828**
- multicore processors, 70**
- multifactor authentication, 872**
- multifunction network devices, 845**
 - DMZ, 846
 - NAT, 845
 - port forwarding, 845-846
- multilevel cell (MLC) SSDs, 526**
- multimedia devices**
 - digital cameras, 328-329
 - microphones, 333-335
 - MIDI enabled devices, 332
 - sound cards
 - audio jacks/cable color standards, 330*
 - configuring, 332*
 - defined, 329*
 - installing, 331-332*
 - TV tuner cards, configuring, 336
 - video capture cards, 335-336
 - webcams, 327
- MultiMedia (MMC) cards, 521**
- multimeters, 16**
 - AC to DC conversions, testing, 152
 - AC voltage, 151
 - amperage, 152
 - cables, 152
 - DC voltage, 151
 - defined, 149
 - readout styles, 149
 - resistance, 152
 - tests
 - leads, 149*
 - modes, 150*
 - performing, 150*
 - voltage levels, 152
- multi-mode fiber-optic cabling, 805**
- multitouch touch screens, 398-399**

multivoltage power supplies, 134

My Computer window (Windows Explorer), 669

N

names

domain, 796

FQDNs, 840

UNC, 838-839

Nano-ITX motherboards, 32

Narrow SCSI

device ID settings, 224

external connectors, 226

host adapters, 222

NAS (network attached storage), 776

NAT (network address translation), 845

NBTSTAT command, 850

needle-nose pliers, 15

negative pressure, 148

Net command, 847

Net Use command, 738

netstat command, 849

network address translation (NAT), 845

network attached storage (NAS), 776

Network dialog, 836

networks, 770

battery backup units support, 158

BIOS settings, 92

cabling

coaxial, 805-806

connectors, 806-807

fiber-optic, 805

municipality rules/regulations, 808

parallel (LPT) crossover, 801

plenum, 806

PVC, 806

serial (RS-232) null modem, 801

STP, 801-803

types, 801

UTP, 801-803

clients, configuring, 834

printers, 835-836

software, installing, 835

client/server, 770-772

command-line tools

IPconfig, 849

NBTSTAT, 850

Net, 847

netstat, 849

NSLookup, 849

Ping, 847-848

Tracert, 848

devices, 775

bridges, 776

firewalls, 777

hubs, 775

Internet appliances, 777

modems, 776

NAS, 776

repeaters, 776

routers, 777

switches, 775

VoIP phones, 777

WAPs, 776

HomeGroup feature, 690

hubs, 814

interface cards

configuring, 816-819

installing, 815-816

IPv6 addresses, 827-829

LANs, 773

MANs, 773

- mobile device connectivity, 424
 - Bluetooth*, 418-421
 - GSM*, 412-413
 - Wi-Fi*, 414-418
- multifunction network devices, 845
 - DMZ*, 846
 - MAC address filtering*, 846
 - NAT*, 845
 - port forwarding*, 845
- network interface cards
 - configuring*, 816-819
 - installing*, 815-816
- PANs, 774
- peer-to-peer, 772
- printers
 - installing*, 835-836
 - sharing*, 471-472
- security
 - wired*, 891-892
 - wireless*, 883-891
- shared resources, 829
 - accessing*, 836
 - administrative shares*, 834
 - client configuration*, 834-836
 - drive mapping*, 840-841
 - file/printer sharing, installing*, 829
 - folders/drives*, 830-834
 - FQDNs*, 840
 - identifying*, 836
 - offline*, 839
 - printers*, 834
 - troubleshooting*, 853
 - UNC*, 838-839
- SOHO. *See* SOHO
- switches, 814
- TCP/IP, configuring, 819-820
 - advanced settings*, 822
 - alternate configurations*, 821
 - DHCP servers*, 821
 - DNS*, 827
 - gateways*, 826
 - IP addressing*, 824-826
 - manually*, 822
 - static versus server-assigned IP addressing*, 819-820
 - WINS*, 826
- tools, 17, 808-809
- topologies, 774-775
- troubleshooting
 - Duplicate Computer Names/Duplicate IP Address errors*, 851
 - entire network failure*, 853
 - interference*, 852
 - low radio frequency signals*, 852
 - performance*, 851-852
 - power management*, 852
 - printing*, 853-854
 - shared resources*, 853
 - web pages, displaying*, 854
- WANs, 773
- web browsers
 - configuring*, 841-842
 - Internet connections, configuring*, 842-843
 - script settings, enabling/disabling*, 843
 - security*, 844-845
- wired, 810
- wireless
 - Bluetooth*, 812
 - cellular*, 813
 - Ethernet*, 811-812
 - infrared*, 813
 - VoIP*, 813-814
- New Technology File System. *See* NTFS**
- no display, troubleshooting, 383**

non-autoranging digital meters, 149
nonnative screen resolutions, 371
nonvolatile memory, 88-89
North American power standard voltage, 134
northbridge chips, 43, 161-162
notebooks. *See* laptops
Notepad, 661-662
nozzle check routines (inkjet printers), 481
NSLookup command, 849
NTBackup utility, 745-747
NTDETECT.COM files, restoring, 712
NTFS (New Technology File System), 587, 658-660, 870
 FAT32, compared, 658
 FAT32 conversions, 912
NTLDR files, restoring, 712
Ntoskrnl.exe file, reinstalling, 713
null-modem cables, 235
number conversions, 825

O

Occupational Safety & Health Administration (OSHA), 934
octets (IP addresses), 825
odd parity, 186
Offline Files dialog, 839
offline files/folders, 839
Ohms (resistance), testing, 152
OLED (organic light emitting diodes) displays, 281, 369
onboard components, evaluating
 general system information, 324
 processor information, 326
Open Handset Alliance, 404
open-source software. *See* Android

operating systems
 access control, 892
 administrator accounts, 893
 auditing, 897-898
 components, 896
 event logging, 897-898
 groups, 894
 guest accounts, 893
 moving/copying files/folders, 896
 permissions, 895-896
 principle of least privilege, 895
 restricted spaces, 896
 UAC, 893-894
 user accounts, 893
 mobile devices, 404
 Android, 404-405
 application sources, 408
 displays, adjusting, 408-411
 geotracking, 412
 GPS, 411
 iOS, 406
 jailbreaking, 408
 rooting, 408
 updating, 433
 not found error, troubleshooting, 548
optical drives
 Blu-ray media types, 532
 comparing, 531-532
 DVD media types, 532
 erasing data, 534
 laptops, replacing, 362
 recording data
 third-party programs, 536-537
 Windows Vista/7, 535-536
 Windows XP, 533-534
 speeds, 533
 types, 531

organic light emitting diodes displays (OLEDs), 281, 369

OSHA (Occupational Safety & Health Administration), 934

overclocking, 72-73, 192-193

overheating, 12, 144

airflow, 146-147

dirt/dust, 148

fan failure, 145

overloading, 145

overloaded power supplies, troubleshooting, 141, 145

overvoltages, 156

P

pairing Bluetooth

Android devices, 418-419

Bluetooth-enabled devices, 419

iOS devices, 420

troubleshooting, 420-421

PANs (personal area networks), 774

paper (printers)

counts, resetting, 479

creased, troubleshooting, 487

impact, 464, 483

jams, 487-488

not feeding, 487

separation pads (laser printers), 450

thermal, 460, 482

parallel (LPT) crossover cables, 801

parallel ports

adding, 247

BIOS settings, configuring, 93

cables, 244-245, 801

configuring, 243-246

connectors, 240-241

defined, 240

ECP or EPP/ECP configurations, 245

loopback plugs, 248

LPT1/LPT2/LPT3 configurations, 245

PCI/PCI Express configurations, 245

pinout, 241-242

printers, 469

serial ports, compared, 232

testing, 248

troubleshooting, 247

parity checking memory, 186-187

parity errors, 194

partitions (hard drives)

active, creating, 652

creating, 652-655

Windows Vista/7, 584-586

Windows XP, 583-584

dynamic/basic disks, 583

extended, creating, 582, 651-653

formatting, 651-652

primary, 581-582, 651

passcode locking mobile devices, 429, 432

passive heat sinks, 75

passive matrix OLEDs (PMOLEDs), 369

passphrases (WPA), 884

passwords, 878

authentication, 871

default administrator, changing, 890

setup, 94

user/power-on, 94

PATA drives

BIOS settings, configuring, 97

cabling, 506

configuring, 100

BIOS, 508

jumper block, 507

- installing, 517-519
 - BIOS configuration*, 519
 - cables*, 517
 - motherboard connection*, 518
 - power connectors*, 517
- settings, 94
- standards, 504-505
- patch cables, 809**
- PATH command, 623**
- paths (Windows)**
 - 7, 620
 - 32-bit versus 64-bit, 620
 - Vista, 620
 - XP, 620
- PC99 system design guide, 330**
- PC Cards, 346-350**
 - cables, 349
 - CardBus support, 348
 - combo, 349
 - dongles, 348
 - failures, 13
 - inserting, 349
 - installing, 816
 - modems, 779, 782
 - removing, 349
 - types, 346-347
 - ZV support, 349
- PC Check, 569**
- PC-Diagnosys, 196**
- PCI BIOS configurations, 105**
- PCI Express x16 slots, 274**
- PCI modems, installing, 781**
- PCI/PCI Express cards, installing, 815**
- PCI slots, 36**
- PCI-X slots, 37**
- PCIE (PCI Express) slots, 39**
- PCMCIA (Personal Computer Memory Card International Association) cards, 346**
- PCs. *See* computers**
- peer-to-peer networks, 772**
- Pen and Input Devices (Windows Control Panel), 689**
- penlights, 15**
- performance**
 - ExpressCards, 350
 - hard drives, 512-513, 543-545
 - networks, 851-852
 - SSDs, 546
 - Windows, 641-642, 716
- peripheral power connectors, 137**
- permissions**
 - inheritance, 895
 - moving/copying files, 896
 - propagation, 896
 - types, 895
 - user/group, 832-834
- personal area networks (PANs), 774**
- Personal Computer Memory Card International Association (PCMCIA) cards, 346**
- personal identification number (PIN) authentication, 871**
- personal physical safety, 934-935**
- PGA (pin grid array) sockets, 64**
- phishing, 880**
- Phoenix BIOS beep codes website, 111**
- physical security, 881**
 - biometrics, 882-883
 - data protection, 883
 - doors, 881-882
- pickup rollers (laser printers), 450**
- Pico-ITX motherboards, 32**

