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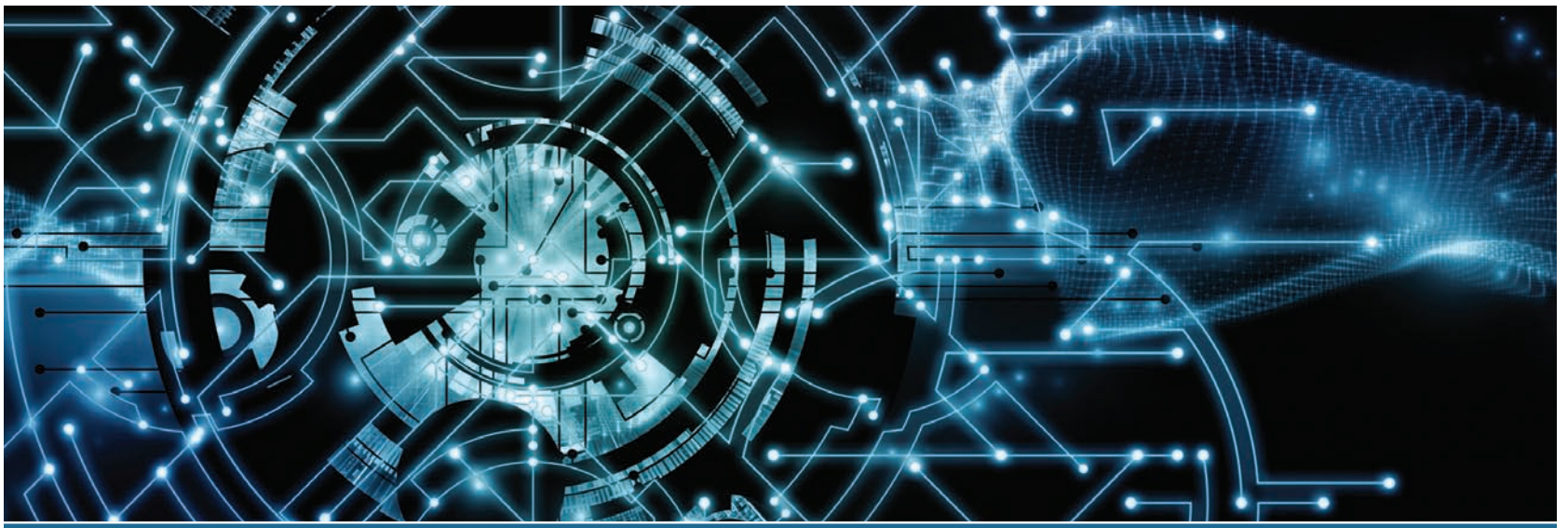
A CompTIA® A+ Core 1 (220-1001) &  
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CHERYL A. SCHMIDT

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# Complete A+ Guide to IT Hardware and Software

A CompTIA A+ Core 1 (220-1001) &  
CompTIA A+ Core 2 (220-1002) Textbook

EIGHTH EDITION

**CHERYL A. SCHMIDT**

FLORIDA STATE COLLEGE AT JACKSONVILLE

PEARSON IT  
CERTIFICATION

# Complete A+ Guide to IT Hardware and Software, Eighth Edition

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ISBN-13: 978-0-7897-6050-0

ISBN-10: 0-7897-6050-9

Library of Congress Control Number: 2019930917

ScoutAutomatedPrintCode

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## Contents at a Glance

Introduction .....	xxiv
Features of this Book .....	xxvi
Chapter 1: Introduction to the World of IT .....	1
Chapter 2: Connectivity .....	33
Chapter 3: On the Motherboard .....	71
Chapter 4: Introduction to Configuration .....	115
Chapter 5: Disassembly and Power .....	161
Chapter 6: Memory .....	211
Chapter 7: Storage Devices .....	251
Chapter 8: Multimedia Devices.....	313
Chapter 9: Printers .....	359
Chapter 10: Mobile Devices.....	419
Chapter 11: Computer Design and Troubleshooting Review.....	527
Chapter 12: Internet Connectivity, Virtualization, and Cloud Technologies .....	573
Chapter 13: Networking .....	619
Chapter 14: Introduction to Operating Systems .....	723
Chapter 15: Introduction to Scripting.....	769
Chapter 16: Advanced Windows .....	831
Chapter 17: macOS and Linux Operating Systems.....	917
Chapter 18: Computer and Network Security .....	959
Chapter 19: Operational Procedures .....	1039
Appendix A: Subnetting Basics .....	1085
Appendix B: Certification Exam Objectives (Online)	
Glossary .....	1089
Index.....	1153

## Contents

<b>Introduction .....</b>	<b>xxiv</b>
<b>Features of this Book .....</b>	<b>xxvi</b>
<b>Chapter 1: Introduction to the World of IT .....</b>	<b>1</b>
Who Needs This Book?.....	2
Technician Qualities .....	2
Breaking into IT with the CompTIA A+ Certification .....	5
Basic Skills for This Course.....	6
Types of Computers.....	9
Basic Computer Hardware .....	9
Mice and Keyboards.....	16
Common Peripherals .....	18
1s and 0s .....	21
Safety Notes .....	25
Chapter Summary.....	25
Key Terms.....	26
Review Questions .....	27
Exercises .....	29
Exercise 1.1 Identifying Tower Computer Parts.....	29
Exercise 1.2 Identifying Computer Parts.....	30
Activities.....	30
Internet Discovery .....	30
Soft Skills.....	31
Critical Thinking Skills.....	31
<b>Chapter 2: Connectivity .....</b>	<b>33</b>
Introduction to Connectivity .....	34
External Connectivity .....	34
Mouse and Keyboard Ports .....	34
Video Ports .....	35
Audio Ports.....	50
eSATA Ports .....	51
Network Ports.....	51
Modem and Serial Ports .....	52
Network Cabling .....	54
Integrated Motherboard Ports.....	57
Getting to Know Ports.....	58
Wireless Connectivity for Input Devices .....	59
Chapter Summary.....	61
Key Terms.....	62
Review Questions .....	64
Exercises .....	65
Exercise 2.1 Identifying Computer Ports.....	65
Exercise 2.2 Identifying More Computer Ports.....	66
Exercise 2.3 Identifying Display Ports .....	66
Exercise 2.4 Identifying Cables .....	67

Activities.....	67
Internet Discovery .....	67
Soft Skills.....	68
Critical Thinking Skills.....	69
<b>Chapter 3: On the Motherboard.....</b>	<b>71</b>
Introduction to the Motherboard .....	72
Processor Overview .....	72
Processor Basics .....	73
Speeding Up Processor Operations Overview .....	76
Cache .....	77
Clocking .....	78
Threading Technology.....	79
Connecting to the Processor.....	79
Multicore Processors .....	80
Graphics Processing Unit (GPU) .....	82
Introduction to Virtualization .....	82
Intel Processors.....	83
AMD Processors.....	84
CPU Sockets.....	85
Processor Cooling.....	86
Installing a Processor.....	88
Upgrading Processors.....	90
Overclocking Processors .....	90
Installing CPU Thermal Solutions .....	91
Troubleshooting Processor Issues .....	92
Expansion Slots .....	93
PCI (Peripheral Component Interconnect).....	94
AGP (Accelerated Graphics Port).....	95
PCIe (Peripheral Component Interconnect Express) .....	96
Chipsets .....	100
Types of Motherboards.....	101
Upgrading and Replacing Motherboards .....	102
Motherboard Troubleshooting.....	103
Chapter Summary.....	106
Key Terms.....	108
Review Questions .....	109
Exercises.....	111
Exercise 3.1 Identifying ATX Motherboard Parts .....	111
Exercise 3.2 Motherboard Analysis .....	112
Activities.....	113
Internet Discovery .....	113
Soft Skills.....	114
Critical Thinking Skills.....	114
<b>Chapter 4: Introduction to Configuration.....</b>	<b>115</b>
Configuration Overview .....	116
BIOS Overview .....	116
The Setup Program.....	117
Flash BIOS .....	118

BIOS/UEFI Configuration Settings.....	119
CMOS Memory .....	123
Motherboard Battery .....	123
Firmware Updates: Flashing the BIOS/UEFI .....	124
Clearing CMOS .....	125
Other Configuration Parameters.....	126
Hardware Configuration Overview .....	132
Installing a USB Device .....	134
Installing an eSATA Card.....	138
Installing a Network Interface Card .....	139
Video Overview .....	140
Video Cards .....	140
Troubleshooting Configurations.....	148
Chapter Summary.....	151
Key Terms.....	152
Review Questions .....	153
Exercises.....	155
Exercise 4.1 System Expansion .....	155
Exercise 4.2 BIOS/UEFI Options .....	157
Activities.....	159
Internet Discovery .....	159
Soft Skills.....	159
Critical Thinking Skills.....	160
<b>Chapter 5: Disassembly and Power .....</b>	<b>161</b>
Disassembly Overview .....	162
Electrostatic Discharge (ESD).....	162
Electromagnetic Interference (EMI) .....	165
Tools .....	165
Disassembly.....	167
Reassembly .....	176
Preventive Maintenance.....	177
Basic Electronics Overview .....	180
Power Supply Overview .....	184
Replacing or Upgrading a Power Supply.....	193
Power Protection .....	197
Symptoms of Power Supply Problems.....	197
Chapter Summary.....	202
Key Terms.....	204
Review Questions .....	205
Exercises.....	208
Exercise 5.1 Identifying Power Supply Connectors .....	208
Exercise 5.2 Recognizing Computer Replacement Parts .....	208
Exercise 5.3 Describing Computer Parts .....	209
Activities.....	209
Internet Discovery .....	209
Soft Skills.....	210
Critical Thinking Skills.....	210

<b>Chapter 6: Memory .....</b>	<b>211</b>
Memory Overview.....	212
Memory Physical Packaging .....	213
Planning a Memory Installation .....	214
Installing Memory Overview .....	226
Adding More Cache/RAM.....	228
Windows Disk Caching .....	229
Monitoring Memory Usage in Windows.....	231
Older Applications in Windows .....	233
Troubleshooting Memory Problems.....	234
Flash Memory.....	235
Chapter Summary.....	238
Key Terms.....	239
Review Questions .....	240
Exercises.....	242
Exercise 6.1 Configuring Memory on Paper .....	242
Exercise 6.2 Configuring Memory on Paper .....	244
Exercise 6.3 Configuring Memory on Paper .....	246
Exercise 6.4 Configuring Memory on Paper .....	247
Activities.....	249
Internet Discovery .....	249
Soft Skills.....	249
Critical Thinking Skills.....	250
<b>Chapter 7: Storage Devices .....</b>	<b>251</b>
Storage Devices Overview .....	252
Hard Drive Overview .....	253
Solid State Drive (SSD) Overview.....	256
Hard Drive Interfaces Overview.....	258
M.2 and NVMe.....	260
PATA, SATA, and SAS Connectivity .....	261
Storage Device Configuration Overview .....	265
System BIOS/UEFI Configuration for Hard Drives .....	271
Hard Drive Preparation Overview.....	272
Windows Disk Management .....	280
Fault Tolerance .....	282
Removable Drive Storage.....	285
Windows Storage Spaces.....	286
Disk Caching/Virtual Memory .....	287
Troubleshooting Storage Devices Overview .....	290
Troubleshooting New Storage Device Installation.....	293
Troubleshooting Previously Installed Storage Devices.....	294
RAID Issues .....	298
SSD Issues.....	299
Chapter Summary.....	301
Key Terms.....	303
Review Questions .....	305
Exercises.....	307
Exercise 7.1 Configuring a PATA IDE Hard Drive on Paper.....	307
Exercise 7.2 Configuring a SATA Hard Drive on Paper .....	308



Activities.....	310
Internet Discovery .....	310
Soft Skills.....	311
Critical Thinking Skills.....	311
<b>Chapter 8: Multimedia Devices .....</b>	<b>313</b>
Multimedia Devices Overview .....	314
Optical Drive Overview.....	314
Optical Drive Installation .....	319
Troubleshooting Optical Drive Issues .....	321
Introduction to Audio .....	324
Installing Sound Cards .....	328
Sound Cards Using Windows.....	328
Speakers.....	330
Troubleshooting Sound Problems .....	333
Scanners.....	335
KVMs .....	339
Projectors.....	340
Video Recording.....	342
Installing and Configuring Other Peripheral Devices .....	345
Chapter Summary.....	351
Key Terms.....	352
Review Questions .....	353
Exercises.....	355
Exercise 8.1 Multimedia Device Research .....	355
Exercise 8.2 Which one will you buy? .....	356
Activities.....	357
Internet Discovery .....	357
Soft Skills.....	357
Critical Thinking Skills.....	358
<b>Chapter 9: Printers .....</b>	<b>359</b>
Printers Overview.....	360
Printer Ports .....	360
Categories of Printers .....	361
Impact Printers .....	361
Inkjet Printers .....	363
Laser Printers.....	366
Thermal Printers .....	371
3D Printers.....	372
Paper.....	375
Virtual Printing .....	377
Refilling Cartridges, Re-inking Ribbons, and Recycling Cartridges.....	379
Upgrading Printers .....	380
Printer Maintenance .....	380
USB Printer Installation .....	386
Installing a Local Printer.....	388
Printers in the Windows Environment.....	388
Printers in the macOS Environment.....	393

Printing Device Sharing .....	395
Cloud Printing .....	399
General Printer Troubleshooting .....	402
USB-Attached Printer Troubleshooting .....	405
Windows Printer Troubleshooting.....	405
Impact Printer Troubleshooting.....	407
Inkjet Printer Troubleshooting .....	408
Laser Printer Troubleshooting.....	408
Chapter Summary.....	411
Key Terms.....	412
Review Questions .....	413
Exercises.....	415
Exercise 9.1 Research a Local Printer .....	415
Exercise 9.2 Printer Driver Research.....	416
Activities.....	416
Internet Discovery .....	416
Soft Skills.....	417
Critical Thinking Skills.....	417
<b>Chapter 10: Mobile Devices .....</b>	<b>419</b>
Mobile Device Overview.....	420
Using Mobile Devices .....	431
Cell Phones.....	435
Mobile Apps .....	439
Mobile Device Wired Connectivity.....	443
Mobile Device Wireless Connectivity.....	444
Mobile Device Email Configuration .....	453
Mobile Device Synchronization and Backup.....	455
Other Mobile Software Tools .....	463
Laptops Overview.....	466
Laptop Hardware .....	466
Laptop Power.....	471
Laptop Repairs Overview.....	475
Laptop Display .....	491
Mobile Device Security.....	499
Mobile Device Travel and Storage.....	504
Mobile Device Troubleshooting Overview .....	504
Chapter Summary.....	517
Key Terms.....	519
Review Questions .....	521
Exercises.....	523
Exercise 10.1 Identifying Laptop Parts.....	523
Exercise 10.2 Common Laptop Keys .....	523
Exercise 10.3 Cell Phone Parts .....	524
Activities.....	525
Internet Discovery .....	525
Soft Skills.....	526
Critical Thinking Skills.....	526

<b>Chapter 11: Computer Design and Troubleshooting Review .....</b>	<b>527</b>
Design Overview .....	528
Computer System Design.....	528
Motherboard and Associated Component Design.....	536
Power Supply and Case Design .....	537
Storage Subsystem Design .....	539
Audio Subsystem Design .....	540
Display Subsystem Design.....	541
Troubleshooting Overview .....	542
Step 1. Identify the Problem.....	543
Step 2. Establish a Theory of Probable Cause (Question the Obvious) .....	544
Step 3. Test the Theory to Determine the Cause.....	551
Step 4. Establish a Plan of Action to Resolve the Problem and Implement the Solution .....	554
Step 5. Verify Full System Functionality and, if Applicable, Implement Preventive Measures.....	554
Step 6. Document Findings, Actions, and Outcomes.....	554
Sample Troubleshooting Flowcharts .....	555
Chapter Summary.....	560
Key Terms.....	563
Review Questions .....	564
Exercises .....	565
Exercise 11.1 Computer System Design.....	565
Exercise 11.2 Design Components .....	567
Exercise 11.3 Subsystem Design Components.....	568
Exercise 11.4 Determine the Troubleshooting Theory Step.....	569
Activities.....	570
Internet Discovery .....	570
Soft Skills.....	571
Critical Thinking Skills.....	571
<b>Chapter 12: Internet Connectivity, Virtualization, and Cloud Technologies .....</b>	<b>573</b>
Internet Connectivity Overview .....	574
Dial-up Overview .....	574
Serial Communication Overview .....	575
Configuring Traditional Serial Devices.....	576
56 kbps Modems .....	577
Digital Modems and ISDN.....	579
VoIP .....	579
Cable Modems.....	581
xDSL Modems .....	584
Satellite Modems.....	586
Modem Preventive Maintenance .....	587
Mobile Connectivity Overview .....	587
Virtualization Basics.....	589
Cloud Computing .....	593
Web Browsers.....	597
Basic Web Browser Issues.....	608
Chapter Summary.....	611
Key Terms.....	613
Review Questions .....	614

Exercises .....	615
Exercise 12.1 Exploring Internet Connectivity Options .....	615
Exercise 12.2 Exploring the <b>Internet Options</b> Window .....	616
Activities .....	617
Internet Discovery .....	617
Soft Skills .....	617
Critical Thinking Skills .....	618
<b>Chapter 13: Networking .....</b>	<b>619</b>
Networking Overview .....	620
Attaching to Different Types of Networks .....	620
Network Topologies .....	625
Network Media Overview .....	627
Copper Media .....	627
Protecting Your Network and Cable Investment .....	636
Ethernet Concepts .....	640
Ethernet over Power .....	641
The OSI Model .....	642
The TCP/IP Model .....	644
Network Addressing .....	646
More IPv4 Addressing .....	647
Wireless Networks Overview .....	650
Wireless Network Standards .....	651
Bluetooth .....	651
Wireless Network Components .....	652
Wireless Network Design .....	654
Antenna Basics .....	660
End-User Device Configuration Overview .....	664
Adding a Computer to a Windows Domain .....	665
Configuring an End-User Device: Addressing .....	665
Wireless NIC–Specific Settings .....	670
Advanced NIC Properties .....	671
NIC Configuration When Using Virtualization .....	672
Thin or Thick Client Installation Overview .....	673
Wireless AP/Router Basic Configuration .....	675
WWAN Cellular Configuration .....	677
IoT and Smart Devices .....	677
Network Troubleshooting .....	684
Troubleshooting Cable and DSL Modems .....	691
Network Printers .....	691
Network Printer Troubleshooting .....	692
Network Servers .....	692
Embedded and Legacy Systems .....	694
Network Terminology .....	694
The TCP/IP Model in Action .....	695
Using the Network and Sharing Center Section of the Control Panel .....	698
Introduction to Shared Folders .....	702
Network Connectivity .....	706
Chapter Summary .....	707
Key Terms .....	709

Review Questions .....	711
Exercises .....	714
Exercise 13.1 Understanding Wireless AP Paper Configuration .....	714
Exercise 13.2 Understanding T568B Color Sequence .....	714
Exercise 13.3 Recognizing Network Devices .....	715
Exercise 13.4 Identifying Basic Wireless Network Parts .....	716
Exercise 13.5 Wireless Network Case Study .....	716
Exercise 13.6 Practicing with Network Numbers and Broadcast Addresses .....	717
Exercise 13.7 Practicing with CIDR Notation .....	718
Exercise 13.8 Determining the Default Gateway .....	718
Activities .....	720
Internet Discovery .....	720
Soft Skills .....	721
Critical Thinking Skills .....	721
<b>Chapter 14: Introduction to Operating Systems .....</b>	<b>723</b>
Operating Systems Overview .....	724
User Interaction with Operating Systems .....	724
Overview of Popular Operating Systems .....	726
32-bit vs. 64-bit Operating Systems .....	727
Windows 7/8/8.1/10 Versions .....	728
Workstation Operating Systems .....	729
Operating Systems for Mobile Devices .....	729
End-of-Life Concerns .....	730
Update Concerns .....	730
Compatibility Concerns .....	731
Corporate Operating System Needs .....	731
Basic Windows Usage Overview .....	733
Shortcuts and Tiles .....	736
Windows 7 Desktop Components .....	737
Windows Desktop/Start Screen Components .....	740
Windows 10 Desktop Components .....	741
Interactions Within a Window .....	743
Managing Windows Files and Folders .....	745
Searches and Indexing .....	751
Attributes, Compression, and Encryption .....	752
Introduction to Windows Control Panel Utilities .....	754
Determining the Windows Version .....	757
Windows Registry .....	758
Editing the Windows Registry .....	759
Backing Up Data .....	760
Recovering the Windows OS .....	760
WinRE .....	761
Chapter Summary .....	762
Key Terms .....	763
Review Questions .....	764
Exercises .....	765
Exercise 14.1 .....	765
Exercise 14.2 .....	766
Exercise 14.3 .....	766

Activities.....	767
Internet Discovery .....	767
Soft Skills.....	767
Critical Thinking Skills.....	768
<b>Chapter 15: Introduction to Scripting .....</b>	<b>769</b>
Scripting Overview.....	770
Command Prompt Overview .....	771
Command Prompt Basics .....	771
Moving Around from a Command Prompt.....	773
The md and rd Commands.....	777
Two Useful Commands: del and type .....	778
Copying Files.....	778
The attrib Command.....	779
Why Learn Commands?.....	780
PowerShell.....	780
Other Commands You Should Look Over.....	781
Command Format.....	781
Introduction to Scripting .....	803
Script File Types.....	804
Environment Variables.....	805
Script Syntax .....	807
Introduction to Script Programming .....	807
Variables .....	808
Data Types .....	810
Examples of Using Variables .....	810
Comments.....	812
Basic Script Constructs .....	813
Decisions: The Selection Structure .....	813
Compound Conditions and Logical Operators.....	817
Loops: The Repetition Structure .....	817
A Brief Look at VBScript and PowerShell .....	820
Chapter Summary.....	823
Key Terms.....	824
Review Questions .....	826
Exercises.....	827
Exercise 15.1.....	827
Exercise 15.2.....	828
Activities.....	828
Internet Discovery .....	828
Soft Skills.....	829
Critical Thinking Skills.....	829
<b>Chapter 16: Advanced Windows .....</b>	<b>831</b>
Advanced Windows Overview .....	832
Preinstallation of Windows.....	832
Installation/Upgrade of Windows.....	841
Corporate Windows Deployment .....	842
Verifying the Installation.....	843
Troubleshooting a Windows Installation.....	843

Reloading Windows.....	845
Windows Updates.....	846
Backing Up the Windows Registry and Data.....	848
Configuring Windows Overview.....	850
Configuring Windows.....	851
Adding Devices.....	852
Installing/Removing Software.....	857
Computer Management Console.....	861
System Tools.....	862
User Account Management.....	866
Managing Storage.....	874
Managing Services and Applications.....	877
Data Sources (ODBC).....	878
Print Management Console.....	879
Overview of the Windows Boot Process.....	880
Speeding Up the Windows Boot Process.....	881
Troubleshooting the Windows Boot Process.....	882
Black Screen/Video Issues.....	884
Recovery Console.....	884
Advanced Boot Options/Startup Settings Menu.....	887
System Configuration Utility.....	889
Task Manager.....	892
Troubleshooting a Service That Does Not Start.....	895
Slow Boot.....	896
Troubleshooting Windows Network Settings.....	897
Windows Reboots.....	898
Shutdown Problems.....	898
Power Options.....	899
Monitoring System Performance.....	900
Supporting Windows Computers Remotely.....	905
Preventive Maintenance for Your Operating System.....	906
Chapter Summary.....	908
Key Terms.....	909
Review Questions.....	911
Exercises.....	912
Exercise 16.1 Windows Tools.....	912
Exercise 16.2 Task Manager Tabs.....	913
Exercise 16.3 System Configuration Tabs.....	914
Activities.....	914
Internet Discovery.....	914
Soft Skills.....	915
<b>Chapter 17: macOS and Linux Operating Systems.....</b>	<b>917</b>
Introduction to macOS.....	918
Navigating the User Interface.....	919
Basic System Usage, Updates, and Backups.....	922
Management and Troubleshooting Tools.....	927
Utilities.....	929
Introduction to Linux.....	938

Navigating the User Interface.....	940
Basic System Usage, Updates, and Backups .....	941
Command-Line Interface.....	944
macOS and Linux Best Practices .....	952
Chapter Summary .....	953
Key Terms.....	954
Review Questions .....	955
Exercises .....	956
Exercise 17.1 .....	956
Exercise 17.2.....	956
Activities.....	956
Internet Discovery .....	956
Soft Skills.....	957
Critical Thinking Skills.....	958
<b>Chapter 18: Computer and Network Security .....</b>	<b>959</b>
Security Overview .....	960
Security Policy.....	960
Physical Security .....	961
Logical Security .....	968
End-User Education .....	972
Protecting Access to Local and Network Resources.....	981
Permissions .....	988
Folder Options .....	997
Protecting the Operating System and Data .....	997
Internet Security .....	1003
Parental Controls .....	1013
NAT/PAT.....	1014
VPN Configuration.....	1014
Remote Access to Network Devices .....	1015
Internet Appliances.....	1016
Wireless Network Security Overview .....	1017
Security Incident Reporting.....	1025
A Final Word About Security.....	1027
Chapter Summary.....	1029
Key Terms.....	1030
Review Questions .....	1032
Exercises.....	1034
Exercise 18.1 .....	1034
Exercise 18.2.....	1035
Exercise 18.3.....	1035
Activities.....	1036
Internet Discovery .....	1036
Soft Skills.....	1037
Critical Thinking Skills.....	1037
<b>Chapter 19: Operational Procedures .....</b>	<b>1039</b>
Operational Procedures Overview.....	1040
Adverse Power Conditions .....	1050
Surge Protectors.....	1051



Line Conditioners .....	1053
Battery Backup .....	1054
IT Documentation.....	1060
Change Management.....	1064
Chapter Summary .....	1077
Key Terms.....	1079
Review Questions .....	1080
Exercises .....	1082
Exercise 19.1 Determining a Power Solution.....	1082
Exercise 19.2 Determining the Type of Documentation Needed .....	1082
Activities.....	1083
Internet Discovery .....	1083
Soft Skills.....	1083
Critical Thinking Skills.....	1084
<b>Appendix A: Subnetting Basics.....</b>	<b>1085</b>
Exercises.....	1088
Exercise A.1 Subnet Practice Exercise .....	1088
<b>Appendix B: Certification Exam Objectives (Online)</b>	
<b>Glossary.....</b>	<b>1089</b>
<b>Index.....</b>	<b>1153</b>

## About the Author

**Cheryl Schmidt** is a professor of Network Engineering Technology at Florida State College at Jacksonville. Prior to joining the faculty ranks, she oversaw the LAN and PC support for the college and other organizations. She started her career as an electronics technician in the U.S. Navy. She teaches computer repair and various networking topics, including CCNA, network management, and network design. She has published other works with Pearson, including *IP Telephony Using CallManager Express* and *Routing and Switching in the Enterprise Lab Guide*.

Cheryl has won awards for teaching and technology, including Outstanding Faculty of the Year, Innovative Teacher of the Year, Cisco Networking Academy Instructor Excellence Award, and Cisco Networking Academy Stand Out Instructor. She has presented at U.S. and international conferences. Cheryl keeps busy maintaining her technical certifications and teaching but also loves to travel, hike, do all types of puzzles, and read.

## Dedication

### *A Note to Instructors:*

I was a teacher long before I had the title professor. Sharing what I know has always been as natural as walking to me, but sitting still to write what I know is not as natural, so composing this text has always been one of my greatest challenges. Thank you so much for choosing this text. I thank you for sharing your knowledge and experience with your students. Your dedication to education is what makes the student experience so valuable.

### *A Note to Students:*

Writing a textbook is really different from teaching class. I have said for years that my students are like my children, except that I don't have to pay to send them through college. I am happy to claim any of you who have this text. I wish that I could be in each classroom with you as you start your IT career. How exciting!

Another thing that I tell my students is that I am not an expert. IT support is an ever-changing field and I have been in it since PCs started being used. You have to be excited about the never-ending changes to be good in this field. You can never stop learning or you will not be very good any more. I offer one important piece of advice:

Consistent, high-quality service boils down to two equally important things: caring and competence.

—Chip R. Bell and Ron Zemke

I dedicate this book to you. I can help you with the competence piece, but you are going to have to work on the caring part. Do not ever forget that there are people behind those machines that you love to repair. Taking care of people is as important as taking care of the computers.

## Acknowledgments

I am so thankful for the support of my family during the production of this book. My husband, Karl, daughters, Raina and Karalina, and son-in-law, Marc, were such a source of inspiration and encouragement. My grandsons, Gavin, Riley, Logan, and Liam, and my granddaughter, Brie, are a constant source of wonderment for me. They were a shining light at the end of some very long days. Thanks to my mother, Barbara Cansler, who taught me to love words and my brother Jeff Cansler for just listening. Thanks to my walking buddy, Kellie, for the miles of letting me work through knotty sections. Thanks to my colleagues, adjuncts, and students at my college who offered numerous valuable suggestions for improvement and testing the new material. Thanks to my colleagues Pamela Brauda and David Singletary for just letting me rant. Finally, I want to thank my personal technical team, Justin Ache, Raina Durrence, Marc Durrence, and Jeff Burns.

Many thanks are also due the folks at Pearson. The professionalism and support given during this edition was stellar. Thank you so much, Pearson team, especially Eleanor Bru, Mary Beth Ray, Kitty Wilson, Mandie Frank, and my favorite technical reviewer/hatchet man, Chris Crayton. A special thanks to Mary Beth Ray, my executive editor and juggler extraordinaire. I hope all of you can see the results of your contributions. I thank the whole team so much for your conscientious efforts.

Finally, thank you to the students who have taken the time to share their recommendations for improvement. You are the reason I write this book each time. Please send me any ideas and comments you may have. I love hearing from you and of your successes. I may be reached at [cheryl.schmidt@fscj.edu](mailto:cheryl.schmidt@fscj.edu).

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Figure 2-18	Raina Durrence	Figure 4-17	Cheryl Schmidt
Figure 2-19	George Nichols	Figure 4-19	Cheryl Schmidt
Figure 2-21a	Raina Durrence	Figure 4-20	Cheryl Schmidt
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# Introduction

*Complete A+ Guide to IT Hardware and Software*, eighth edition, is a textbook and optional lab manual intended for one or more courses geared toward CompTIA A+ Certification and computer repair. It covers all the material needed for the CompTIA A+ Core 1 (220-1001) and CompTIA A+ Core 2 (220-1002) exams. The book is written so that it is easy to read and understand, with concepts presented in building-block fashion. The book focuses on hardware, software, mobile devices, virtualization, basic networking, and security.