- picture quality, troubleshooting, 298-299
- PIN (personal identification number) authentication, 871**
- pin grid array (PGA) sockets, 64
- Ping command, 847-848**
- pinouts (serial ports), 233-234
- plasma displays, 279, 370
- plenum cabling, 806
- plug-and-play OS, configuring, 93
- PMOLEDs (passive matrix OLEDs), 369**
- PnP BIOS configurations, 105**
- PnP/PCI Configuration dialog, 105**
- point-to-point protocol over Ethernet (PPPoE), 787
- pointing devices
 - maintenance, 257
 - troubleshooting, 253-256
 - double-clicking icons, 256*
 - jerky pointer movement, 256*
 - pointer does not move, 254-256*
- points of failure, 12-13
- polyvinyl chloride (PVC) cabling, 806
- POP (Post Office Protocol), 797**
- POP3 email**
 - Android, 421-422
 - iOS, 422-423
- ports**
 - audio, 249-250
 - BIOS, configuring, 100-103
 - audio, 102*
 - Ethernet, 102*
 - IEEE-1394, 102*
 - I/O devices, 103*
 - PATA/IDE, 100*
 - SATA, 100*
 - USB host adapters, 102*
 - component video, 289
 - composite, 289
 - DisplayPort, 288
 - DVI, 286
 - forwarding, 845
 - FXO, 814
 - HDMI, 286-288
 - IEEE 1394, 218
 - cables, 218*
 - cards, installing, 220*
 - compatible devices, 219*
 - troubleshooting, 220-221*
 - versions, 218*
 - I/O
 - addresses, 235*
 - overview, 208*
 - IRQ, 235
 - legacy, 208
 - mice, 251
 - hardware resources, 252*
 - maintenance, 257*
 - troubleshooting, 253-256*
 - Micro-USB, 399
 - motherboards, 31-35
 - parallel. *See* parallel ports
 - PS/2, 249
 - replicators, 381
 - RGB, 289
 - SCSI. *See* SCSI
 - serial, 231
 - adding, 238*
 - BIOS settings, 93*
 - cables, 235*
 - configuring, 236*
 - devices, 231*
 - loopback plugs, 248*
 - modem similarities, 778*

- parallel ports, compared, 232*
- pinouts, 233-234*
- printers, 469*
- software, configuring, 236-237*
- troubleshooting, 238-239*
- types, 232*
- SVGA, 286
- S-video, 289
- UDP, 799-800
- USB
 - 1.1/2.0, 210
 - 2.0 devices not operating at maximum speed, 217
 - 3.0, 211
 - adding, 213-214
 - black exclamation point on yellow field, 217
 - cable length, 212
 - defined, 209
 - device drivers not installed, 216
 - enabling in BIOS, 215
 - generic hubs, 214
 - improper designs, 215
 - laptops, 352
 - logos, 212
 - power problems, 216-217
 - printers, 469
 - root hubs, 212
 - speeds, 211
 - standards, 209
 - too many connected devices, 217
- VGA, 285
- POST (power-on self test), 85**
 - beep codes, 54, 111
 - cards, 113
 - error messages, 112
 - hex codes, 112-113
 - overview, 110

Post Office Protocol (POP), 797**power**

AC

*flow problems, 156**loss restart settings, 94*

BIOS settings, configuring, 93, 104

conditioners, 160-161

connectors, 135-138

control panel settings, 682

*Windows Vista/7, 685-686**Windows XP, 683-684*

disconnecting from motherboards, 139

efficiency, 133

example, 130

installing, 140

laptops, 384-385

mounting screws, removing, 140

multivoltage, 134

networks, troubleshooting, 852

overview, 130

plans, creating, 686

protection, 933

*battery backup units, 158-160**power conditioners, 160-161**surge suppressors, 156-157*

removing, 139-140

safety, 135

shock/fire hazards, avoiding, 154

split rail, 131

surges, 933

testing, 16, 149-152

*AC to DC conversions, 152**AC voltage, 151**acceptable voltage levels, 152**amperage, 152**cables, 152*

- DC voltage*, 151
 - resistance*, 152
- troubleshooting
 - AC power flow problems*, 156
 - dead systems*, 143-144
 - defective*, 149-152
 - fans*, 149
 - loud noises*, 142
 - overheating*, 144-148
 - overload*, 141
- USB port problems, 216-217
- Wake on LAN, 94
- wattage ratings, 130-133
 - labels*, 131
 - replacement, calculating*, 132-133
 - safety certification*, 131
- power-on self test. See POST**
- Power Options dialog box**, 686
- POWERCFG.EXE**, 684
- PPPoE (point-to-point protocol over Ethernet)**, 787
- pretexting**, 880
- PRI (Primary Rate Interface)**, 785
- primary partitions**, 581-582, 651
- Primary Rate Interface (PRI)**, 785
- primary VGA BIOS settings, configuring**, 93
- principle of least privilege**, 895
- Print Management utility**, 648
- print queues**
 - backed up, 489-490
 - clearing, 490
 - releasing, 489
- printers**
 - battery backup units, 160
 - configuring, 472-474
 - preferences*, 473
 - properties sheets, accessing*, 472-473
 - properties versus preferences*, 474
 - saving changes*, 475
 - Control Panel settings, 689
 - drivers, 464
 - firmware, upgrading, 469
 - graphics resolution, 491
 - impact
 - defined*, 461
 - dot-matrix print process*, 462
 - dot-matrix printheads*, 463
 - faded prints*, 486
 - maintenance*, 483
 - paper*, 464
 - printer ribbons*, 463
 - streaks/smudges, troubleshooting*, 485
 - inkjet
 - calibrating*, 458, 480
 - components*, 456
 - faded prints*, 486
 - ink cartridges*, 457-458
 - maintenance*, 480-481
 - overview*, 455
 - streaks/smudges, troubleshooting*, 484
 - turning on/off*, 457
 - installing, 465
 - Add Printer Wizard*, 465-466
 - vendor-supplied drivers*, 467
 - interfaces, 469-471
 - Bluetooth*, 470
 - Ethernet*, 470
 - infrared*, 471
 - Wi-Fi*, 471
 - laser
 - calibrating*, 479
 - cleaning*, 479-480
 - color versus monochrome*, 454
 - components*, 450

- defined*, 450
- EP process*, 451-454
- faded prints*, 486
- maintenance*, 478-480
- streaks/smudges, troubleshooting*, 484
- toner cartridges*, 450-451
- maintenance, 18
- managing in Windows, 648
- memory
 - errors, troubleshooting*, 490-491
 - installing*, 467-468
 - size, verifying*, 473
- network
 - installing*, 835-836
 - sharing*, 471-472, 829, 834
 - troubleshooting*, 853-854
- spoolers, 477
- test pages, printing, 476
- thermal
 - defined*, 459
 - dye-sublimation ribbons*, 460
 - faded prints*, 486
 - maintenance*, 482-483
 - paper*, 460
 - processes*, 459
 - streaks/smudges, troubleshooting*, 485
 - technologies*, 459
 - thermal versus thermal transfer*, 460
- troubleshooting
 - access denied messages*, 492
 - backed up queues*, 489-490
 - colors*, 300, 492
 - connectivity*, 488
 - creased paper*, 487
 - faded prints*, 485-486
 - garbled characters*, 488
 - ghost images*, 486
 - HP LaserJet error codes*, 492-493
 - installation*, 492
 - low memory errors*, 490-491
 - not printing*, 492
 - paper jams*, 487-488
 - paper not feeding*, 487
 - streaks/smudges*, 484-485
 - toner not fused to paper*, 486
 - vertical lines on pages*, 489
- PrinterTechs.com**, 479
- Problem Reports and Solutions (Windows Control Panel)**, 689
- Process Explorer utility**, 638
- processing (laser printers EP process)**, 453
- processors**
 - 32-bit versus 64-bit architecture, 73
 - AMD, 64
 - Intel comparison*, 58
 - PGA sockets*, 64
 - Socket 940*, 66
 - Socket AM2*, 66-67
 - Socket AM2+*, 67
 - Socket AM3*, 67-68
 - Socket AM3+*, 68
 - Socket FM1*, 69
 - website*, 70
 - ARM, 398
 - bus speeds, 71
 - cache memory, 70-71
 - configuring, 106
 - cooling, 74
 - heat sinks*, 75
 - liquid*, 76
 - defined, 29
 - fan connectors, 44
 - hyperthreading, 70
 - information, retrieving, 326