Some of the best features of the book include the coverage of difficult subjects in a step-by-step manner, carefully developed graphics that illustrate concepts, photographs that demonstrate various technologies, reinforcement questions, critical thinking skills, soft skills, and hands-on exercises at the end of each chapter. Also, this book is written by a teacher who understands the value of a textbook from someone who has been in IT her entire career.

## What's New in the Eighth Edition?

This update has been revised to include more coverage of hardware, mobile devices, and troubleshooting. There are also new sections on managed/unmanaged switches, VLANs, cloud-based network controllers, IoT device configuration, Active Directory settings, common documentation, and scripting. The following are a few of the many new features of this edition:

- > This book conforms with the latest CompTIA A+ exam requirements, including those of the CompTIA A+ Core 1 (220-1001) and CompTIA A+ Core 2 (220-1002) exams.
- > Chapter 2 now includes network cabling basics.
- > The video chapter has been removed as the certification exam includes only Windows configuration of video, which is covered in Chapter 16.
- > Chapter 12 now includes all virtualization and cloud technologies information.
- > Chapter 13 includes IoT device configuration.
- > The operating system–related chapters have been rearranged. Chapter 14 is an introduction to operating systems and Windows basics. Chapter 15 contains the command prompt and scripting sections. Chapter 16 contains the bulk of the information on configuring and supporting Windows 7, 8, and 10. Chapter 17 is still the macOS and Linux chapter.
- > Chapters 1 through 9 focus on hardware. Chapter 10 covers mobile devices. Chapter 11 is on computer design and serves as a troubleshooting review. Chapter 12 covers Internet connectivity, virtualization, and cloud computing. Chapter 13 dives into networking. Chapters 14 through 17 cover operating systems. Chapter 18 handles security concepts. Finally, Chapter 19 contains operational procedures. Appendix A provides an introduction to subnetting.
- > The book has always been filled with graphics and photos, but even more have been added to target those naturally drawn to the IT field. This edition is full color.
- > There are questions at the end of each chapter, and even more questions are available in the test bank available from the Pearson Instructor Resource Center.

## Organization of the Text

The text is organized to allow thorough coverage of all topics and also to be a flexible teaching tool. It is not necessary to cover all the chapters, nor do the chapters have to be covered in order.

- > **Chapter 1** provides an introduction to IT and careers that need the information in this book. It identifies computer parts. Chapter 1 does not have a specific soft skills section, as do the other chapters. Instead, it focuses on common technician qualities that are explored in greater detail in the soft skills sections of later chapters. Finally, Chapter 1 has a great introduction to using Notepad, the Windows Snipping Tool, and Internet search techniques.
- > **Chapter 2** is about connecting things to the computer and port identification. Details are provided on video, USB, and sound ports. The soft skills section is on using appropriate titles.
- > **Chapter 3** details components, features, and concepts related to motherboards, including processors, caches, expansion slots, and chipsets. Active listening skills are the focus of the soft skills section.
- > **Chapter 4** deals with system configuration basics. BIOS options, UEFI BIOS, and system resources are key topics. The soft skills section covers the importance of doing one thing at a time when replacing components.
- > **Chapter 5** steps through how to disassemble and reassemble a computer. Tools, ESD, EMI, and preventive maintenance are discussed. Subsequent chapters also include preventive maintenance topics. Basic electronics and computer power concepts are also included in this chapter. The soft skills section involves written communication.
- > **Chapter 6** covers memory installation, preparation, and troubleshooting. The importance of teamwork is emphasized as the soft skill.
- > **Chapter 7** deals with storage devices, including PATA, SATA SCSI, SAS, and SSDs. RAID is also covered. Phone communication skills are covered in the soft skills section of this chapter.
- > **Chapter 8** covers multimedia devices, including optical drives, sound cards, cameras, scanners, and speakers. The chapter ends with a section on having a positive, proactive attitude.
- > **Chapter 9** provides details on printers. A discussion of work ethics finishes the chapter.
- > **Chapter 10** is on mobile devices, including details on mobile device operating systems, configuration, backup, security, and troubleshooting. The soft skills section takes a brief foray into professional appearance.
- > **Chapter 11** covers computer design. Not only are the specialized computers and components needed within the types of systems covered, but computer subsystem design is also included. Because design and troubleshooting are high on the academic learning progression, the chapter also includes a review of troubleshooting, including logic, error codes, and troubleshooting flowcharts. The soft skills section provides recommendations for dealing with irate customers.
- > **Chapter 12** handles Internet connectivity, virtualization, and cloud technologies. Internet browser configuration is covered, along with the soft skill of mentoring.
- > **Chapter 13** introduces networking. Basic concepts, terminology, and exercises make this chapter a favorite. The introduction to subnetting has been moved to an appendix. The focus of the soft skills section is being proactive instead of reactive.
- > **Chapter 14** provides an introduction to operating systems in general and discusses basic differences between the Windows versions and how to function in the various Windows environments. The soft skills section includes tips on how to stay current in this fast-paced field.
- > **Chapter 15** is a new introduction to scripting and includes how to function from the command prompt and the basics of scripting in Python, JavaScript, shell scripting, VBScript, batch files, and PowerShell. The soft skills section discusses looking at a problem from the user's perspective and being more empathetic.
- > **Chapter 16** covers Windows 7, 8, and 10. Details include how to install, configure, and troubleshoot the environment. Avoiding burnout is the soft skill discussed in this chapter.
- > **Chapter 17** discusses the basics of macOS and Linux. It provides a basic introduction to these two environments to help a technician become familiar with the environment and a few tools. The soft skills section talks about being humble.
- > **Chapter 18** describes computer, mobile device, and network security. The soft skills section is on building customer trust.
- > **Chapter 19** guides the student through operational procedures such as workplace safety, recycling, disposal, a review of power protection, change management, and communication skills.

## Features of This Book

The following key features of the book are designed to enable a better learning experience.

- > **Objectives**—Each chapter begins with *both* chapter objectives and the CompTIA A+ exam objectives.
- > **Graphics and photographs**—Many more full-color images and all-new graphics have been added to better illustrate the concepts.
- > **Tech Tips**—The chapters are filled with Tech Tips that highlight technical issues and certification exam topics.
- > **Key terms in context**—As you read the chapter, terms that appear in blue are considered key terms and are defined in the glossary.
- > **Key Terms list**—At the end of the chapter, all key terms are listed, along with page numbers to which to refer for context.
- > **Soft Skills**—Technology is not the only thing you must learn and practice; each chapter offers advice, activities, and examples of how to be a good tech, an ethical tech, a good work mate, a good communicator, and so on.
- > **Chapter Summary**—The summary recaps the key concepts of the chapter, and you can use it for review to ensure that you’ve mastered the chapter’s learning objectives.
- > **A+ Certification Exam Tips**—Read through these tips on the CompTIA A+ exams so you aren’t caught off guard when you sit for the exam.
- > **Review Questions**—Hundreds of review questions, including true/false, multiple choice, matching, fill-in-the-blank, and open-ended questions, assess your knowledge of the topics taught in each chapter.
- > **Applying your knowledge**—There are hundreds of Exercises and Activities by which to put into practice what you are learning. For example:
  - > **Exercises**—Sometimes called “paper labs,” these need no lab devices to complete in the classroom or for homework.
  - > **Activities**—Extensive practice with Internet discovery, soft skills, and critical thinking skills round out your technical knowledge so that you can be prepared for IT work. These can be used to “Flip the Classroom;” instead of lectures, instruction is interactive and in the hands of the students.
- > **Lab Exercises**—The separate companion *Complete A+ Guide to IT Hardware and Software Lab Manual* (ISBN 978-0-13-538019-2) contains more than 140 labs in total. These hands-on labs enable you to link theory to practical experience.

## Companion Website

Register this book to get access to sample videos plus additional bonus content to help you succeed with this course and the certification exam. Check this site regularly for any updates or errata that might become available for this book. Be sure to check the box that you would like to hear from us to receive news of updates and exclusive discounts on related products.

To access this companion website, follow the steps below:

1. Go to [www.pearsonITcertification.com/register](http://www.pearsonITcertification.com/register) and log in or create a new account.
2. Enter the ISBN: 978-0-7897-6050-0
3. Answer the challenge question as proof of purchase.
4. Click the “Access Bonus Content” link in the Registered Products section of your account page to be taken to the page where your downloadable content is available.

Please note that many of our companion content files can be very large, especially image and video files.

If you are unable to locate the files for this title by following the steps above, please visit [www.pearsonITcertification.com/contact](http://www.pearsonITcertification.com/contact) and select the “Site Problems/Comments” option. Our customer service representatives will assist you.

## CompTIA A+ Exam Objectives

To earn CompTIA A+ certification, you must pass both the CompTIA A+ Core 1 (220-1001) and CompTIA A+ Core 2 (220-1002) certification exams.

Tables I-1 and I-2 summarize the domain content for each exam.

**TABLE I-1** CompTIA A+ Core 1 (220-1001)exam

Domain	Percentage of examination
1.0 Mobile Devices	14%
2.0 Networking	20%
3.0 Hardware	27%
4.0 Virtualization and Cloud Computing	12%
5.0 Hardware and Network Troubleshooting	27%
Total	100%

**TABLE I-2** CompTIA A+ Core 2 (220-1002) exam

Domain	Percentage of examination
1.0 Operating Systems	27%
2.0 Security	24%
3.0 Software Troubleshooting	26%
4.0 Operational Procedures	23%
Total	100%

Table I-3 shows a summary of the exam domains addressed in each chapter. Each chapter lists the certification objectives it covers in the chapter opener. See Appendix B on the companion website for a detailed table that identifies where you can find all the CompTIA A+ exam objectives covered in this book.

**TABLE I-3** Summary of exam domains by chapter

Table of contents	220-1001 domains	220-1002 domains
Chapter 1: Introduction to the World of IT	3	4
Chapter 2: Connectivity	1, 2, 3	4
Chapter 3: On the Motherboard	3, 5	4
Chapter 4: Introduction to Configuration	3, 5	
Chapter 5: Disassembly and Power	3, 5	4
Chapter 6: Memory	3, 5	1
Chapter 7: Storage Devices	3, 5	1, 2, 3, 4
Chapter 8: Multimedia Devices	3	1, 4
Chapter 9: Printers	2, 3, 5	1, 3, 4
Chapter 10: Mobile Devices	1, 2, 3, 5	1, 2, 3

<b>Table of contents</b>	<b>220-1001 domains</b>	<b>220-1002 domains</b>
Chapter 11: Computer Design and Troubleshooting Review	3, 5	4
Chapter 12: Internet Connectivity, Virtualization, and Cloud Technologies	2, 3, 4	1, 2, 3
Chapter 13: Networking	2, 3, 4, 5	1, 2, 3, 4
Chapter 14: Introduction to Operating Systems		1, 2, 3
Chapter 15: Introduction to Scripting		1, 3, 4
Chapter 16: Advanced Windows		1, 2, 3, 4
Chapter 17: macOS and Linux Operating Systems		1, 3
Chapter 18: Computer and Network Security	2, 3	1, 2, 3, 4
Chapter 19: Operational Procedures		4

# 1

## Introduction to the World of IT



### In this chapter you will learn:

- > Qualities a technician should have
- > Basic skills needed to function in the Windows environment and in the technical world
- > Important computer parts
- > Basic computer terms

### CompTIA Exam Objectives:

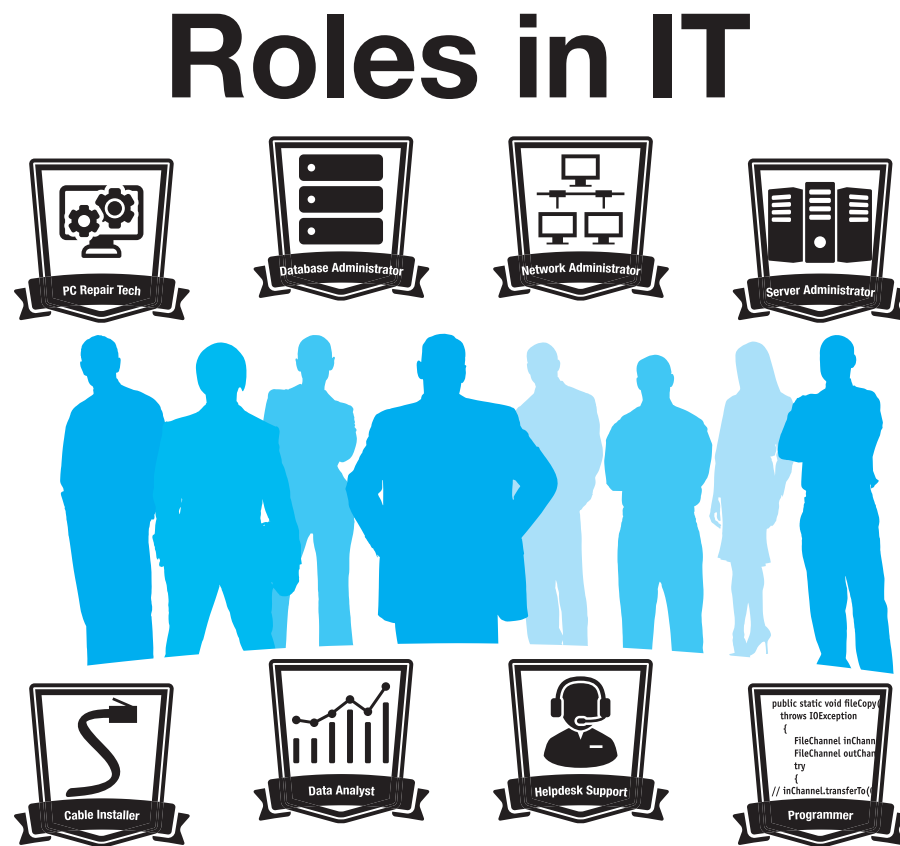
What CompTIA A+ exam objectives are covered in this chapter?

- ✓ 1001-3.6 Explain the purposes and uses of various peripheral types.
- ✓ 1002-4.4 Explain common safety procedures.
- ✓ 1002-4.7 Given a scenario, use proper communication techniques and professionalism.

## Who Needs This Book?

More types of people than you would first think need this book. People who obviously need this information are those who will fix computers or work on a help desk or support desk. However, there are other types of users who might not be so obvious. Many folks who break into the information technology (IT) world do so through jobs that require the A+ certification. Consider medical electronics technicians who repair common equipment used in hospitals. These technicians need this course because many medical devices connect to a PC or have PC-based software that controls the device. Further, the medical devices commonly attach to wired and wireless networks.

Look at Figure 1.1 to see the types of jobs and people who need the information in this book. It might also give you ideas about something you might like to do for a career.