- integrated GPUs, 74
- Intel, 58
 - AMD comparison*, 58
 - LGA*, 59
 - LGA 775*, 61
 - LGA 1155*, 63-64
 - LGA 1156*, 62-63
 - LGA 1366*, 62
 - website*, 70
- laptops, replacing, 368
- multicore, 70
- overclocking, 72-73
- point of failure, 12
- virtualization support, 73
- Windows requirements, 567
- x84, 606
- x86, 606
- Professional edition**
 - Windows 7, 609
 - Windows XP, 607
- professionalism (customers)**
 - interaction, 939-941
 - property, respecting, 941
- profiles (hardware)**, 681
- Program Compatibility Wizard**
 - Windows 7, 615
 - Windows XP/Vista, 616-617
- Programs and Features (Windows control panel)**, 687
- projectors**
 - connecting to laptops, 379
 - troubleshooting, 301-302
- PROMPT command**, 623
- propagation**, 896
- properties sheets (printers)**, accessing, 472-473
- property (customers)**, respecting, 941

protection. See also security

- ESD, 16, 930-932
- fire, 934
- mobile device screens, 411
- power supplies
 - battery backup units*, 158-160
 - power conditioners*, 160-161
 - surge suppressors*, 156-157

protocols

- DHCP, 796
- email, 797-798
- FTP, 794
- HTTP/HTTPS, 792
- IMAP, 798
- LDAP, 799
- POP, 797
- RDP, 798
- SIP, 814
- SSL, 792
- TCP/IP. *See* TCP/IP
- TLS, 792

PS/2 mouse settings, configuring, 92**PS/2 ports**, 249**punch down tools**, 17, 808**PVC (polyvinyl chloride) cabling**, 806**Q****quality**

- color
 - displays, configuring*, 295-296
 - troubleshooting*, 301
- graphics, troubleshooting, 301
- laptop displays, 370-371
- pictures, troubleshooting, 298-299

quiet boot, configuring, 93

R

radio-frequency identification (RFID) chips, 871

RAID (redundant array of inexpensive drives), 526

ATA/SATA arrays, creating, 528-530

levels, 526-527

troubleshooting, 549

RAID-5 arrays, 653

RAM (Random Access Memory). See memory

Rambus Direct RAM (RDRAM), 183

Rambus RDRAM Module (RIMM), 185

ratings (power supplies), 130-133

efficiency, 133

labels, 131

replacement, calculating, 132-133

safety certification, 131

RAW photo codecs, 329

RD command, 623, 629

RDP (Remote Desktop Protocol), 798

RDRAM (Rambus Direct RAM), 183

reading flash memory cards, 523-524

read-only, Blu-ray media (BD-ROM), 532

Read-Only Memory (ROM), 177

read/write failures, troubleshooting, 543

ReadyBoost (Windows), 613-614

Real-time Transport Control Protocol (RTCP), 814

Real-time Transport Protocol (RTP), 814

rear view (desktops), 5

recording

BSOD errors, 707

data to optical discs

third-party programs, 536-537

Windows Vista/7, 535-536

Windows XP, 533-534

recovery

Automated System Recovery (ASR), 739-741

BIOS update failures, 117

data

external drive docks, 550

external drive enclosures, 550

hard disk diagnostic programs, 551

software, 552

Windows-based disk tools, 551

malware, 916

Windows, 595-596

Windows Shadow Copy, 612

WinRE, 741-744, 916

accessing, 741-742

options, 743-744

Recovery Console, 718, 735-739, 916

access locations, 737

commands, 737-739

Attrib, 737-738

Batch, 737

Bootcfg, 737

ChDir, 737

Chkdsk, 737

Cls, 737

Copy, 737

Delete, 737

Dir, 737

Disable, 737

Diskpart, 737

Enable, 737

Exit, 737

Expand, 738
Fixboot, 738-739
Fixmbr, 738-739
Format, 738
Help, 738
Listsvc, 738
Logon, 738
Map, 738
Mkdir, 738
More, 738
Net Use, 738
Rename, 738
Rmdir, 738
Set, 738
Systemroot, 738
Type, 738
 starting, 735-736
recovery discs, 596
recycled toner cartridges, 451
redundant array of inexpensive drives.
 See RAID
refresh rates (displays), 296-297, 301
REGEDIT, 661, 718, 722-724
region settings (Windows installation),
 579
registered memory, 188
Registry
 backing up, 724
 editing, 722
 text files, importing, 722
REGSVR32, 718, 721
releasing print queues, 489
remote access programs, 915
Remote Desktop Protocol (RDP), 798
remote Windows installation, 577
remote wipe programs, 432
Removable Storage Manager (RSM),
 541

removing

data remnants, 877
 devices, 735
 ExpressCards, 351
 fans from laptops, 366
 heat sinks from laptops, 367
 keyboard keytops, 259
 malware, 916-917
 motherboards, 48-50
 PC Cards, 349
 power supplies, 139-140
 processors from laptops, 367
 thermal printer debris, 483
 utilities (Add/Remove Programs), 686
 wireless cards, 362-365

Rename command, 623, 738

repair Windows install, 574-575

repeaters, 776

replacing

BIOS chips, 118-119
 impact printer paper, 483
 impact printer printheads, 483
 impact printer ribbons, 483
 inkjet cartridges, 480
 laptop hardware, 354
 batteries, 355-356
 hard drives, 358-359
 inverters, 373
 keyboards, 356-357
 memory, 360-361
 optical drives, 362
 processors, 368
 screens, 365-366
 speakers, 358
 touchpads, 357-358
 wireless cards, 362-365

- power supplies
 - removing existing, 139-140*
 - requirements, 138*
- smartphone
 - batteries, 401*
 - memory cards, 400, 403*
- toner cartridges, 478
- requirements**
 - dial-up Internet connections, 784
 - power supplies, calculating, 132-133
 - virtualization
 - emulator, 693*
 - resource, 693*
 - security, 694*
 - Windows, 566-569
 - compatibility, verifying, 568-569*
 - hardware, 606-607*
 - minimum, 567*
 - Windows 7, 567*
- resetting mobile devices**
 - hard resets, 437
 - soft resets, 436
- resistance (Ohms), testing, 152**
- resolution (displays)**
 - configuring, 292-295
 - laptops, 370
 - troubleshooting, 301
- resource requirements virtualization, 693**
- resource websites, 18**
- responding to incidents**
 - chain of custody, 939
 - documentation, 938
 - first responses, 938
- restoring**
 - backups, 750-752
 - NTDETECT files, 712
 - NTLDR files, 712
 - systems, 756-760
 - earlier conditions, 758*
 - restore points, creating, 757*
 - Windows, 595-596, 746
- restricting spaces, 896**
- retrieving**
 - processor information, 326
 - system information, 324
- revolutions per minute (RPM), 513**
- rewritable/erasable DVDs, 532**
- rewriteable/erasable Blu-ray (BD-RE), 532**
- RFID (radio-frequency identification) chips, 871**
- RG-6 cabling, 806**
- RG-59 cabling, 806**
- RGB video connectors, 289**
- ribbons (printers)**
 - dot matrix, replacing, 483
 - impact, 463
 - thermal, 460, 482
- RichCopy utility, 628**
- RIMM (Rambus RDRAM Module), 185**
- ring topologies, 774**
- RJ-11 cords, troubleshooting, 782**
- Rmdir command, 738**
- ROBOCOPY.EXE utility, 627-628**
- ROM (Read-Only Memory), 177**
- root hubs, 212**
- rooting mobile devices, 408**
- rootkits, 915**
- routers, 777, 791**
- RPM (revolutions per minute), 513**
- RS-232. See serial ports**
- RSM (Removable Storage Manager), 541**