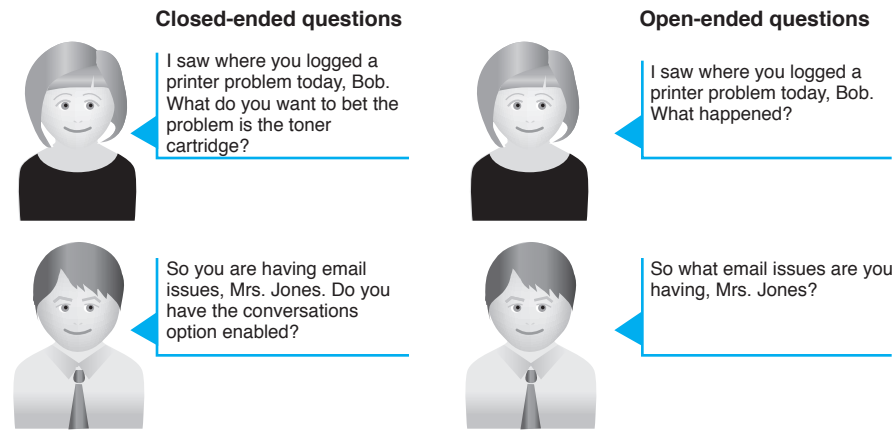


**FIGURE 1.1** IT roles

## Technician Qualities

Each chapter includes a small bit of space on qualities a technician should possess or strive toward. Spending a little brain power on improving what many call your “soft skills” will pay off in promotions and divergence into other IT-related fields. Three of the most important qualities of a technician are active listening skills, a good attitude, and logic. Active listening means that you truly listen to what a person (especially one who is having a problem) is saying. Active listening skills involve good eye contact, nodding your head every now and then to show that you are following the conversation, taking notes on important details, and avoiding distractions such as incoming cell

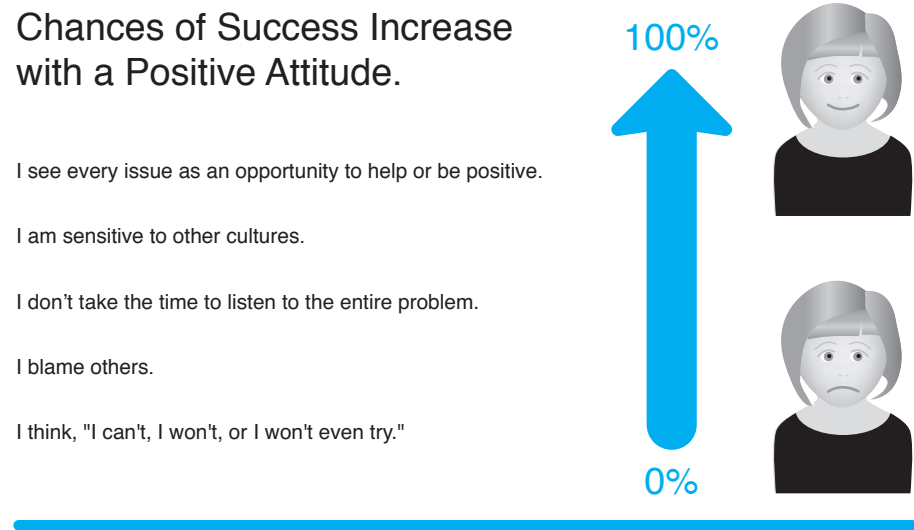
phone calls or text messages. Clarify customer statements by asking pertinent questions and avoid interrupting. Allow customers to complete their sentences. Many technicians jump into a problem the moment they hear the first symptom described by the user. Listen to the entire problem. Ask open-ended questions—questions that allow the user to expand on the answer rather than answer with a single word, such as *yes* or *no*. Figure 1.2 illustrates this point.



Allow the users to state the problem without leading them toward a solution. Restate the problem to ensure understanding and ask questions for clarity and to narrow your understanding.

**FIGURE 1.2** Asking technical questions

A positive attitude is probably the best quality a technician can possess. A good attitude is helpful when a user is upset because a computer or an attached device is not working properly. A technician with a positive attitude does not diminish the customer’s problem; every problem is equally important to the computer user. A positive attitude is critical for being successful in the computer service industry. Figure 1.3 shows how negative attitudes affect your success.



**FIGURE 1.3** Have a positive attitude

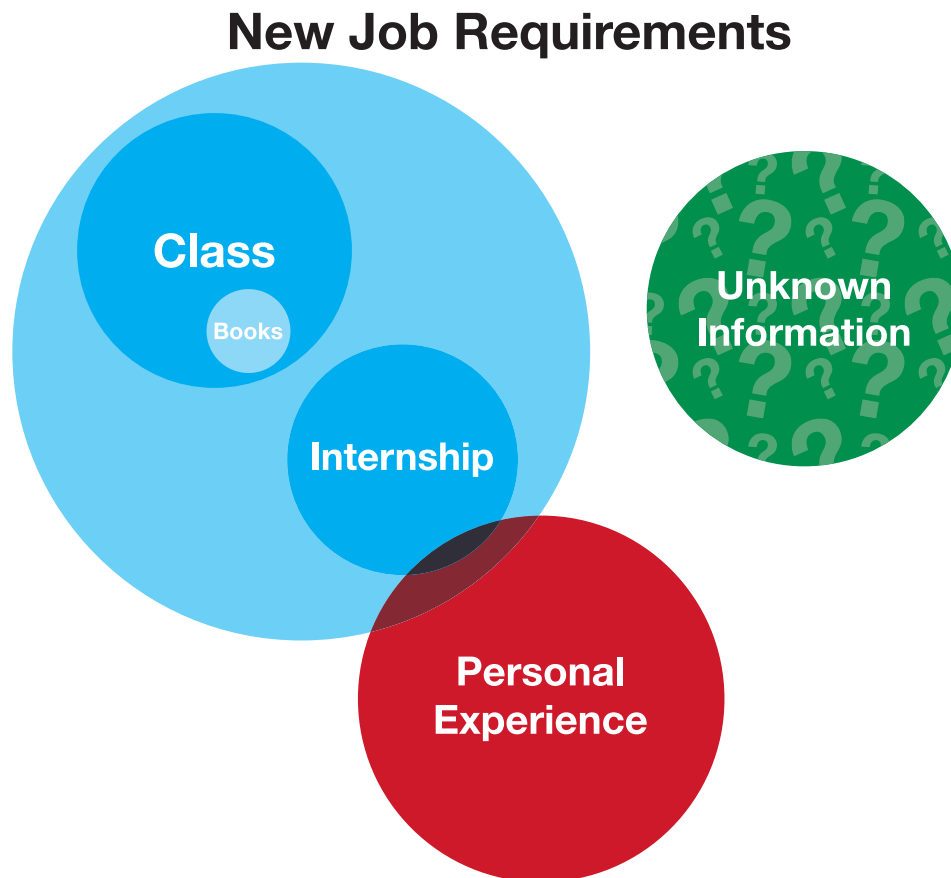
A technician must be familiar with and thoroughly understand computer terminology to (1) use logic to solve problems; (2) speak intelligently to other technical support staff in clear, concise, and direct statements; (3) explain the problem to the user; and (4) be proficient in the field. Changes



occur so frequently that technicians must constantly update their skills. Develop a passion for learning the latest information and searching for information that helps you solve problems.

Avoid developing tunnel vision (that is, thinking that there is only one answer to a problem). Step back and look at the problem so that all possible issues can be evaluated. Be logical in your assessment and the methods used to troubleshoot and repair. This book will help you with all of this by explaining computer terminology in easy-to-understand terms and providing analogies that can be used when dealing with customers.

Before delving into computer topics, you should remember that a class can't fully prepare you for every aspect of a job. You must learn things on your own and constantly strive to update your skills so you do not become obsolete. The IT field changes rapidly. Figure 1.4 illustrates this concept.



**FIGURE 1.4** Preparing for IT job requirements

Finally, you will find that you must be a jack-of-all-trades, as shown in Figure 1.5.

# COMPUTER TECHNICIAN: JACK OF ALL TRADES!



**FIGURE 1.5** Computer technician skills

## Breaking into IT with the CompTIA A+ Certification

Many IT-related jobs require the A+ certification. Even if not required, the certification shows that you have a good understanding of how computers work. This certification does not guarantee you a job, but it does open doors in that a company may interview you if you lack IT experience but have the A+ certification.

A+ certification requires that you take two exams (220-1001 and 220-1002). Each of these exams covers specific material. Table 1.1 shows the major categories for the 220-1001 exam and how they map to information in this book. Table 1.2 shows the same type of information for the 220-1002 exam.

**TABLE 1.1** CompTIA 220-1001 A+ certification topics

Domain	Percentage of examination	Chapter(s)
1.0 Mobile Devices	14%	10
2.0 Networking	20%	12–13
3.0 Hardware	27%	1–9, 11
4.0 Virtualization and Cloud Computing	12%	12
5.0 Hardware and Network Troubleshooting	27%	1–13

**TABLE 1.2** CompTIA 220-1002 A+ certification topics

Domain	Percentage of examination	Chapter(s)
1.0 Operating Systems	27%	14–17
2.0 Security	24%	18
3.0 Software Troubleshooting	26%	14–18
4.0 Operational Procedures	23%	19

“What are the exams like?” you might ask. The exams include multiple-choice and performance-based questions. Performance-based questions might be a drag-and-drop scenario or ask you to do something specific on a particular device or within a particular operating system environment. Each exam is 90 minutes long and contains a maximum of 90 questions. The testing system allows you to bookmark questions that you might want to return to at the end if you have time. Successful candidates will have the knowledge required to do the following:

- > Assemble components based on customer requirements.
- > Install, configure, and maintain devices including Internet of Things (IoT) devices, personal computers (PCs), and software for end users.
- > Understand the basics of networking and security/forensics.
- > Properly and safely diagnose, resolve, and document common hardware and software issues.
- > Apply troubleshooting skills.
- > Provide appropriate customer support.
- > Understand the basics of virtualization, desktop imaging, and deployment.

More information can be found on the CompTIA website ([www.comptia.org](http://www.comptia.org)).

At the beginning of each chapter, you will see a list of the CompTIA A+ exam objectives that are covered in that chapter. At the end of each chapter, I’ve provided some A+ certification exam tips—tips to definitely pay attention to if you plan on taking the A+ exams. By the end of this course, you will have learned all the topics covered on the certification exams; however, before you actually take the exams, I recommend that you dedicate some time to review the chapters in this book thoroughly, study the objectives, and take some practice exams. Pearson IT Certification, the publisher of this book, develops many different certification exam prep resources that suit various study styles. See the back of this book for more information or go to <http://pearsonitcertification.com/aplus> to browse the options.

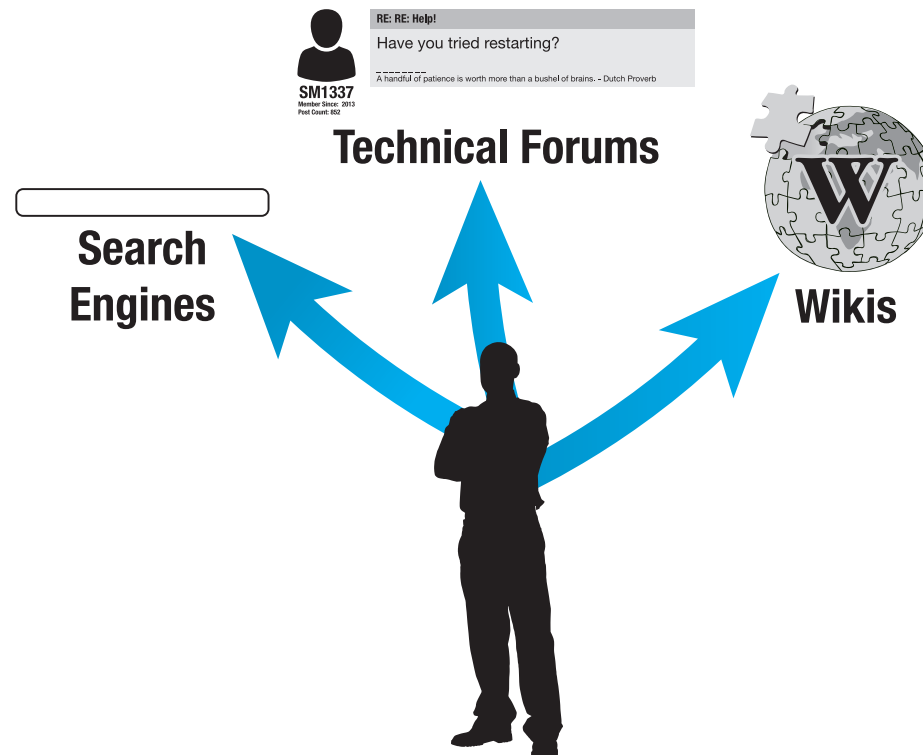
## Basic Skills for This Course

In order to repair a computer, you need a few basic skills that include being familiar with the keyboard and inputting information, searching for information on the Internet, and capturing

information. Just because you may not be a good typist does not mean that you will not be good in an IT-related field.

## Searching for Information on the Internet

IT people need to use all available resources, including online resources. As noted, you need to be capable of searching for information online. Figure 1.6 illustrates various online resources that IT people search all the time.



**FIGURE 1.6** Search skills

Each chapter in the book has an activity at the end of it that enables you to practice searching the Internet for information relevant to the chapter. Tips for searching include the following:

- > Search engines use different algorithms, so if one does not work, try another one. Examples of search engines are Google, Bing, Yahoo, AOL, Ask, and Lycos. To access a search engine, open a web browser and type one of the search engine names followed by .com. Figure 1.7 shows where you enter the search engine name in the address bar.



**FIGURE 1.7** Web browser address bar

- > Use descriptive key words.
- > Do not include common words like *the*, *in*, *at*, or *for* because search engines tend to skip these words anyway. If you do want to use one of them, put a plus sign ( $\oplus$ ) in front of the word.
- > Avoid using a complex version, plural, or past tense of a word to avoid elimination of pages that are relevant. For example, to search for how to install a Bluetooth headset, avoid using the word *installation*, *installed*, or *installing* in the search window. Simply include the word *install*.
- > If several words are used together (an exact phrase), such as Windows 10, put quotations around the phrase—"Windows 10".
- > Use as many distinguishing words as possible.
- > If two words have the same meaning and are commonly used, use the word *or* in the search. For example, to search for generic information on a dot matrix printer, which is sometimes called an impact printer, you might search as follows: "dot matrix" or "impact printer". Note that the vertical bar (|), which is the key above the  $\leftarrow$ Enter key, can be used instead of the word *or*, as follows: "dot matrix" | "impact printer".
- > If a particular term can have two meanings (such as the word *memory* relating to something inside a computer or else relating to a brain function), you can use the minus sign in order to keep some information from being displayed. `memory -brain`, for example, would be a search for memory without any brain function results included.
- > If a particular term (such as *memory*) is generic, you can add a word and use the word *AND* in order to clarify the search, such as `computer AND memory`.
- > When searching for technical information, include the hardware or software manufacturer. A search for `Microsoft Windows 10` provides different results than simply a search for `Windows 10`.
- > If nothing relevant is on the first page of links, change the key words used in your search.

Consider the situation of a keyboard that intermittently works on a Microsoft Surface computer. The keyboard does not come standard as part of a Surface purchase. You do not own a Surface yourself and are unfamiliar with the tablet but must support it. An example of what might be typed into a search engine is `Microsoft Surface intermittent keyboard`.

## Capturing Files

Sometimes, part of technical documentation is being able to capture what is on the screen. Windows versions come with a great tool for doing just that. The Snipping Tool makes documenting problems easy. It is also easy to copy what you capture into other applications. No matter what IT job you may have when you enter the workforce, documentation is a part of all IT jobs.

## Creating a Text File

Another part of documentation might involve creating or using a text file, known as a .txt file. You might need to send it as an attachment, or you might need to create a text file as part of the documentation process or as part of the job. Sometimes a text file is the easiest type of file to create, especially on a mobile device. Text files can be created using a word processor and the *Save As* process, or they can be created using specific text software or an app. Text files are popular because they can be opened by many applications or other mobile apps. Text files commonly include only text, without multiple fonts or graphics. Windows ships with a basic application called Notepad that can be used to create or open text files.

## Types of Computers

The simplest place to start to learn about computer technical support is with the devices themselves. Computer devices come in many shapes and sizes. The **PC**, or personal computer, comes in desktop, tower, and all-in-one models, as well as mobile models such as laptops, smartphones, and tablets. Figure 1.8 shows some of the computing devices technical staff are expected to support.