RTCP (Real-time Control Protocol), 814

RTP (Real-time Transport Protocol), 814

run-line utilities, 661

CMD, 661

DXDiag, 661, 672

Explorer, 661-662

Common Tasks view, 664-665

drives, viewing, 664

Favorite Links view, 665

libraries, 668

My Computer window, 669

starting, 662

Windows 7 view, 665

Windows Vista/7 display options, 667

Windows XP display options, 666

MMC, 661

MSConfig, 661

MSInfo32, 661, 670

Notepad, 661-662

Regedit, 661

SERVICES.MSC, 661

runtimes (battery backup units), 158

S

S1/S3 standby, 94

Safe Mode, 718, 728

safety

chemicals, 936-938

electricity, 932-934

AC outlets, 932

blackouts, 933

brownouts, 933

dirty power, 933

fires, 934

power surges, 933

sags, 933

surge suppressors, 933

ESD, preventing, 16, 930-932

personal physical, 934-935

power supplies, 135

certification, 131

shock/fire hazards, avoiding, 154

sags (electricity), 933

SATA drives

BIOS settings, configuring, 97

cabling, 508-510

host adapters, 517

installing, 515-517

ports, configuring, 100

RAID arrays, creating, 528-530

settings, 94

standards, 504-505

satellite Internet service, 789-790

saving

BIOS configuration changes, 109

data to CDs/DVDs

third-party programs, 536-537

Windows Vista/7, 535-536

Windows XP, 533-534

printer settings, 475

scanning infrared monitors, 261

Scheduled Tasks (Windows), 645-646

screen calibration (mobile devices), 409-411

screen orientation (mobile devices), locking, 408-409

screwdrivers, 15

scripts (Internet), enabling/disabling, 843

SCSI (Small Computer Systems Interface), 221

cables, 225-227

cards, installing, 228

- daisy chaining
 - creating*, 227
 - maximum length*, 229
 - overview*, 222
 - termination methods*, 229
- defined, 221
- device IDs, configuring, 223-224
- interface, 510
- Narrow host adapters, 222
- printers, 469
- signaling types, 227
- standards, 225
- troubleshooting, 230-231
- SD (Secure Digital) cards**, 522
- SDHC (Secure Digital High Capacity) cards**, 522
- SDRAM (synchronous DRAM)**, 181-182
- SDSL (Synchronous DSL)**, 786
- SDXC (Secure Digital Extended Capacity) cards**, 522
- Seagate website, 747
- Secure Digital (SD) cards, 522
- Secure Digital Extended Capacity (SDXC) cards, 522
- Secure Digital High Capacity (SDHC) cards, 522
- Secure Shell (SSH), 795
- Secure Socket Layers (SSL), 792
- security**
 - authentication, 871-872
 - BIOS
 - features*, 899-900
 - settings*, 108-109
 - boot virus detection, 94
 - data, 883
 - backups*, 877
 - destruction/disposal methods*, 898-899
 - encryption*, 875-876
 - local security policies*, 874
 - locking computers*, 878-879
 - migration*, 877
 - passwords*, 878
 - physical protection*, 883
 - remnant removal*, 877
 - encryption, 875-876
 - exceptions, 902-903
 - FAT32 conversions to NTFS, 912
 - file sharing, 832-834
 - file systems, 870
 - incident reporting, 879
 - laptops, 381
 - malware
 - protection, testing*, 913
 - recovery*, 916
 - removing*, 916-917
 - rootkits*, 915
 - spyware*, 915
 - Trojan horses*, 915
 - types*, 914-915
 - user education*, 917-918
 - viruses*, 914
 - Windows Defender*, 916
 - worms*, 914
 - mobile devices
 - antivirus software*, 434
 - backups*, 432-433
 - compromised/damaged devices*, 432-435
 - data protection*, 429
 - hard resets*, 437
 - lost/stolen*, 432
 - operating system updates*, 433
 - passcode locking*, 429, 432
 - soft resets*, 436
 - turning off applications*, 435-436

- operating systems access, 892-898
 - administrator accounts, 893*
 - auditing, 897-898*
 - components, 896*
 - event logging, 897-898*
 - groups, 894*
 - guest accounts, 893*
 - moving/copying files/folders, 896*
 - permissions, 895-896*
 - principle of least privilege, 895*
 - restricted spaces, 896*
 - UAC, 893-894*
 - user accounts, 893*
- passwords, 878
- physical, 881
 - biometrics, 882-883*
 - data protection, 883*
 - doors, 881-882*
- social engineering, 880-881
- software firewalls, 873
 - configuring, 900-901*
 - troubleshooting, 903-904*
- unused wireless connections, 910-912
- virtualization requirements, 694
- virus protection, 872-873
- web browsers, configuring, 844-845
- wired networks, 891-892
- wireless clients, configuring, 904
 - troubleshooting, 909-910*
 - Windows 7, 908-909*
 - Windows Vista, 908*
 - Windows XP SP2/SP3, 905-908*
- wireless networks
 - access point firmware, updating, 890*
 - default administrator passwords, changing, 890*
 - default SSIDs, changing, 886*
 - DHCP versus static IP addresses, 885*
 - firewalls, 891*
 - MAC addresses, filtering, 887-890*
 - radio levels, 891*
 - SSID broadcasting, disabling, 886*
 - WAP location, 891*
 - WEP/WPA, 883-884*
- self-booting diagnostic programs, 569**
- self-powered hubs, 214**
- serial ports, 231**
 - adding, 238
 - BIOS settings, configuring, 93
 - cables, 235
 - configuring, 236
 - devices, 231
 - loopback plugs, 248
 - modem similarities, 778
 - parallel ports, compared, 232
 - pinouts, 233-234
 - printers, 469
 - software, configuring, 236-237
 - troubleshooting
 - cabling, 239*
 - COM 4 I/O port conflicts, 238*
 - configuration problems, 239*
 - mismatched connectors, 239*
 - testing, 239*
 - types, 232
- serial (RS-232) null modem cables, 801**
- server-assigned versus static IP addressing, 819-820**
- server/client networks, 770-772**
- Server Message Block (SMB), 799**

servers

- client/server networks, 770-772
- DHCP
 - TCP/IP, configuring*, 821
 - versus static IP addresses*, 885
- home, 323-324
- service failures, 715-717
- service packs, installing, 593-595
- Service Set Identifier (SSID), 818, 886
- services (Windows), 642-644
- Services dialog box, 643
- SERVICES.MSC utility, 661
- Session Initiation Protocol (SIP), 814
- Set command, 623, 738
- Setup Manager Utility, 576
- setup passwords, 94
- Sfc (System File Checker), 718-719
- Shadow Copy (Windows), 612
- shadowing, 93
- shared resources, 829
 - accessing, 836
 - administrative shares, 834
 - client configuration, 834-836
 - drive mapping, 840-841
 - file/printer sharing, installing, 829
 - folders/drives, 830-834
 - simple file sharing*, 831
 - user/group permissions*, 832-834
 - FQDNs, 840
 - identifying, 836
 - offline, 839
 - printers, 471-472, 834
 - troubleshooting, 853
 - UNC, 838-839
- Shielded Twisted Pair. *See* STP
- shoulder surfing, 880
- Sidebar (Windows), 611
- signaling types (SCSI), 227
- SIMM (Single Inline Memory Module), 184
- simple file sharing, 831
- Simple Mail Transfer Protocol (SMTP), 797
- Simple Network Management Protocol (SNMP), 798
- Single Inline Memory Module (SIMM), 184
- Single Inline Pin Package (SIPP), 184
- single-level cell (SLC) SSDs, 526
- single-mode fiber-optic cabling, 805
- single-sided memory, 188
- SIP (Session Initiation Protocol), 814
- SIPP (Single Inline Pin Package), 184
- SiSoftware Sandra 2012, 569
- site-local addresses, 828
- six-step troubleshooting methodology, 14
- sizes
 - battery backup units, determining, 159-160
 - CRT monitors, 277
 - graphics, troubleshooting, 301
 - icons, 300
 - LCD monitors, 279
 - memory, 179, 194
 - printer memory, verifying, 473
 - text, troubleshooting, 300
- SLC (single-level cell), 526
- slow hard drive performance, troubleshooting, 543-545
- slow SSD performance, troubleshooting, 546
- Small Computer Systems Interface. *See* SCSI
- small icons view (Windows Explorer), 667

small office/home office. *See* SOHO

Small Outline DIMM (SODIMM), 185

Small Outline Rambus Module, 185

smart cards, 871, 882

SmartMedia cards, 521-522

smartphones

Airplane Mode, 412

battery cards, replacing, 401

memory cards, replacing, 400, 403

SMB (Server Message Block), 799

smoke, troubleshooting, 55

SMTP (Simple Mail Transfer Protocol), 797

smudges during printing, troubleshooting, 484-485

SNMP (Simple Network Management Protocol), 798

social engineering, 880-881

sockets (AMD)