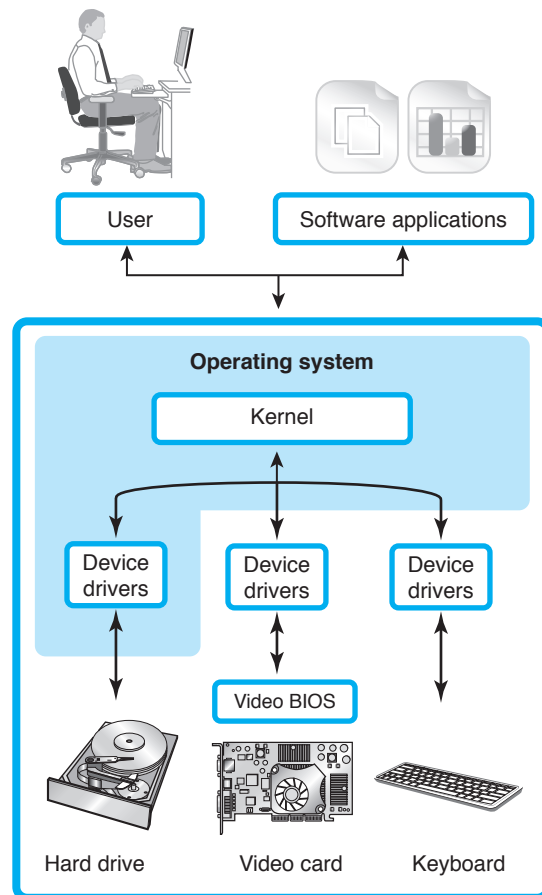
**FIGURE 1.8** Types of computers

## Basic Computer Hardware

Computer systems include hardware, software, and firmware. **Hardware** is something you can touch and feel; the physical computer and the parts inside the computer are examples of hardware. The monitor, keyboard, and mouse are hardware components. **Software** interacts with the hardware. Windows, Linux, macOS, Microsoft Office, Solitaire, Google Chrome, Adobe Acrobat Reader, and WordPerfect are examples of software.

Without software that directs the hardware to accomplish something, a computer is no more than a doorstop. Every computer needs an important piece of software called an **operating system**, which coordinates the interaction between hardware and software applications. The operating system also handles the interaction between a user and the computer. Examples of operating systems include Windows 7, 8, 8.1, and 10, macOS, and various Linux systems, such as Red Hat and Ubuntu.

A **device driver** is a special piece of software designed to enable a hardware component. The device driver enables the operating system to recognize, control, and use the hardware component. Device drivers are hardware and operating system specific. For example, a printer requires a specific device driver when connected to a computer loaded with Windows 7. The same printer will most likely require a different device driver when using Windows 8 or 10. Each piece of installed hardware requires a device driver for the operating system being used. Figure 1.9 shows how hardware and software must work together.



**FIGURE 1.9** Hardware and software

Notice in Figure 1.9 the operating system kernel. The kernel is the central part of an operating system. The kernel is the connection between hardware and the applications being used.

Software applications are normally loaded onto the hard drive. When a user selects an application, the operating system controls the loading of the application. The operating system also controls any hardware devices (such as the mouse, keyboard, monitor through the video adapter, and printer) used with the application.

**Firmware** is a combination of hardware and software, such as electronic chips that contain software: The chip is physical, which is hardware, and it has software built into the chip. An example of firmware is the basic input/output system (**BIOS**) chip. The BIOS always has startup software inside it that must be present for a computer to operate. This startup software locates and loads the operating system. The BIOS also contains software instructions for communication with input/output devices, as well as important hardware parameters that determine to some extent what hardware can be installed. For example, the system BIOS has the ability to allow other BIOS chips that are located on adapters (such as the video card) to load software that is loaded in the card's BIOS.

A PC typically consists of a case (chassis), a keyboard that allows users to provide input into the computer, a **monitor** that outputs or displays information (shown in Figure 1.10), and a mouse that allows data input or is used to select menus and options. Figure 1.10 shows a computer monitor, which may also be called a flat panel, display, or screen.

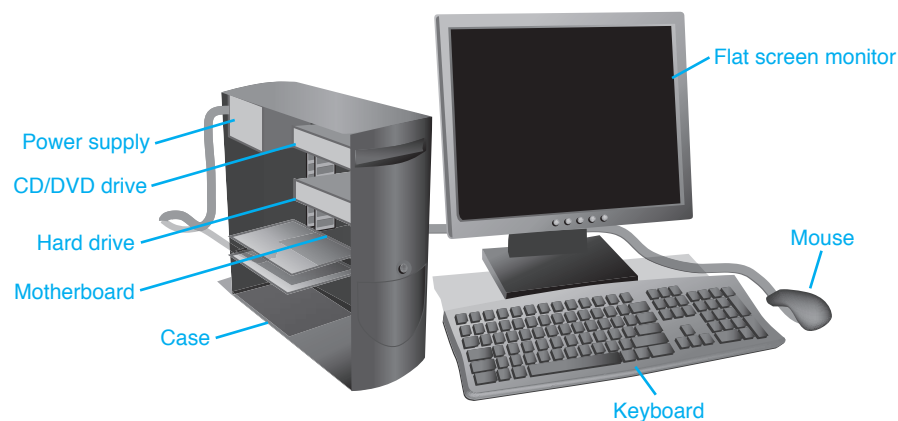
When the computer cover or side is opened or removed, the parts inside can be identified. The easiest part to identify is the **power supply**, which is the metal box normally located in a back corner of a case. A power cord connects the power supply to a wall outlet or surge strip. One purpose of the power supply is to convert the outlet AC voltage to DC voltage used internally in the

PC. The power supply distributes this DC voltage using power cables that connect to the various internal computer parts. A fan located inside the power supply keeps the computer cool to prevent damage to the components.

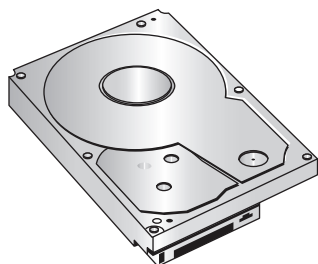


**FIGURE 1.10** Computer monitor

A personal computer usually has a device to store software applications and files. Two examples of storage devices are the hard drive and optical drive. The **hard drive**, sometimes called the hard disk, is a rectangular box normally inside the computer's case that is sealed to keep out dust and dirt. The hard drive has no external opening. The computer must be opened in order to access a hard drive. A **DVD drive**, or **optical drive**, holds discs (compact discs, or CDs), digital versatile discs (DVDs), or Blu-ray discs (BDs) that have data, music, video, or software applications on them. The front of the optical drive has a tray that would eject outward so a disc may be inserted. Figure 1.11 shows the major components of a tower computer. Figure 1.12 shows a hard drive. Figure 1.13 shows an optical drive. Figure 1.14 shows a power supply. The hard drive in Figure 1.12, optical drive in Figure 1.13, and power supply in Figure 1.14 all are shown as they would look before being installed into the computer case. Figure 1.15 shows a tower computer case.



**FIGURE 1.11** Tower computer



**FIGURE 1.12** Hard drive





**FIGURE 1.13** DVD or optical drive

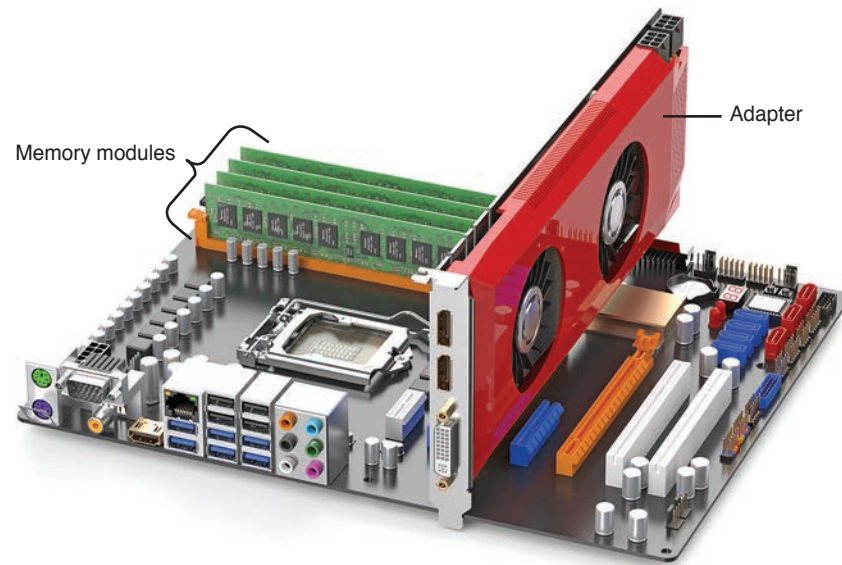


**FIGURE 1.14** Power supply



**FIGURE 1.15** Tower case

The **motherboard** is the main circuit board inside a PC and contains the most electronics. It is normally located on the bottom of a desktop or laptop computer and mounted on the side of a tower computer. Other names for the motherboard include mainboard, planar, or system board. The motherboard is the largest electronic circuit board in the computer. External devices connect directly to the back of the motherboard or ports on the front of the computer. Figure 1.16 shows a motherboard when it is not installed inside a computer as well as memory and an adapter, which are covered next.



**FIGURE 1.16** Computer motherboard

The motherboard holds memory modules. **Memory** is an important part of any computing device. Memory modules hold applications, part of the operating system, and user documents. Random access memory (**RAM**) is the most common type of memory and is volatile—that is, the data inside the module is lost when power is removed. When a user types a document in a word processing program, both the word processing application and the document are in RAM. If the user turns the computer off without saving the document to removable media or the hard drive, the document is lost because the information does not stay in RAM. (Note that some applications have the ability to periodically save a document, but this is not a guarantee that it has the latest information.) Figure 1.17 shows memory modules when they are not installed into the motherboard memory slots. Look back to Figure 1.16 to see the memory modules installed in the motherboard. Memory is covered in great detail in Chapter 6, “Memory.”



**FIGURE 1.17** Memory modules

A device may have a cable that connects the device to the motherboard. Other devices require an adapter. An **adapter** is an electronic card that plugs into an **expansion slot** on the motherboard. Other names for an adapter are controller, card, controller card, circuit card, circuit board, and adapter board. Adapters allow someone to add a functionality or enhancement that is not provided through the ports on the motherboard. An example is someone who wants better sound or video graphics, or additional ports of some type in order to connect external devices. Figure 1.18 shows an adapter. Notice how the contacts at the bottom are a particular shape. Chapter 3, “On the Motherboard,” goes into more detail about the types of expansion slots and adapters. You can also look back to Figure 1.16 to see a video adapter installed into a motherboard expansion slot.



**FIGURE 1.18** Adapter

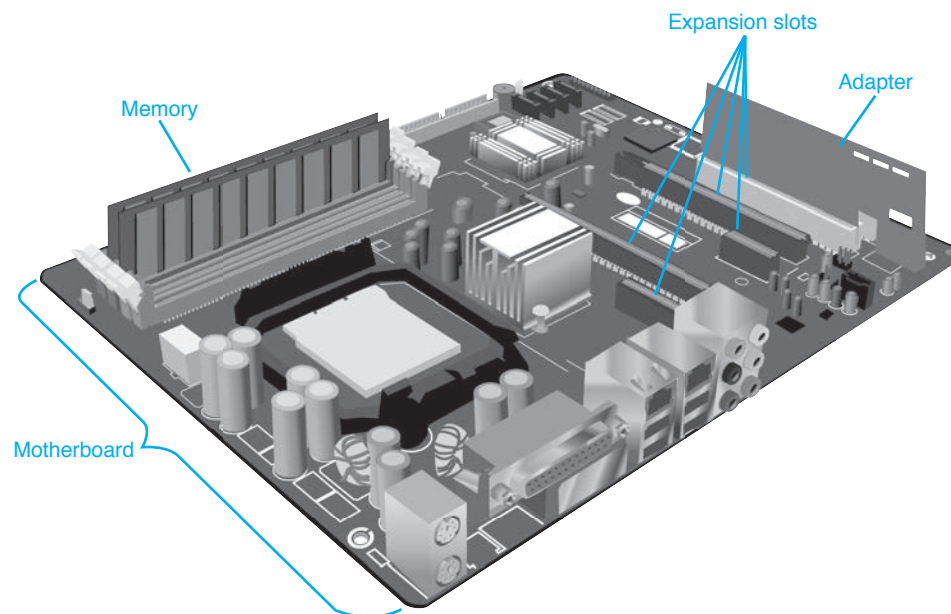
**TECH TIP****How to identify an adapter's function**

Tracing the cable attached to an adapter or looking at the device connected to the adapter can help identify an adapter's function.

The following are the generic steps for installing adapters:

- Step 1.** Always follow the manufacturer's installation directions. Use an antistatic wrist strap when handling adapters. Electrostatic discharge (ESD) can damage electronic parts. (See Chapter 5, "Disassembly and Power," for more details on ESD.)
- Step 2.** Be sure the computer is powered off and unplugged.
- Step 3.** Remove any brackets from the case or plastic covers from the rear of the computer that may prevent adapter installation. Install the adapter in a free expansion slot and reattach any securing hardware.
- Step 4.** Attach any internal device cables that connect to the adapter, as well as any cables that go to an external port on the adapter.
- Step 5.** Attach any internal or external devices to the opposite ends of the cable, if necessary.
- Step 6.** Power on any external devices connected to the adapter, if applicable.
- Step 7.** Reattach the computer power cord and power on the computer.
- Step 8.** Load any application software or device drivers needed for the devices attached to the adapter.
- Step 9.** Test the device connected to the adapter.

See Figure 1.19 for an illustration of a motherboard, expansion slots, memory, and an adapter in an expansion slot.



**FIGURE 1.19** Motherboard with expansion slots and an adapter

## Mice and Keyboards

Input devices, such as the mouse and keyboard, attach to the motherboard. The most common type of **mouse** is an optical mouse, which has optical sensors that detect the direction in which the mouse moves. It uses reflections from light-emitting diodes (LEDs) from almost any surface to detect the mouse location. Mice commonly can be adjusted for sensitivity—how far you have to move the mouse to move the cursor on the screen a desired amount. Mice are rated in dots per inch (DPI), or how many dots (pixels) on the screen the mouse moves per square inch. The higher the number, the more sensitive the mouse. Mouse sensitivity can range from 100 to 6400 DPI; mice with higher DPI numbers are typically used for gaming or design. Figure 1.20 shows a photo of the bottom of an optical mouse.



**FIGURE 1.20** Optical mouse

A **keyboard** is an input device that connects to a port on the motherboard or attaches wirelessly. Features users look for in a keyboard include a separate numeric keypad for those that have to input a great deal of numbers, adjustable tilt legs, and spill resistance. Figure 1.21 shows the type of keyboard and mouse that are commonly used with a tower, desktop, or all-in-one computer.



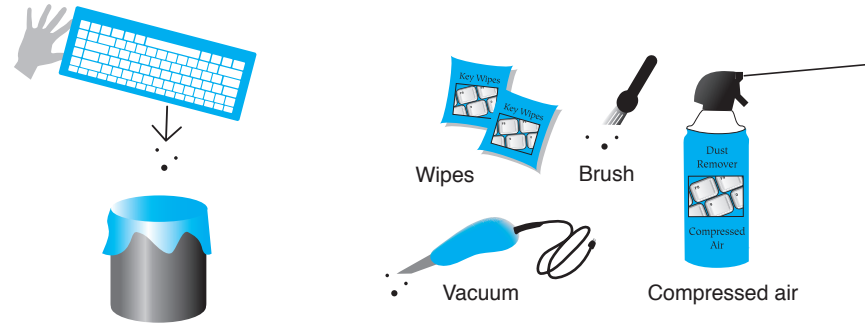
**FIGURE 1.21** Keyboard and mouse

## Mouse and Keyboard Preventive Maintenance

Mouse cleaning kits are available in computer stores, but normal household supplies also work. Use the following procedures to clean an optical mouse:

- > Wipe the bottom with a damp, lint-free cloth.
- > Use compressed air to clean the optical sensors.