940, 66

AM2, 66-67

AM2+, 67

AM3, 67-68

AM3+, 68

FM1, 69

PGA, 64

SODIMM (Small Outline DIMM), 185

soft resets (mobile devices), 436

software, 10-11

data recovery, 552

firewalls, 873, 900-904

network client, installing, 835

operating systems. *See* operating systems

serial port, configuring, 236-237

SOHO (small office/home office), 815

creation overview, 854-855

IPv6 addresses, 827-829

network interface cards

configuring, 816-819

full-duplex/half-duplex modes, 817

hardware resources, 816

installing, 815-816

media types, 817

PC Card/CardBus cards, 816

PCI/PCI Express, 815

USB adapters, 816

WLANs, 818-819

shared resources, 829

accessing, 836

administrative shares, 834

client configuration, 834-836

drive mapping, 840-841

file/printer sharing, installing, 829

folders/drives, 830-834

FQDNs, 840

identifying, 836

offline, 839

printers, 834

UNC, 838-839

TCP/IP, configuring, 819

advanced settings, 822

alternate configuration, 821

DHCP servers, 821

DNS, 827

gateways, 826

IP addressing, 824-826

manually, 822

static versus server-assigned IP addressing, 819-820

subnet masks, 824

Windows, 820

WINS, 826

- web browsers
 - configuring, 841-842*
 - Internet connections, configuring, 842-843*
 - multifunction network devices, 845-846*
 - script settings, enabling/disabling, 843*
 - security, 844-845*
- solid state drives (SSDs), 525**
- sound cards**
 - audio jacks/cable color standards, 330
 - configuring, 332
 - defined, 329
 - installing, 331-332
- southbridge chips, 43, 161-162**
- spam, 915**
- SPDIF (Sony/Philips Digital Interconnect Format), 250**
- speakers (laptops), 358**
- Speech Recognition dialog box, 335**
- speed**
 - bus, 71
 - memory, 179, 193-194
 - optical drives, 533
 - USB, 211
- spikes, 156**
- spin rate (hard drives), 513**
- split rail power supplies, 131**
- spoolers (print), 477**
- SPS (battery backup units), 158-160**
- spyware, 915**
- SRAM (static RAM), 181**
- SSDs (solid state drives), 525-526, 546**
- SSH (Secure Shell), 795**
- SSIDs (Service Set Identifiers), 818, 886**
- SSL (Secure Socket Layers), 792**
- Stacks view (Windows Explorer), 668**
- Standard Certification Marks website, 132**
- standards**
 - laptop display resolution, 370
 - PATA/SATA, 504-505
 - SCSI, 225
 - USB ports, 209
- star topologies, 774**
- Start menu (Windows), customizing, 612**
- Starter edition (Windows 7), 608**
- startup**
 - 3TB hard drives, 659
 - Advanced Options, 726-729
 - BIOS settings, configuring, 98-100
 - blank screens, troubleshooting, 54
 - clean, 714
 - diagnostic screen, configuring, 93
 - failures, 709
 - GUI not loading, 714*
 - missing GUI, 714*
 - Missing Operating System, 713*
 - Vista/7, 710-711*
 - XP, 712-713*
 - multiboot configurations, 711
 - operating system not found, troubleshooting, 548
 - POST code beeps, troubleshooting, 54
 - quiet, configuring, 93
 - sequence, 98-100
 - Windows installation, 570
 - WinRE Startup Repair option, 743
- static IP addresses, 885**
- static RAM (SRAM), 181**
- static versus server-assigned IP addressing, 819-820**
- stolen mobile device protection, 432**
- STOP errors, 706-709**

storage devices

data recovery tools

- data recovery software, 552*
- external drive docks, 550*
- external drive enclosures, 550*
- hard disk diagnostic programs, 551*
- Windows-based disk tools, 551*

drive interfaces, 502

- external, 502*
- hot-swappable, 511*
- internal, 502*
- overview, 503*
- PATA, 504-508*
- SATA, 504-510*
- SCSI, 510*

flash memory, 520

- cards, 520-524*
- SSDs, 525-526*
- USB drives, 524*

floppy drives, 538

- capacities, 538*
- cleaning, 540*
- defined, 538*
- external, 540*
- hardware configuration, 539-540*
- maintenance, 540-541*

hard drives. *See* hard drives

optical drives

- Blu-ray media types, 532*
- comparing, 531-532*
- DVD media types, 532*
- erasing data in Windows XP, 534*
- recording data, 533-537*
- speeds, 533*
- types, 531*

RAID, 526

- ATA/SATA arrays, creating, 528-530*
- levels, 526-527*

tape drives, 541-542

troubleshooting

- boot failures, 547*
- drive-recognition problems, 548*
- hard drive slow performance, 543-545*
- loud noises, 546*
- operating system not found, 548*
- RAID, 549*
- read/write failures, 543*
- SSD slow performance, 546*

STP (Shielded Twisted Pair) cabling

- categories, 802-803
- connectors, 803
- overview, 801-803
- standard, 803

streaks during printing, troubleshooting, 484-485**striped arrays, 653****subnet masks, 824-825****Super Extended Graphics Array Plus (SXGA+), 370****SuperMulti DVD drives, 532****SuperSpeed USB, 209****surface wave monitors, 261****surge suppressors, 157, 933****surges, 156****SVGA cards, 286****S-video connectors, 289****switchboxes, troubleshooting, 247****switches, 263, 775, 814****SXGA+ (Super Extended Graphics Array Plus), 370****Symantec Ghost Solution Suite, 578****synchronization (mobile devices), 424, 429**

Android, 424-427

BlackBerry, 428

iOS, 427

Windows CE/Mobile, 428

**synchronous DRAM (SDRAM),
181-182**

Synchronous DSL (SDSL), 786

Sysprep utility, 578

system

configuring

audio/video editing, 316-317

gaming, 319-320

graphic/CAD/CAM design, 314-315

home servers, 323-324

home theaters, 321-322

thick clients, 322

thin clients, 323

virtualization, 318-319

dead, troubleshooting, 143-144

fan connectors, 44

File Checker (Sfc), 718-719

general information, retrieving, 324

Image Manager, 576

Image Recovery option (WinRE), 743

lockups, troubleshooting, 54

Monitor (Windows), 641-642

not starting, troubleshooting, 55-58

dead shorts, 57

incorrect front panel wiring connections, 55

loose BIOS chips, 56

loose/missing memory modules, 56

loose/missing power leads, 55

properties sheet, 680

hardware profiles, 681

virtual memory settings, 681-682

restoration discs, 596

Restore (Windows), 756-760

configuring, 759

restore points, creating, 757

restoring to earlier conditions, 758

tasks to try first, 759

WinRE, 743

testing tools, 16

Systemroot command, 738

T

Tablet PC Settings (Windows Control Panel), 688

tablets, 399-400

tags (HTML), 793

tailgating, 880

tape drives, 541-542

Task Manager, 648-649

Task Scheduler (Windows), 645-646

Taskkill utility, 638-640

Tasklist.exe utility, 636-638

tasks (Windows)

creating, 645-646

managing, 648-649

TCP/IP (Transport Control Protocol/Internet Protocol), 792

configuring, 819

advanced settings, 822

alternate configuration, 821

DHCP servers, 821

DNS, 827

gateways, 826

IP addressing, 824-826

manually, 822

static versus server-assigned IP addressing, 819-820

subnet masks, 824

Windows, 820

WINS, 826

DHCP, 796

DNS, 795-796

- email, 797-798
- FTP, 794
- HTML, 793-794
- HTTP/HTTPS, 792
- LDAP, 799
- RDP, 798
- SMB, 799
- SNMP, 798
- SSH, 795
- SSL, 792
- Telnet, 794
- TLS, 792
- UDP ports, 799-800
- Telnet, 794**
- temperature (environment), 936**
- terminating SCSI daisy-chaining, 229**
- test pages, printing, 476**
- testing**
 - cables, 808
 - electricity, 16
 - memory, 196
 - microphones, 334-335
 - parallel ports, 248
 - POST
 - beep codes, 111*
 - cards, 113*
 - error messages, 112*
 - hex codes, 112-113*
 - overview, 110*
 - power supplies, 149-152
 - AC to DC conversions, 152*
 - AC voltage, 151*
 - acceptable voltage levels, 152*
 - amperage, 152*
 - cables, 152*
 - DC voltage, 151*
 - resistance, 152*
 - security programs, 913
 - serial ports, 239
 - system, 16
- tethering Wi-Fi, 416**
- text, troubleshooting**
 - color fringes, 301
 - size, 300
- thermal compound, 164**
- thermal printers**
 - defined, 459
 - direct thermal versus thermal transfer, 460
 - dye-sublimation ribbons, 460
 - maintenance, 482-483
 - debris, removing, 483*
 - heating elements, cleaning, 482*
 - paper, 482*
 - ribbons, 482*
 - paper, 460
 - processes, 459
 - technologies, 459
 - troubleshooting
 - faded prints, 486*
 - streaks/smudges, 485*
- thermal transfer printing, 460**
- thick client systems, 322**
- thin client systems, 323**
- Thin Ethernet, 806**
- third-party**
 - drag-and-drop file copying programs, 537
 - drivers, 588
 - optical disc mastering programs, 536
- thumbnail view (Windows Explorer), 667**
- tiles view (Windows Explorer), 666**
- TIME command, 622**
- times and dates, 579**

TLS (Transport Layer Security), 792**toner cartridges, 450-451**

- installing, 451
- probes, 17, 809
- recycled, 451
- replacing, 478
- vacuums, 18

tools

- assembly/disassembly, 15
- command-line
 - IPconfig*, 849
 - NBTSTAT*, 850
 - Net*, 847
 - netstat*, 849
 - NSLookup*, 849
 - Ping*, 847-848
 - Tracert*, 848
- data recovery
 - external drive docks*, 550
 - external drive enclosures*, 550
 - hard disk diagnostic programs*, 551
 - software*, 552
 - Windows-based disk tools*, 551
- electrical testing, 16
- ESD protection, 16
- hardware-assisted virtualization detection, 326
- multimeters
 - AC to DC conversions, testing*, 152
 - AC voltage*, 151
 - amperage*, 152
 - cables*, 152
 - DC voltage*, 151
 - defined*, 149
 - readout styles*, 149
 - resistance*, 152
 - test leads*, 149
 - test modes*, 150

tests, performing, 150

voltage levels, 152

- network installation/configuration, 17
- networks, 808-809
- printers, 18
- processor information, retrieving, 326
- Recovery Console, 916
- system testing, 16
- toner probe, 809
- Windows administrative, 618-619
- Windows command-line
 - CD*, 629
 - command prompts, starting*, 621-622
 - COPY*, 624-625
 - DEL*, 635-636
 - Diskpart*, 633-635
 - Format*, 629-632
 - internal commands*, 622-623
 - MD*, 629
 - RD*, 629
 - ROBOCOPY.EXE*, 627-628
 - Taskkill utility*, 638-640
 - Tasklist.exe*, 636-638
 - wildcards*, 624
 - XCOPY command*, 625-627
- Windows diagnostic and repair, 717-719
 - Advanced Boot Options*, 726-729
 - Automated System Recovery*, 718-741
 - Defrag*, 718
 - Device Manager*, 718, 729-735
 - Event Viewer*, 718, 724
 - Fixboot*, 718
 - Fixmbr*, 718
 - MSConfig*, 718-721
 - Recovery Console*, 718, 735-739
 - REGEDIT*, 718, 722-724
 - REGSVR32*, 718, 721

- Repair Discs*, 719
- Safe Mode*, 718
- System File Checker*, 718-719
- WinRE*, 718, 741-744
- topologies (networks)**, 774-775
- torx drivers**, 15
- touch-on-tube monitors**, 261
- touch screen monitors**, 260-261
 - installing, 262
 - interfacing, 261
 - surface treatments, 261
 - troubleshooting, 262-263
- touch tablets**, 253
- touchpads**, 357-358
- Tracert command**, 848
- transfer belts/rollers (laser printers)**, 450
- transferring data**, 589
 - USMT, 590-591
 - Windows Easy Transfer, 590
- transferring (laser printers EP process)**, 453
- transient voltage surge suppressor (TVSS)**, 156
- Transport Control Protocol/Internet Protocol**. *See* TCP/IP
- Transport Layer Security (TLS)**, 792
- triple-channel memory**, 180
- Trojan horses**, 880, 915
- troubleshooting**
 - Bluetooth connections, 420-421
 - BSOD (Blue Screen of Death) errors, 706-709
 - chip creep, 56
 - CMOS Checksum errors, 119
 - displays
 - 3D games*, 300
 - color fringes around text/graphics*, 301
 - color quality*, 301
 - flickers*, 300-301
 - icon size*, 300
 - monitors/projectors*, 300-302
 - mouse pointers*, 300
 - no picture with replacement video cards*, 301
 - picture quality*, 298-301
 - picture size changes*, 301
 - preventative maintenance*, 302-303
 - projectors*, 301-302
 - refresh rates*, 301
 - resolution*, 301
 - screen/print colors not matching*, 300
 - text size*, 300
 - video cards*, 300-302
 - wavy lines*, 301
 - DSL telephone interference, 787
 - fatal errors, 110
 - IEEE 1394, 220-221
 - keyboards, 258
 - laptops
 - Bluetooth connectivity*, 386
 - displays*, 382-384
 - keyboards*, 385
 - power problems*, 384-385
 - Wi-Fi connectivity*, 386
 - memory
 - cache RAM*, 195
 - compatibility*, 192
 - overclocking*, 192-193
 - parity errors*, 194
 - preventative maintenance*, 196
 - sizing errors*, 194
 - speed mismatches*, 193-194
 - testing programs*, 196

- mice/pointing devices, 253-256
 - double-clicking icons*, 256
 - jerky pointer movement*, 256
 - pointer does not move*, 254-256
- mobile devices
 - displays*, 411
 - email connections*, 423
 - hard resets*, 437
 - soft resets*, 436
 - turning off applications*, 435-436
 - Wi-Fi*, 416-418
- motherboards
 - BIOS time and settings resets*, 53
 - blank screen on bootup*, 54
 - continuous reboots*, 53
 - POST code beeps at startup*, 54
 - smoke/burning smells*, 55
 - system lockups*, 54
 - system not starting*, 55-58
 - unexpected shutdowns*, 52
- networks
 - Duplicate Computer Names/Duplicate IP Address errors*, 851
 - entire network failure*, 853
 - interference*, 852
 - IPconfig command*, 849
 - low radio frequency signals*, 852
 - NBTSTAT command*, 850
 - Net command*, 847
 - netstat command*, 849
 - NSLookup command*, 849
 - performance*, 851-852
 - ping command*, 847-848
 - power management*, 852
 - printing*, 853-854
 - shared resources*, 853
 - Tracert command*, 848
 - web pages, displaying*, 854
- parallel ports, 247
- points of failure, 12-13
- power supplies
 - AC power flow problems*, 156
 - dead systems*, 143-144
 - defective*, 149-152
 - fans*, 149
 - loud noises*, 142
 - overheating*, 144-148
 - overload*, 141
- printers
 - access denied messages*, 492
 - backed up queues*, 489-490
 - colors*, 492
 - connectivity*, 488
 - creased paper*, 487
 - faded prints*, 485-486
 - garbled characters*, 488
 - ghost images*, 486
 - HP LaserJet error codes*, 492-493
 - installation*, 492
 - low memory errors*, 490-491
 - not printing*, 492
 - paper jams*, 487-488
 - paper not feeding*, 487
 - streaks/smudges*, 484-485
 - toner not fused to paper*, 486
 - vertical lines on pages*, 489
- Problem Reports and Solutions (Windows Control Panel), 689
- RAID, 549
- RJ-11 cords, 782
- SCSI, 230-231
- serial ports, 238-239
- six-step methodology, 14
- software firewalls, 903-904

storage devices

- boot failures, 547*
- drive-recognition problems, 548*
- hard drive slow performance, 543-545*
- loud noises, 546*
- operating system not found, 548*
- read/write failures, 543*
- SSD slow performance, 546*

touch screen monitors, 262-263

unused wireless connections, 910-912

USB ports

- 2.0 devices not operating at maximum speed, 217*
- black exclamation point on yellow field, 217*
- device drivers not installed, 216*
- improper designs, 215*
- not BIOS enabled, 215*
- power problems, 216-217*
- too many connected devices, 217*

Windows

- Blue Screen of Death errors, 706-709*
- boot failures, 709-714*
- compatibility errors, 716*
- devices failing to start, 715*
- DLL messages, missing, 715*
- files not opening, 717*
- improper shutdowns, 714*
- service failures, 715-717*
- slow performance, 716*

wireless clients, 909-910

turning on/off

- applications (mobile devices), 435-436
- inkjet printers, 457

TVSS (transient voltage surge suppressor), 156**Type command, 623, 738****Type I PC Cards, 347****Type II PC Cards, 347****Type III PC Cards, 347****types**

- battery backup units, 158
- Blu-ray media, 532
- displays, 276
 - CRT monitors, 277*
 - data projectors, 280-281*
 - LCD monitors, 278-279*
 - LED monitors, 279*
 - OLED, 281*
 - plasma, 279*
- DSL, 786
- DVD media, 532
- Ethernet networks, 810
- ExpressCards, 350
- fiber-optic cabling, 805
- flash memory cards, 520-523
 - CompactFlash, 521*
 - memory sticks, 521-522*
 - microSD, 522*
 - microSDHC, 522*
 - miniSD, 522*
 - miniSDHC, 522*
 - MultiMedia, 521*
 - Secure Digital, 522*
 - Secure Digital Extended Capacity, 522*
 - Secure Digital High Capacity, 522*
 - SmartMedia, 521*
 - xD-Picture Card, 523*

malware, 914-915

memory, 177-178

mini-PCI cards, 363

modems, 779

network cables, 801
 coaxial, 805-806
 connectors, 806-807
 fiber-optic, 805
 plenum, 806
 PVC, 806
 STP, 801-803
 UTP, 801-803

parallel cables, 244-245

permissions, 895

printer interfaces, 469-471

unicast addresses, 828

video cards, 274

video connectors
 component, 289
 composite, 289
 DisplayPort, 288
 DVI, 286
 HDMI, 286-288
 RGB, 289
 SVGA, 286
 S-video, 289
 VGA, 285

Windows installations, 570
 clean, 571-573
 multiboot, 573
 repair, 574-575
 upgrade, 571