Keyboards also need periodic cleaning. Figure 1.22 shows keyboard-cleaning techniques.





1. Turn keyboard upside down and gently shake out debris




2. Clean the keyboard (several options shown)

**FIGURE 1.22** Keyboard cleaning techniques

## Keyboard/Mouse Troubleshooting

One of the easiest ways to determine whether a keyboard is working is to press the  or  key and watch to see if the keyboard light illuminates. Sometimes an application setting may be causing what appears to be a keyboard problem. Use another application to see if the keyboard is the problem. Keyboards can have LED lights that indicate particular functions. Table 1.3 lists the most common ones. Note that different vendors label the lights in various ways.

**TABLE 1.3** Common keyboard lights

Associated toggle key	Keyboard light	Description
	Number lock (NUM LOCK)	Toggles the 10-key pad between digits 0 through 9 and various functions, such as HOME, PG UP, PG DOWN, END, and various arrow keys.
	Capital letters lock (CAPS LOCK)	Toggles between all uppercase and lowercase letters.
	Scroll lock	A rarely used key used to prevent scrolling and use of the arrow keys to progress through information displayed.

### TECH TIP

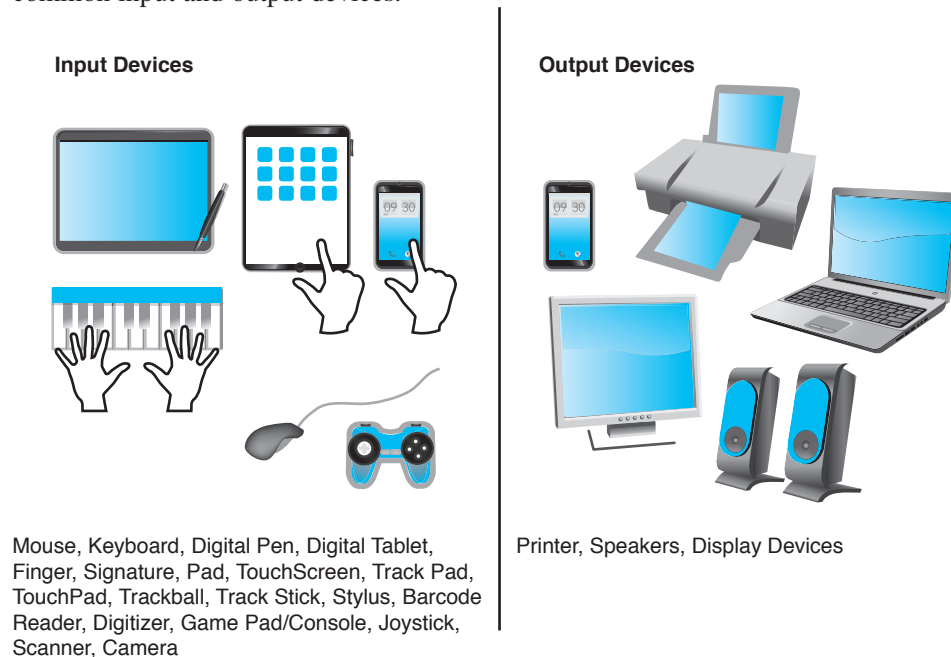
#### One key doesn't work

If a particular key is not working properly, remove the key cap. A small, flat-tipped screwdriver can assist with this. After removing the key cap, use compressed air around the sticky or malfunctioning key.

If coffee or another liquid spills into a PC keyboard, all is not lost. It is sometimes possible to clean a PC keyboard by disconnecting it, removing any batteries it might have, and soaking it in a bathtub or a flat pan of water. Distilled or boiled water cooled to room temperature works best. Afterward, the keyboard can be disassembled and/or scrubbed with lint-free swabs or cloths. However, PC keyboards and mice are normally considered throw-away technology. It is cheaper to get a new one rather than spend a lot of time trying to repair it.

### Common Peripherals

Many devices connect to a computer to provide input, such as a mouse or keyboard, or output, such as a display. Some devices can be both input and output devices, such as smart TVs, set-top boxes (the boxes used to connect a TV to a cable or satellite system), Musical Instrument Digital Interface- (MIDI-) enabled devices (which are electronic musical devices), touchscreens, or printers. In the case of a printer, data is sent from a computer to the printer, and the printer can send data (information), such as an out-of-ink message, back to the computer. Figure 1.23 shows some common input and output devices.



**FIGURE 1.23** Input and output devices

Table 1.4 lists various peripherals that you will see used and attached to computers today.

**TABLE 1.4** Common peripherals

Peripheral	Description
<b>Printer</b>	An output device that transfers information such as text and graphics from a computer onto paper or other media.
<b>Flatbed scanner</b>	An input device that digitizes words or graphics and can be used as a copier. A scanner may have an automatic document feeder ( <b>ADF</b> ) that allows one or more documents to be fed into the scanner.
<b>Barcode scanner/QR scanner</b>	A handheld device that reads a code displayed as a series of vertical lines of varying widths or a quick response (QR) code that is a square that has embedded information such as a website within the displayed pattern (see Figure 1.24).
<b>VR headset</b>	A virtual reality (VR) device that is worn over the eyes to see a high-definition image or situation as part of a game, demonstration, or tour (see Figure 1.25).

Peripheral	Description
<b>Touchpad</b>	A space on a laptop below the keyboard that is used to control the cursor.
<b>Signature pad</b>	A digital input device that allows users to digitally sign their names, such as when credit cards are used at a checkout register.
<b>Game controller</b>	An input device used with games or entertainment systems.
<b>Camera/webcam</b>	An input device used to capture video images or motion. More information can be found in Chapter 8, "Multimedia Devices."
<b>Microphone</b>	An input device used to capture sound. More information can be found in Chapter 8.
<b>Headset</b>	An input/output device that commonly has a microphone and headphones, as shown in Figure 1.26.
<b>Projector</b>	An output device used to show an image on a screen or wall. The amount of <b>brightness</b> the projector outputs is measured in <b>lumens</b> . Common projector specifications for a business or educational environment is 2500 to 6000 lumens. Use the higher lumens projector for rooms that have windows or lights that cannot be dimmed.
<b>External storage drive</b>	An external hard drive, flash drive, or memory used to store data. These devices are covered in detail in Chapters 6, "Memory," and 7, "Storage Devices."
<b>KVM</b>	A switch that enables connectivity of devices so they can be shared between computers (see Figure 1.27). For example, one keyboard, one mouse, and one display and two computers could connect to a keyboard, video, and mouse (KVM) switch.
<b>Magnetic reader/chip reader</b>	A device that accepts cards that are inserted into the device in order to read data from the card or the chip on the card.
<b>NFC device/tap-to-pay device</b>	A device that accepts cards that are tapped against the display (tap-to-pay) or held in close proximity (near field communication [NFC]) in order to read data from a smartphone or card.
<b>Smart card reader</b>	A device that can read data from a card that has a magnetic strip such as a credit card, special business card, ID card, or room access card.



Barcode



QR code

FIGURE 1.24 Barcode and QR code





**FIGURE 1.25** VR headset



**FIGURE 1.26** Headset



FIGURE 1.27 KVM switch

## 1s and 0s

Computers are digital devices. That means they understand 1s and 0s. One 1 or one 0 is known as a **bit**. In actuality, a 1 is simply a voltage level. So, when we type characters into a word processing application, the keyboard translates those characters into voltage levels. Figure 1.28 shows this concept. Notice that each letter is represented by a combination of eight 1s and 0s. Each 1 is a voltage level sent to the motherboard (and components on it). Each 0 is simply the absence of a voltage level.



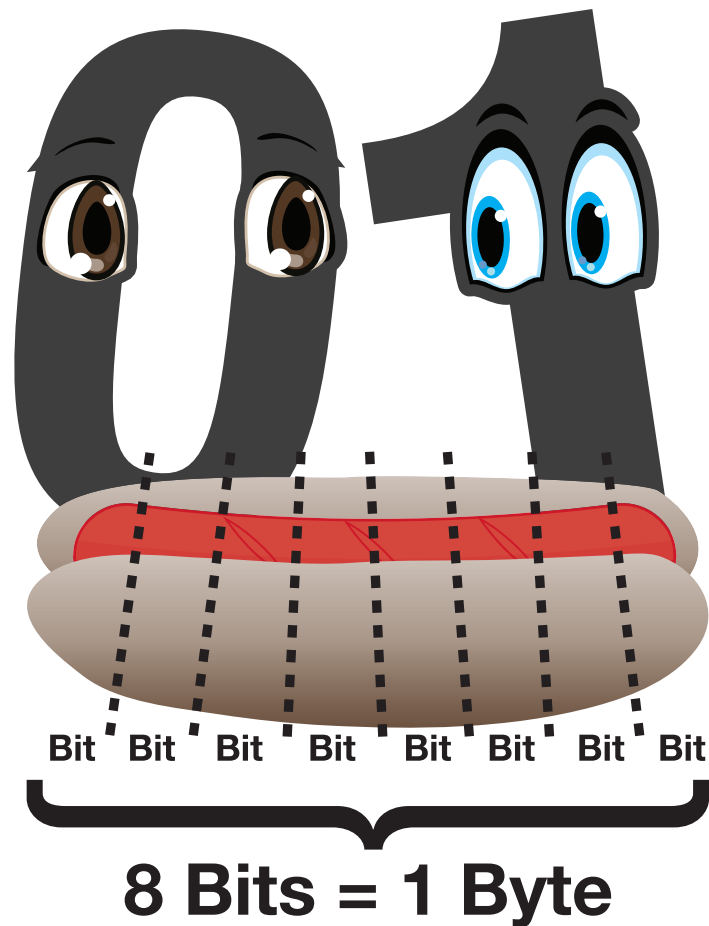
		<b>D</b>	<b>E</b>	<b>A</b>	<b>R</b>	[space]	<b>M</b>	<b>O</b>	<b>M</b>
What we see		01000100	01000101	01000001	01010010	00100000	01001101	01010010	01001101
What a computer sees		⚡	⚡⚡	⚡	⚡⚡⚡	⚡	⚡⚡⚡	⚡⚡⚡	⚡⚡⚡

FIGURE 1.28 Binary bits

Technicians need to be able to describe capacities such as hard drive capacities and available drive space. Eight bits grouped together are a **byte**. Figure 1.29 shows a hot dog divided into eight sections (which make a big old “byte”).



**FIGURE 1.29** A byte

Approximately 1,000 bytes is a **kilobyte** (kB), as shown in Figure 1.30. 1 kB is 1,024 bytes to be exact, but industry folks simply round off the number to the nearest thousand for ease of calculation. Approximately 1 million bytes is a **megabyte** (MB), but a true megabyte is 1,048,576 bytes. 540 megabytes is abbreviated as 540 MB, or 540 M. Notice in Figure 1.31 that a megabyte stores a lot more 1s and 0s than a kilobyte.

Approximately 1 billion bytes (1,073,741,824 bytes) is a **gigabyte** (GB), which is shown as 1 GB or 1 G. Approximately 1 trillion bytes (1,099,511,627,776 bytes) is a **terabyte**, which is shown as 1 TB or 1 T. Figures 1.32 and 1.33 show how storage capacities get larger.