U

UAC (User Account Control), 893-894

UART (universal asynchronous receiver transmitter), 779

UDF (Live File System), 535

UDP (User Datagram Protocol), 799-800

UEFI (Unified Extensible Firmware Initiative), 91, 659

Ultimate Boot CD, 569

Ultimate edition
 Windows 7, 609
 Windows Vista, 608

Ultra 160 SCSI, 225

Ultra 320 SCSI, 225

Ultra Extended Graphics Array (UXGA), 370

Ultra SCSI, 225

Ultra-Wide SCSI, 225

Ultra-X website, 113

Ultra2 SCSI, 225

Ultra2Wide SCSI, 225

unattended Windows installation, 576

unbuffered memory, 188

UNC (Universal Naming Convention), 838-839

unexpected shutdowns, troubleshooting, 52

unicast addresses, 828

Unified Extensible Firmware Initiative (UEFI), 91, 659

universal asynchronous receiver transmitter (UART), 779

Universal Naming Convention (UNC), 838-839

Universal Serial Bus. *See* **USB**

Unshielded Twisted Pair. *See* **UTP**

updates
 access point firmware, 890
 Automatic Updates (Windows control panel), 688
 BIOS, 114-115
 failure recovery, 117
 Flash, 115-117
 replacing, 118-119
 mobile device operating systems, 433

printer drivers, 464

Windows

compatibility, 617

firmware, 760

hotfixes, 595

service packs, installing, 593-595

Windows Update, 592-593

upgrading

printer firmware, 469

smartphone memory cards, 400-403

Windows, 571

UPS (battery backup units), 158-160

automatic shutdown, 159

laser printers, 160

network support, 158

runtimes, 158

size, determining, 159-160

surge suppression features, 159

types, 158

upstream, 786

USB (Universal Serial Bus), 209

1.1/2.0, 210

3.0, 211

adding, 213-214

BIOS settings, configuring, 93

cable length, 212

defined, 209

flash memory drives, 524

generic hubs, 214

host adapters, configuring, 102

Implementers Forum website, 350

laptops, 352

legacy settings, configuring, 93

logos, 212

network adapters, installing, 816

printers, 469

root hubs, 212

speeds, 211

standards, 209

troubleshooting, 215-217

2.0 devices not operating at maximum speed, 217

black exclamation point on yellow field, 217

device drivers not installed, 216

improper designs, 215

not BIOS enabled, 215

power problems, 216-217

too many connected devices, 217

User Account Control (UAC), 893

User Datagram Protocol (UDP), 799-800

user/group permissions, 832-834

user/power-on password, 94

username authentication, 871

USMT (User State Migration Tool), 590-591

utilities. *See also* commands

Add/Remove Programs, 686

Chkdsk, 754-755

CONVERT.EXE, 660

Defrag, 755

Disk Management. *See* Disk Management

Diskpart, 633-635

file copy, 753

FORMAT.EXE, 631-632

NTBackup, 745-747

Performance Monitor, 641-642

POWERCFG.EXE, 684

Print Management, 648

Process Explorer, 638

RichCopy, 628

ROBOCOPY.EXE, 627-628

run-line, 661
 CMD, 661
 DXDiag, 661, 672
 Explorer. See *Explorer*
 MMC, 661
 MSConfig, 661
 MSInfo32, 661, 670
 Notepad, 661-662
 Regedit, 661
 SERVICES.MSC, 661
 System Monitor, 641-642
 Task Manager, 648-649
 Task Scheduler, 645-646
 Taskkill, 638-640
 Tasklist, 636-638

UTP (Unshielded Twisted Pair) cabling

categories, 802-803
 connectors, 803
 grades, 801
 overview, 801-803
 standard, 803

UXGA (Ultra Extended Graphics Array), 370

V

variables (memory)

chips, 179
 dual-channel, 180
 error checking, 179
 modules
 per bank requirements, 179
 types, 178
 number of modules, 180
 sizes, 179
 speed, 179
 triple-channel, 180

VDI (virtual desktop infrastructure), 692

vendor-supplied print drivers, installing, 467

ventilation, 936

VER command, 623

versions

Android, 405
 IEEE 1394, 218
 iOS, 406
 Windows
 7, 608-609
 hardware requirements, 606-607
 Vista, 607-608
 XP, 607

vertical lines (printed pages), troubleshooting, 489

vertical refresh rates, 296

VESA (Video Electronics Standards Association), 288

VGA cards, 285

video

cards

AGP slots, 274
capture, 335-336
cooling, 163, 275-276
defined, 274
GPUs, 275
installing, 282-284
PCI Express x16 slots, 274
troubleshooting, 300-302
TV tuner cards, 336
types, 274

connectors

component, 289
composite, 289
DisplayPort, 288
DVI, 286

HDMI, 286-288
RGB, 289
SVGA, 286
S-video, 289
VGA, 285
 editing systems, configuring, 316-317
 Electronics Standards Association (VESA), 288
 webcams, 327
 Windows requirements, 567
 Zoomed Video (ZV) cards, 349

viewing

- desktop components, 5
- disk status, 655

virtual desktop infrastructure (VDI), 692

virtual memory, 178, 681-682

Virtual Memory dialog box, 682

virtualization, 692

- benefits, 693
- BIOS settings, 93, 106-107
- client-side, 692
- configuring, 318-319
- defined, 692
- emulator requirements, 693
- features, 693
- hardware assisted, 326
- host/guest, 692
- hypervisor, 692
- machine manager (VMM), 692
- processors, 73
- resource requirements, 693
- security requirements, 694

viruses, 872-873, 914. *See also* malware

Vista editions (Windows), 607-608

VM (virtual machine), 692

VMM (virtualization machine man-

ager), 692
VoIP (Voice over Internet Protocol), 777, 813-814
VOL command, 623
voltage (power supplies), 134
volume (microphones), 333
volumes, creating, 655

W

Wake on LAN (WOL), 94

WANs (wide area networks), 769, 773

WAPs (Wireless Access Points), 776, 891

watts (power supplies), 130-133

- labels, 131
- replacement, calculating, 132-133
- safety certification, 131

wavy lines, troubleshooting, 301

web-based email, 421

web browsers

- configuring, 841-842
 - Internet connections*, 842-843
 - script settings, enabling/disabling*, 843
 - security*, 844-845
- web pages not displaying, 854

webcams, 327

websites

- 3TB hard drives, booting, 659
- Acer beep codes, 111
- AMD
 - processors*, 70
 - Virtualization Technology and Microsoft Hyper-V System Compatibility Check Utility*, 326
- American Megatrend BIOS Support, 115
- American Power Conversion, 160

- AMI BIOS beep codes, 111
- Answers That Work Task List Programs, 644
- Belarc, 115, 325
- BlackBerry Desktop Software, 428
- clean boot, 714
- CompTIA A+ certification, 18
- Computer Protection Program, 874
- CPU-Z, 326
- DDR comparisons, 185
- Dell
 - beep codes*, 111
 - power connectors*, 137
- Depot International, 479
- device failures, 715
- Device Manager error codes, 734
- digital TV vendors, 322
- disk defragmentation, 755
- “Disk Status Descriptions,” 655
- Diskpart utility, 635
- DMA/UDMA transfers, 545
- Ecova Plug Load Solutions, 133
- EFS data recovery, 875
- The Elder Geek’s Windows Services Guide, 644
- Elston Systems, 113
- eSupport, 115
- Ethernet cable color coding diagram, 803
- FAT64 file systems, 658
- FTP products, 794
- Gibson Research Corporation
 - Perfect Passwords*, 884
 - SecurAble*, 326
- GoldMemory, 196
- hardware profile alternatives, 681
- Hitachi Feature Tool, 547
- hotfixes, 595
- HP LaserJet Error Codes, 493
- HP MSDS documents, 937
- IBM beep codes, 111
- Intel Processor Identification Utility, 326
- Intel processors, 70
- IPv6 addressing, 829
- Kernel memory dumps, 709
- Laplink, 571
- Laptop Repair Help, 353
- laser printer maintenance kits, 479
- Live File System, 535
- LoJack for Laptops, 109
- MaximumPC, 193
- MemTest86, 196
- Microsoft support, 18, 53
- NTBackup utility, 746
- OSHA, 934
- overclocking, 193
- PC Check, 569
- PC-Diagnosys, 196
- Phoenix BIOS beep codes, 111
- POWERCFG.EXE, 684
- PrinterTechs.com, 479
- Process Explorer utility, 638
- REGSVR32, 721
- resources, 18
- RichCopy utility, 628
- Seagate, 747
- SiSoftware Sandra 2012, 569
- SSID broadcasting, 886
- Standard Certification Marks, 132
- surge suppressor standards, 157
- Symantec Ghost Solution Suite, 578
- System File Checker, 719
- System Image Manager, 576
- TuffTEST, 569

- Ultimate Boot CD, 569
- Ultra-X, 113
- USB
 - device conflicts*, 217
 - Implementers Forum*, 350
- USMT, 591
- virtualization security, 694
- Western Digital, 747
- Wim's BIOS, 115
- Windows
 - 7, 608-609
 - Easy Transfer*, 590
 - hardware requirements*, 567
 - Memory Diagnostic program*, 196
 - repair installation*, 575
 - Virtual PC*, 618
 - Vista*, 608, 711
 - XP security checklist*, 874
- WinRE, installing, 742
- WEP (Wireless Equivalent Privacy), 818, 883-884**
- Western Digital website, 747**
- wide area networks (WANs), 769, 773**
- Wide SCSI device ID settings, 224**
- Wide Ultra Extended Graphics Array (WUXGA), 370**
- Wide XGA (WXGA), 370**
- Wide XGA Plus (WXGA+), 370**
- Wi-Fi**
 - Bluetooth, 812
 - cellular, 813
 - Ethernet, 811-812
 - infrared, 813
 - laptops
 - antennas*, 373
 - troubleshooting*, 386
 - mobile devices, 414-418
 - Android*, 414
 - icon*, 415
 - iOS*, 415
 - tethering*, 416
 - troubleshooting*, 416-418
- printers, 469-471
- Protected Access (WPA), 818, 884
- Protected Setup (WPS), 819
- security
 - access point firmware, updating*, 890
 - default administrator passwords, changing*, 890
 - default SSIDs, changing*, 886
 - DHCP versus static IP addresses*, 885
 - firewalls*, 891
 - MAC addresses, filtering*, 887-890
 - radio levels*, 891
 - SSID broadcasting, disabling*, 886
 - WAP location*, 891
 - WEP/WPA*, 883-884
- unused connections, 910-912
- VoIP, 813-814
- wildcards (Windows), 624**
- WiMAX (Worldwide Interoperability for Microwave Access), 791**
- Wim's BIOS website, 115**
- windowboxing, 372**
- Windows**
 - 7
 - Action Center*, 691
 - Backup and Restore Center*, 750-753
 - boot errors*, 710-711
 - editions*, 608-609
 - Explorer*, 665-667
 - HomeGroup*, 690
 - libraries*, 668
 - power schemes*, 685-686
 - Problem Reports and Solutions*, 689

- Programs and Features*, 687
- restore points, creating*, 757
- restoring systems to earlier conditions*, 758
- Tablet PC Settings*, 688
- versions*, 608-609
- WinRE*, 741-744
- administrative features
 - computer management (MMC)*, 640-641
 - Performance Monitor*, 641-642
 - print management*, 648
 - services*, 642-644
 - System Monitor*, 641-642
 - Task Manager*, 648-649
 - Task Scheduler*, 645-646
- backups
 - Backup and Restore Center (7)*, 750-753
 - Backup and Restore Center (Vista)*, 748-750
 - file copy utilities, compared*, 753
 - image (7)*, 752
 - image (Vista)*, 749
 - image (XP)*, 747
 - NTBackup*, 745-747
 - restoring*, 746, 750-752
- Blue Screen Of Death errors, 706
 - causes*, 707
 - recording*, 707
 - researching causes*, 707
 - spontaneous shutdown/restart*, 708-709
- boot failures, 709
 - GUI not loading*, 714
 - missing GUI*, 714
 - Missing Operating System*, 713
 - Vista/7*, 710-711
 - XP*, 712-713
- booting to safe mode, 717
- CE devices, synchronizing to PCs, 428
- command-line tools
 - CD command*, 629
 - command prompts, starting*, 621-622
 - COPY command*, 624-625
 - DEL command*, 635-636
 - Diskpart*, 633-635
 - Format command*, 629-632
 - internal commands*, 622-623
 - MD command*, 629
 - RD command*, 629
 - ROBOCOPY.EXE*, 627-628
 - Taskkill utility*, 638-640
 - Tasklist.exe*, 636-638
 - wildcards*, 624
 - XCOPY command*, 625-627
- compatibility errors, 716
- Complete PC Restore option (WinRE), 743
- control panel
 - Action Center*, 691
 - Add/Remove Programs*, 686
 - All Control Panel Items view*, 676
 - Automatic Updates*, 688
 - Category view*, 674
 - Devices and Printers*, 689
 - display settings, configuring*, 678
 - features*, 673-674
 - folder options*, 679
 - function access via property sheets*, 678
 - HomeGroup*, 690
 - Pen and Input Devices*, 689
 - power options*, 682-686
 - Problem Reports and Solutions*, 689
 - Programs and Features*, 687

- starting*, 674
- switching views*, 676
- System properties sheet*, 680-682
- Tablet PC Settings*, 688
- data transfers, 589-591
- Defender, 916
- devices failing to start, 715
- diagnostic/repair tools, 717-719
 - Advanced Boot Options*, 726-729
 - Automated System Recovery*, 718, 739-741
 - Defrag*, 718
 - Device Manager*, 718, 729-735
 - Event Viewer*, 718, 724
 - Fixboot*, 718
 - Fixmbr*, 718
 - MSConfig*, 718-721
 - Recovery Console*, 718, 735-739
 - REGEDIT*, 718, 722-724
 - REGSVR32*, 718, 721
 - Repair Discs*, 719
 - Safe Mode*, 718
 - System File Checker*, 718-719
 - WinRE*, 718, 741-744
- disk defragmentation, 755
- disk drive errors, checking, 754-755
- Disk Management. *See* Disk Management
- disk tools, 551
- DLL messages, missing, 715
- Easy Transfer, 590
- Explorer, 662
 - Common Tasks View*, 664-665
 - display options*, 666-667
 - drives, viewing*, 664
 - Favorite Links View*, 665
 - libraries*, 668
 - My Computer window*, 669
 - starting*, 662
 - Windows 7 View*, 665
- features, 609-610
 - administrative tools*, 618-619
 - Aero/Aero Glass*, 610
 - compatibility mode*, 615-617
 - file structures and paths*, 620
 - gadgets*, 611
 - ReadyBoost*, 613-614
 - Shadow Copy*, 612
 - Sidebar*, 611
 - Start menu, customizing*, 612
 - XP Mode*, 618
- file systems
 - converting*, 660
 - defined*, 657
 - determining*, 659
 - FAT32*, 657
 - FAT64*, 658
 - NTFS*, 658-660
- files not opening, 717
- firmware updates, 760
- hardware requirements, 606-607
- improper shutdowns, 714
- installing
 - boot methods*, 570
 - clean*, 571-573
 - file systems*, 586-588
 - hard drive partitions*. *See* *hard drives, partitions*
 - hardware requirements*, 566-569
 - image deployment*, 577-579
 - multiboot*, 573
 - remote network*, 577
 - repair*, 574-575
 - third-party drivers*, 588

- time/date/language/region settings*, 579
- types*, 570
- unattended*, 576
- upgrade installations*, 571
- without DVD drive*, 570
- workgroups versus domain setup*, 589
- Internet Naming Service (WINS), 826
- maintenance, 744
- Memory Diagnostic tool, 196, 744
- mobile devices, synchronizing to PCs, 428
- Mobility Center, 379
- Recovery Environment. *See* WinRE
- restoring, 595-596
- run-line utilities, 661
 - CMD*, 661
 - DXDiag*, 661, 672
 - Explorer*. *See* *Explorer*
 - MMC*, 661
 - MSConfig*, 661
 - MSInfo32*, 661, 670
 - Notepad*, 661-662
 - Regedit*, 661
 - SERVICES.MSC*, 661
- service failures, 715
- slow performance, 716
- System Restore, 756-760
 - configuring*, 759
 - restore points, creating*, 757
 - restoring to earlier conditions*, 758
 - tasks to try first*, 759
- updating
 - hotfixes*, 595
 - service packs, installing*, 593-595
 - Windows Update*, 592-593
- virtualization
 - benefits*, 693
 - client-side*, 692
 - defined*, 692
 - emulator requirements*, 693
 - features*, 693
 - host/guest*, 692
 - hypervisor*, 692
 - resource requirements*, 693
 - security requirements*, 694
- Virtual PC, 618
- Vista
 - Backup and Restore Center*, 748-750
 - boot errors*, 710-711
 - Explorer*, 667
 - Pen and Input Devices*, 689
 - power schemes*, 685-686
 - Problem Reports and Solutions*, 689
 - Programs and Features*, 687
 - restore points, creating*, 757
 - restoring systems to earlier conditions*, 758
 - Tablet PC Settings*, 688
 - versions*, 607-608
 - WinRE*, 741-744
- XP
 - Add/Remove Programs*, 686
 - ASR*, 739-741
 - Automatic Updates*, 688
 - boot errors*, 712-713
 - editions*, 607
 - Explorer*, 666
 - hardware profiles*, 681
 - mode*, 618
 - power schemes*, 683-684
 - Recovery Console*, 735-739
 - restore points, creating*, 757

restoring systems to earlier conditions,
758

security checklist website, 874

WinRE (Windows Recovery Environment), 718, 741-744, 916

accessing, 741-742

options, 743-744

WINS (Windows Internet Naming Service), 826

wire strippers, 18, 808

wired networks, 810

wireless

Access Points (WAPs), 776

cards (laptops), removing, 362-365

clients, configuring, 904

troubleshooting, 909-910

Windows 7, 908-909

Windows Vista, 908

Windows XP SP2/SP3, 905-908

Equivalent Privacy (WEP), 818,
883-884

LANs (WLANs), configuring, 818-819
networks. *See* Wi-Fi

wizards

Add Printer, 465-466

Automated System Recovery, 739

Files and Settings Transfer (FAST), 590

Program Compatibility

Windows 7, 615

Windows XP/Vista, 616-617

WLANs (Wireless LANs), configuring, 818-819

WOL (Wake on LAN), 94

Worldwide Interoperability for Microwave Access (WiMAX), 791

worms, 914

WPA (Wi-Fi Protected Access), 818, 883-884

WPS (Wi-Fi Protected Setup), 819

write-protect boot sector BIOS settings, 94

writeable/nonerasable Blu-ray media (BD-R), 532

writeable/nonerasable DVDs (DVD-R/DVD+R), 532

WS_FTP Pro, 794

WUXGA (Wide Ultra Extended Graphics Array), 370

WXGA (Wide XGA), 370

WXGA+ (Wide XGA Plus), 370

X - Z

x84, 606

x86, 606

XCOPY command, 625-627

xD-Picture Card cards, 523

XGA (Extended Graphics Array), 370

XP editions (Windows), 607

ZV (Zoomed Video) cards, 349