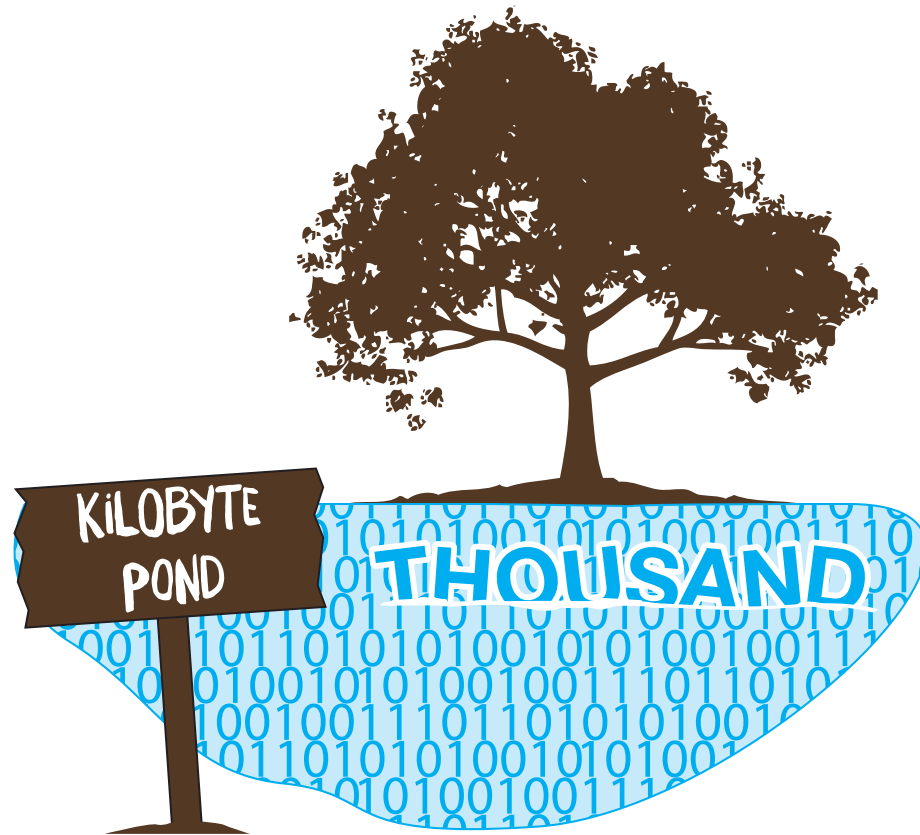


FIGURE 1.30 A kilobyte

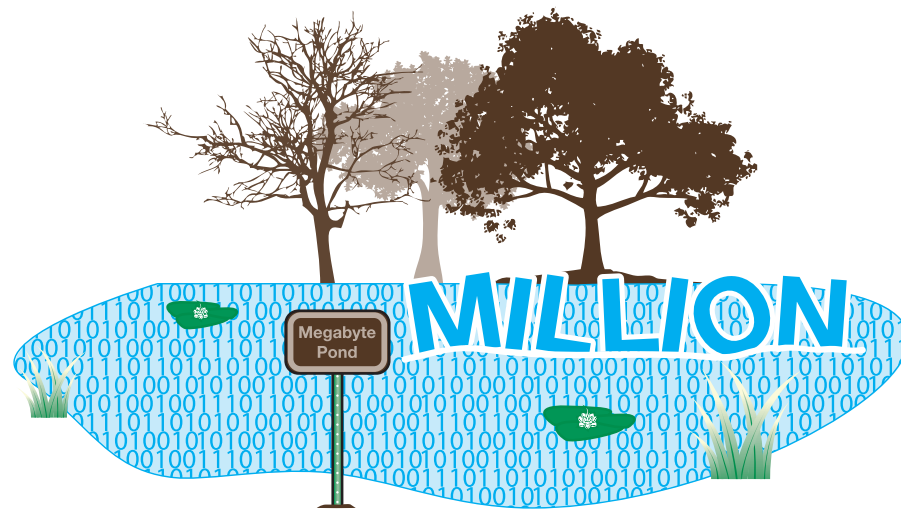


FIGURE 1.31 A megabyte

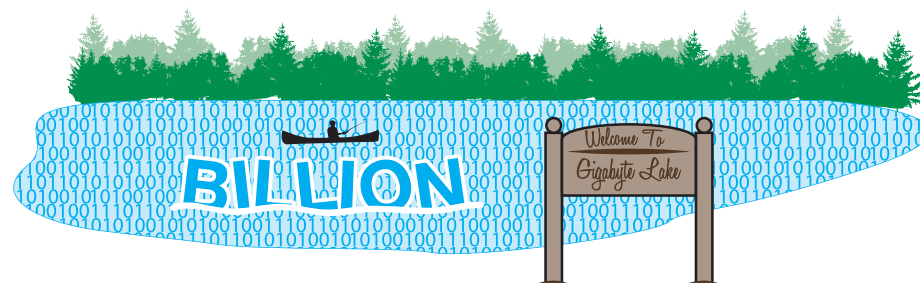
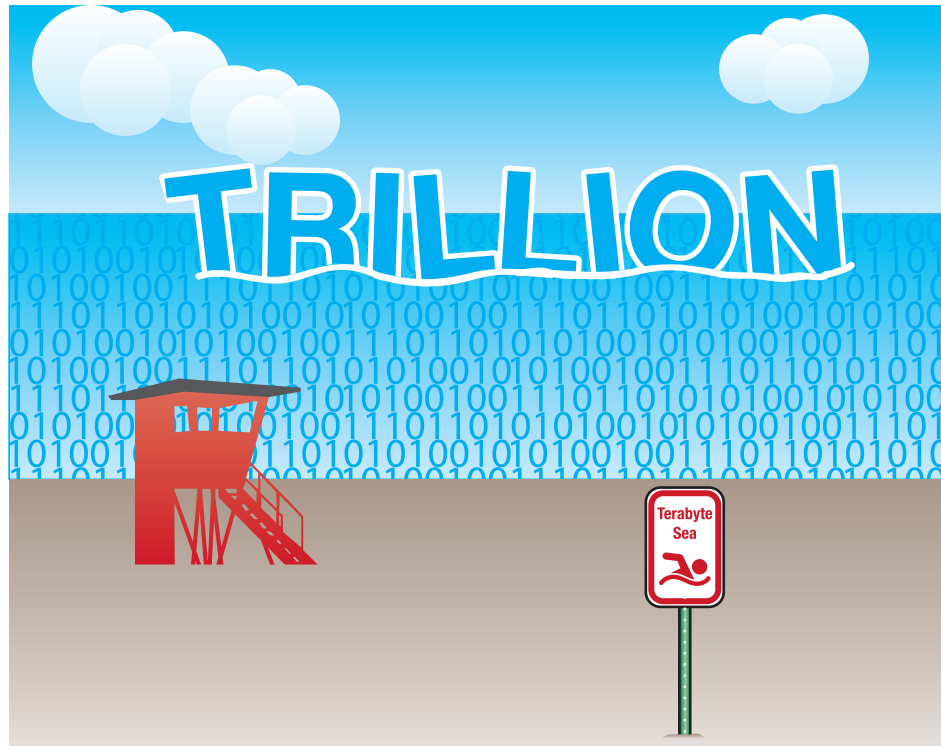


FIGURE 1.32 A gigabyte



**FIGURE 1.33** A terabyte

When information needs to be expressed exactly, binary prefixes are used. For example, when describing the value  $2^{10}$  (1,024), instead of saying this it is 1 kilobyte, which people tend to think of as approximately 1,000 bytes, the term kibibyte (KiB) is used. When describing the value  $2^{20}$ , or 1,048,576, the term mebibyte (MiB) is used. Table 1.5 shows the terms used with computer storage capacity and binary prefixes when exact measurements are needed.

**TABLE 1.5** Storage terms and binary prefixes

Term	Abbreviation	Description
Kilobyte/kibibyte	kB/KiB	~1 thousand bytes/ $2^{10}$ bytes
Megabyte/mebibyte	MB/MiB	~1 million bytes/ $2^{20}$ bytes
Gigabyte/gibibyte	GB/GiB	~1 billion bytes/ $2^{30}$ bytes
Terabyte/tebibyte	TB/TiB	~1 trillion bytes/ $2^{40}$ bytes
Petabyte/pebibyte	PB/PiB	~1,000 trillion bytes/ $2^{50}$ bytes
Exabyte/exbibyte	EB/EiB	~1 quintillion bytes/ $2^{60}$ bytes
Zettabyte/zebibyte	ZB/ZiB	~1,000 exabytes/ $2^{70}$ bytes
Yottabyte/yobibyte	YB/YiB	~1 million exabytes/ $2^{80}$ bytes

Frequencies are also important measurements in computers because people want to know how fast their computers, processors, memory, and other parts are operating. Frequencies are shown in similar measurements, but instead of bits (b) or bytes (B), speeds are shown in hertz (Hz). A hertz is a measurement of cycles per second. Something that operates at approximately 1 million cycles per second is said to operate at 1 megahertz (1 MHz). For 1 billion cycles per second, the measurement is known as 1 gigahertz, or 1 GHz. Transfer speeds are commonly shown in bits per second, such as gigabits per second, or Gb/s, or bytes per second, such as in megabytes per second,

or MB/s. Notice the capital letter B to indicate bytes as compared to the lowercase b to indicate bits. These measurements are used in a lot of IT-related hardware and software.

## Safety Notes

Safety is covered in each chapter, especially in Chapter 5, but no book on computer repair can begin without stating that both the technician and the computer can be harmed by poor safety habits. Before beginning any PC service, remove jewelry. To protect yourself and the computer, make sure to power off the computer and remove the power cord when disassembling, installing, or removing hardware or when doing preventive maintenance (cleaning).

### TECH TIP

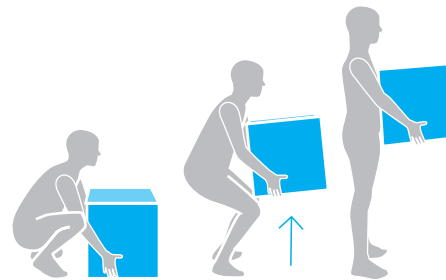
#### Some things should be left alone

Never take apart an older CRT monitor or power supply unless you have been specifically trained on these components.

Technicians can also be harmed when doing menial tasks such as lifting a computer or heavy laser printer. Lifting is a common requirement listed in IT job advertisements or explained during interviews. Technical jobs frequently specify a maximum lifting requirement of 40 to 50 pounds. Use proper safety precautions, such as those shown in Figure 1.34. The type of equipment you need and things you can do to prevent harm to the computer are covered more explicitly in Chapter 5, on power and disassembly.



Remove jewelry before working inside of a computer



- Bend at the knees
- Use your legs to lift
- Use lifting aids when possible
- Ask for assistance when possible

FIGURE 1.34 Safety tips

## Chapter Summary

- > Many IT roles require detailed knowledge of PC hardware and software.
- > Computer technicians should actively listen, have a positive attitude, and use logic when solving problems.
- > The CompTIA A+ certification requires two exams: 220-1001 and 220-1002. Many people break into the IT field with this certification.
- > IT staff must be proficient at searching for information on the Internet, capturing files, and documenting technical information.
- > Computers consist of hardware (the physical parts), software (the operating system and applications), and firmware (hardware that contains software).

- > A technician needs to be able to identify important computer parts installed in a computer and as standalone parts: case, keyboard, mouse, motherboard, monitor, power supply, hard drive, optical drive, adapter, and memory.
- > A technician needs to know the purposes of common peripherals used in industry: printer, ADF/flatbed scanner, barcode/QR scanner, VR headset, touchpad, signature pad, game controller, camera/webcam, microphone, speakers, headset, projector, external storage device, KVM, magnetic/reader, chip reader, NFC/tap-to-pay device, and smart card reader.
- > Mice, keyboards, and touchscreens are important input devices. Mice and keyboards can be wired or wireless.
- > Safety is important when working on a computer. Power it down and remove the power cord before working inside it.
- > Use proper lifting techniques when servicing equipment.

### A+ CERTIFICATION EXAM TIPS

- ✓ Get a good night's rest the night before the exam.
- ✓ Ensure that you are knowledgeable about and proficient with all of the terms and technologies listed in the official CompTIA A+ exam objectives. Some students study for a particular exam by going through the objectives one by one and reviewing the material as they go through.
- ✓ Ensure that you can identify the basic parts of a computer and explain the purpose of each one. Ensure that you know the following parts: hard drive, DVD drive, power supply, motherboard, and RAM.
- ✓ Know the purpose of common peripherals used in the industry: printer, ADF/flatbed scanner, barcode/QR scanner, monitor, VR headset, optical drive, mouse, keyboard, touchpad, signature pad, game controller, camera/webcam, microphone, speakers, headset, projector, external storage device, KVM, magnetic/reader, chip reader, NFC/tap-to-pay device, and smart card reader.
- ✓ Know the following safety procedures: disconnect power, remove jewelry, lifting techniques, and weight limitations.
- ✓ Review the "Soft Skills" section at the end of the chapter. Make sure you know what open-ended questions are.

## Key Terms

adapter 14	gigabyte 22	operating system 9
ADF 18	hard drive 11	optical drive 11
barcode scanner 18	hardware 9	PC 9
BIOS 10	headset 19	power supply 10
bit 21	keyboard 16	printer 18
brightness 19	kilobyte 22	projector 19
byte 21	KVM switch 19	QR scanner 18
camera 19	lumens 19	RAM 13
chip reader 19	magnetic reader 19	signature pad 19
device driver 9	megabyte 22	smart card reader 19
DVD drive 11	memory 13	software 9
expansion slot 14	microphone 19	tap-to-pay device 19
external storage device 19	monitor 10	terabyte 22
firmware 10	motherboard 13	touchpad 19
flatbed scanner 18	mouse 16	VR headset 18
game controller 19	NFC device 19	webcam 19

## Review Questions

- Match each part to the appropriate description.
 

___ motherboard	a. Converts AC to DC
___ RAM	b. Holds the most data
___ DVD drive	c. Has the most electronics
___ hard drive	d. Fits in an expansion slot
___ adapter	e. Contents disappear when power is off
___ power supply	f. Holds a disc
- Which device would commonly be found in a laptop?  
[ mouse | barcode scanner | touchpad | signature pad ]
- Which of the following are important suggested Internet search tips? (Choose two.)
  - Try another search engine if the first one does not provide satisfactory results.
  - Use as many common words as possible, like the, in, at, or for.
  - Put quotation marks around two or more words that might be found consecutively in output.
  - Use as few words as possible.
  - Avoid using the name of the equipment manufacturer.
- Which type of memory is commonly found on a motherboard?  
\_\_\_\_\_
- When lifting a heavy computer, you should squat, bend at the knees, and use your legs to lift. [ T | F ]
- How many tests must a person take in order to be A+ certified?  
[ 0 | 1 | 2 | 3 | 4 ]
- Is the following question open ended or closed ended? You say your computer has been running slowly since Monday. Which applications have you installed this week? [ open ended | closed ended ]
- List one example of having a positive attitude.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- Which of the following devices are common output devices? (Select all that apply.)  
[ digital piano | speakers | display | stylus | track stick | barcode reader | printer ]
- People who work with computers might be expected to lift up to how many pounds?  
[ 10 to 20 | 20 to 30 | 30 to 40 | 40 to 50 ]
- Which Microsoft Windows application could be used to create a text file?  
[ Textpad | Notepad | WriteIt | NoteIt ]
- Which Windows tool can be used to capture the screen?  
[ Notepad | Bluetooth | Internet Explorer | Snipping Tool ]
- Rewrite the following conversation into an open-ended question.  
Technician: Good morning. I have a service log that states you are getting an error message whenever you access a PDF file. Have you done your Acrobat updates lately?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



14. List one procedure you would do to help an erratic optical mouse.

---

---

15. Match the capacity to the description.

___ bit	a. 8 bits
___ kilobyte	b. a 1 or a 0
___ megabyte	c. approximately 1,000 bytes
___ byte	d. approximately 1 million bytes
___ gigabyte	e. approximately 1 trillion bytes
___ terabyte	f. approximately 1 billion bytes

16. Match the peripheral to the description.

___ flatbed scanner	a. has an ADF
___ KVM	b. might send you to a web page
___ QR scanner	c. used to capture video
___ touchpad	d. allows two computers to share multiple monitors
___ webcam	e. found on a laptop near the keyboard

17. What is a feature of an optical mouse?

- a. LEDs
- b. contacts
- c. volatility
- d. electrical conversion

18. Which device is normally found inside a computer?

[ touchpad | printer | headset | hard drive ]

19. Which device normally can be seen if looking inside a desktop computer with the cover off and when normally looking at the computer?

[ hard drive | motherboard | DVD drive | RAM ]

20. Where can you find RAM in a desktop computer?

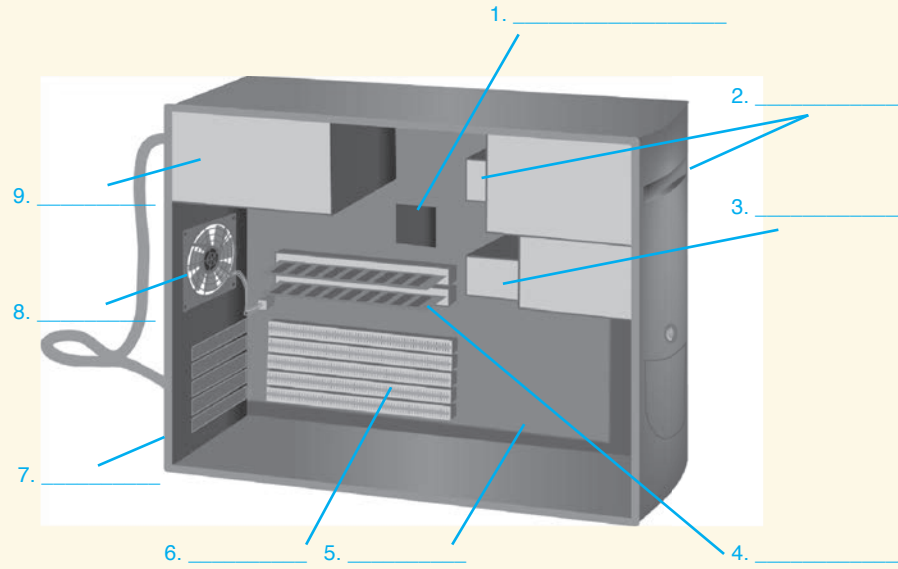
- a. inside the power supply
- b. inserted into the motherboard
- c. below the keyboard
- d. in a KVM

## Exercises

### Exercise 1.1 Identifying Tower Computer Parts

**Objective:** To identify various computer parts correctly

**Procedure:** Identify each computer part in Figure 1.35.



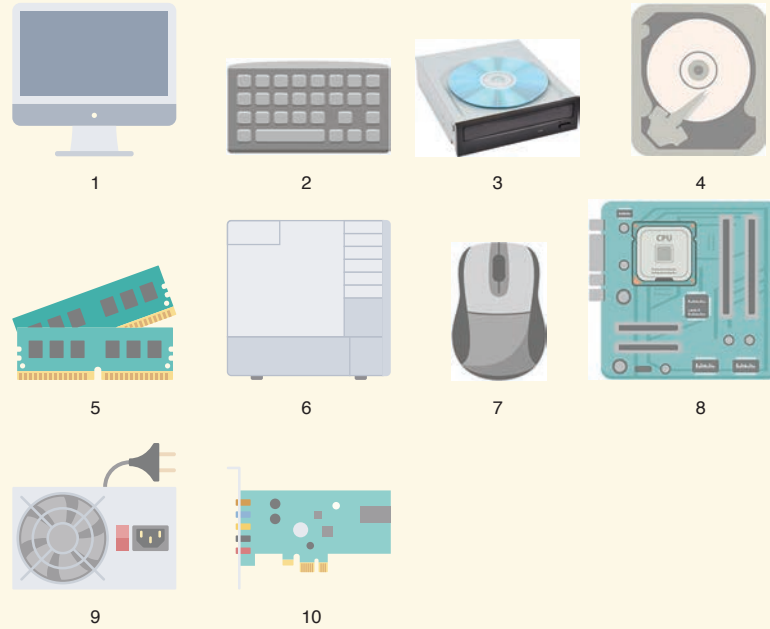
**FIGURE 1.35** Tower computer parts identification

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_
9. \_\_\_\_\_

### Exercise 1.2 Identifying Computer Parts

**Objective:** To identify various computer parts correctly

**Procedure:** Identify each computer part in Figure 1.36.



**FIGURE 1.36** Computer parts identification

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_
9. \_\_\_\_\_
10. \_\_\_\_\_

### Activities



#### Internet Discovery

**Objective:** To obtain specific information from the Internet regarding a computer or its associated parts

**Parts:** Computer with Internet access

**Procedure:** Using the Internet, locate technical information about a computer. Answer the following questions based on the retrieved information. Note that you may need to open more than one document in order to answer the questions.

**Questions:**

1. What is the name of the computer for which you found technical information?  
\_\_\_\_\_
2. How much RAM comes with the computer?  
\_\_\_\_\_
3. Which URL did you use to find this information?  
\_\_\_\_\_
4. Which search term(s) would you use for the following scenario? An HP Windows 10 computer has a Samsung ML-2160 laser printer attached. This printer supports both wired and wireless printing. The computer that is wired to the printer can print just fine, but no wireless devices in the house can access or even see the printer.  
\_\_\_\_\_  
\_\_\_\_\_
5. Which search term(s) would you use in a search engine to help a friend who has accidentally deleted a file on a Windows 7 computer?  
\_\_\_\_\_
6. Which search terms would you use to find a video that shows you how to add an application to a Windows 8.1 desktop?  
\_\_\_\_\_

**Soft Skills**

**Objective:** To enhance and fine-tune a future technician's ability to listen, communicate in both written and oral forms, and support people who use computers in a professional manner

**Procedure:**

1. In a team environment, list three qualities that are important in a computer technician. Create scenarios that demonstrate these qualities. Share these findings in a clear and concise way with the class.
2. In a team environment, list three qualities that are not good practices for computer technicians. Create scenarios that demonstrate these qualities. Share these findings in a clear and concise way with the class.

**Critical Thinking Skills**

**Objective:** To analyze and evaluate information as well as apply learned information to new or different situations

**Procedure:**

1. Find an advertisement for a computer in a local computer flyer, in a newspaper, in a magazine, in a book, or on the Internet. List the components you know in one column and the components you do not know in another column. Select one component you do not know and research that component. On a separate piece of paper, write a description of the component, based on your research, and then share it with at least one other person. Write the name of the person with whom you shared.
2. Why do you think that many computer components are considered "throw-away" technology? List your reasoning. In groups of three or four, share your thoughts. Nominate a spokesperson to share your group reaction in two sentences or less.
3. One device touts a transfer speed of 100 Mb/s, whereas another device advertises 50 MB/s. Compare the two devices' transfer speeds and indicate which one is faster. Locate a component you have or would like to have. Compare products paying particular attention to the transfer speed. Document your findings.

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# Index

## Symbols

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[command name] /? command, 782  
µPGA (micro pin grid array)  
  sockets, 85  
== (comparison operators), 814  
! (exclamation points), Device  
  Manager, 149  
+5 V power supplies, 198  
+12 V power supplies, 198

## Numbers

---

1.8-inch hard drives, 483  
1s and 0s, 21-22  
2.0 audio subsystems, computer  
  design, 540  
2.1 audio subsystems, computer  
  design, 540  
2.4 GHz radio frequency, wireless  
  networks, 650  
2.5-inch hard drives, 253, 483  
3.5-inch hard drives, 253  
3D printers, 361, 372-374  
3G networks, 451, 588  
4G networks, 451, 588  
4GB RAM, 222  
+5 V power supplies, 198  
5 GHz radio frequency, wireless  
  networks, 650  
5G networks, 451, 588  
6a UTP cables, 628  
8-bit sound cards, 326  
10BaseT Ethernet standard, 641

10GBaseER Ethernet standard, 641  
10GBaseLR Ethernet standard, 641  
10GBaseLX4 Ethernet standard, 641  
10GBaseSR Ethernet standard, 641  
10GBaseT Ethernet standard, 641  
+12 V power supplies, 198  
16-bit sound cards, 327  
24-bit sound cards, 327  
24-pin motherboard connectors, 185  
32-bit OS (Operating Systems),  
  727-728  
56 kbps modems, 577-579  
64-bit OS (Operating Systems),  
  727-728  
100BaseT Ethernet standard, 641  
115 V vs 220 V input voltage, 184  
568A/B cabling standard, 56  
802.11a wireless standard, 447, 651  
802.11ac wireless standard, 447, 651  
802.11ad wireless standard, 651  
802.11b wireless standard, 447, 651  
802.11e wireless standard, 651  
802.11g wireless standard, 447, 651  
802.11i wireless standard, 651  
802.11n wireless standard, 447, 651  
1000BaseLX Ethernet standard, 641  
1000BaseSX Ethernet standard, 641  
1000BaseT Ethernet standard, 641

## A

---

A-Series processors, 85  
A-Series PRO processors, 85

AAA (Authentication, Authori-  
  zation, Accounting), 966  
AAX (Audible enhanced audio) file  
  extension, 747  
AC (Alternating Current), 180  
AC circuit testers, 199  
Accelerated Graphics Port. *See* AGP  
accelerometers, gaming apps, 439  
access  
  access attacks, network security,  
    979  
  access denied messages  
    printer issues, 407  
    shared folders/hidden shares,  
    992  
  command prompts, 786  
  environment variables, 805  
  parental controls, 1013  
  remote network devices, 801  
  unauthorized access, mobile  
    devices, 501  
access time (memory), 224-225  
Accessibility setting (macOS,  
  System Preferences), 929  
accessories, mobile devices, 428  
accounts  
  AD accounts, 984-986  
  administrator accounts, 871  
  child accounts, parental  
    controls, 1013  
  email, hijacked accounts, 1007  
  Power Users groups, 871  
  recovery, 871, 1000  
  standard user accounts, 871

- UAC, 872
- user accounts
  - adding credentials to Windows, 868
  - administrator accounts, 871
  - Credential Manager, 867-870
  - credentials, 866
  - Device Manager, 873
  - editing, 870
  - Local Users and Groups tool, 870-871
  - Power Users groups, 871
  - recovery options, 871
  - removing credentials from Windows, 869
  - standard user accounts, 871
  - UAC, 832, 872
- ACL (Access Control Lists), 845, 969
- ACPI (Advanced Configuration and Power Interface)
  - ACPI Function power setting, 193
  - BIOS/UEFI settings, 192-193
  - configuring, 121
  - hibernate mode, 192
  - operating states, 191-192
  - sleep/suspend mode, 192
  - Wake on LAN feature, 192-193, 672
  - Wake on Ring feature, 192
- activation clocks, re-arming, 842-843
- active cables, 38
- active listening skills, 2, 105-106
- active status state (disk management), 297
- Activity Monitor (macOS), 930
- AD (Active Directory), 732, 983. *See also* users, managing
  - accounts, 984-988
  - data storage, 986
  - domains, managing, 795
  - group policies, 987-988
  - groups, adding users to, 984
  - local security policies, 987
- ad hoc mode, wireless networks, 398, 654
- adapters
  - advantages of, 58
  - cleaning, 178
  - configuring, 132-133
  - defined, 14
  - DVI-to-HDMI adapters, 41
  - DVI-to-VGA adapters, 41
  - grounding problems, 162-165
  - installing, 15, 132-135
  - miniPCI/PCIe adapters, 469
  - network, 791-792
  - non-video adapters, power consumption, 195
  - PCIe, removing, 98-99
  - PnP, 132
  - removing, 167, 173, 180
  - SATA, 268
  - USB-to-HDMI adapters, 491
  - video adapters, 140-143, 195, 541
- add-on video cards, 140
- add-ons, 606
- adding computers to domains, 665
- addresses
  - broadcast addresses, 648, 1087
  - end-user device configuration, 665-666
  - host addresses, 647
  - IP addresses, 645-647, 666, 1085-1087
  - IPv4 addresses, 646-650
  - IPv6 addresses, 646
  - link-local, 646
  - MAC addresses, 645-646, 694
  - private IP addresses, 647
  - public IP addresses, 647
- ADF (Automatic Document Feeders), 18, 335
- administrators, 981
  - accounts, 871
  - AP, 676
  - command prompt privileges, 771
  - defragmenting hard drives, 877
  - groups, 981
  - passwords, changing, 982
  - privileges, commands, 803
  - rights, 853-855
  - shares, 991
- ADSL (Asymmetrical DSL), 584-585, 653
- Advanced Boot Options menu, 887-889
- Advanced Configuration and Power Interface. *See* ACPI
- Advanced tab (Internet Explorer 11, Internet Options window), 599, 607-608
- Aero, 832
- aerosol cans, disposal, 179
- AES (Advanced Encryption Standard), 651, 671, 1001
- AFP (Apple Filing Protocol), 696
- After Power Failure power setting (ACPI), 193
- AGP (Accelerated Graphics Ports)
  - bus speeds, 77
  - slots, 95-97
  - video adapters, 195
- AHCI (Advanced Host Controller Interface) mode, 271
- AI (Adobe Illustrator) extension, 747
- airborne particle pollution, UPS/SPS battery backups, 1057-1058
- air (compressed), 178, 1044
- air filters, 178, 538, 1044

- air vents, 189
- airflow, 190
- Airplane Mode, 448
- AirPrint print servers, 399
- alcohol (denatured), cleaning printers, 178
- alerts, Windows Firewall alert options, 1011
- all-in-one computers, disassembling, 176
- alphanumeric characters (Windows scripting, variables), 810
- Alternate Mode (USB ports), 44
- alternative configurations, 668
- ALU (Arithmetic Logic Units), 74
- AM3 sockets, 86
- AM3+ sockets, 86
- AM4 sockets, 86
- Amazon Marketplace, 442
- AMD (American Micro Devices)
  - Direct Connect, 80
  - processors, 84-85
- AMI BIOS/UEFI chips, audio beeps (POST codes), 546
- amplification (speakers), 331-332
- amps (amperes), 182
- analog phone lines versus digital phone lines, 578
- analog signals, 35
- AND operators (Windows scripting), 817
- Android, 423, 729
  - Amazon Marketplace, 442
  - Android Backup Service, 460
  - APK, 442
  - apps, 439-442
  - authentication, 457
  - backups, 459-460
  - Bluetooth, 446
  - factory resets, 460, 501
  - hard resets, 505
  - interacting with (gestures), 434-435
  - location tracking, 501
  - lock screen, 435
  - mutual authentication for multiple services, 457
  - notification areas, 432
  - Recovery Mode, 461, 505
  - security, 500-503
  - smart cameras, 421-423
  - sound settings, 490
  - synchronization, 457
  - system bars, 432
- antennas
  - attenuation, 661
  - directional antennas, 660
  - gain, 662
  - interference, 661
  - isotropic antennas, 661
  - laptops, 488
  - MIMO antennas, 651, 663
  - MU-MIMO antennas, 651, 664
  - omnidirectional antennas, 660-661
  - parabolic antennas, 663
  - patch antennas, 663
  - signal strength, 662
  - site surveys, 662
  - WiFi antennas, 493
  - wireless networks, 488, 660-664
  - Yagi antennas, 663
- antimalware
  - Disable Early Launch Anti-Malware Protection (Advanced Boot Options menu), 888
  - firewalls and, 1009
  - logical security, 968
  - mobile devices, 464, 499
- antistatic bags, 164, 1049
- antistatic brushes, 178
- antistatic measures, motherboards, 103
- antistatic wrist straps, 162-163
- antivirus software, 840, 978
  - Disable Execute Bit, 121
  - firewalls and, 1009
  - logical security, 968
  - mobile devices, 499
  - reinitializing, 843
  - rogue antivirus applications, 1003
  - security policies, 960
- AP (Access Points), 652-654
  - administration, 676
  - channel IDs, 657-659, 676
  - D-Link, 1150
  - data speed ranges, 664
  - MAC address filtering, 1022
  - maintenance, 676
  - omnidirectional antennas, 661
  - passwords, 1022
  - PoE injectors, 657
  - PoE switches, 657
  - repeaters, 656
  - security, 676, 1022-1024
  - SSIDs, 655
  - storage, 676
  - wireless AP, 675-677, 1017, 1023-1024
- APFS (Apple File System), macOS support, 934
- API (Application Programming Interfaces), 329
- API Mode (Zigbee devices), 679



- APIPA (Automatic Private IP Addressing), end-user device configuration, 667
- APK (Application Packages), 442
- App History tab (Task Manager), 893
- apparent power, 184
- appearance/grooming (technicians, communication skills), 516-517, 1067
- Apple computers, motherboards, 104
- Apple Configurator free app, 464
- Apple ID (macOS), 923
- Apple iOS, 423, 729
  - Apple Digital AV adapters, 444
  - App Store, 442
  - apps, 439-442
  - backups, 461-462
  - Bluetooth, 446
  - factory resets, 501
  - hard resets, 505
  - iCloud backups, 461
  - interacting with (gestures), 434-435
  - iTunes backups, 462
  - Lightning ports, 443
  - location tracking, 501
  - lock screen, 435
  - notification areas, 432
  - resetting devices, 461
  - restoring devices, 461
  - security, 500-503
  - smart cameras, 421-423
  - sound settings, 490
  - synchronization, 458-459
  - system bar, 432
- Apple Macintosh OS. *See* macOS
- Application layer
  - OSI model, 644
  - TCP/IP model, 645, 697
- application logs
  - Event Viewer, 864-865
  - reviewing (troubleshooting), 543
- Apply button (Windows dialog boxes), 744
- App Store (macOS), 929
  - Apple IDs, 923
  - system updates, 924
- apps, 439
  - Amazon Marketplace, 442
  - antivirus apps (rogue), 1003
  - APK, 442
  - Apple Configurator free app, 464
  - app scanners, 464
  - App Store, 442
  - authenticator apps, 500, 966
  - automatically loading programs from startup, stopping, 883
  - buying, OS and, 724
  - cell tower analyzers, 465
  - closing, 442
  - cloud-based apps, 594
  - compatibility, troubleshooting, 731
  - critical apps, backups, 998
  - deleting, 442
  - email apps, cloud computing, 594
  - file types, defined, 731
  - fitness apps, 455
  - folders, creating, 442
  - force stopping, 442
  - gaming apps, 439
  - geotracking apps, 439-441
  - Google Play, 442
  - GPS apps, 439
  - high resource utilization, 505
  - installing, 442, 506
  - iTunes, 442
  - launching, 858
  - licensing, 973
  - light switches (smart), controlling, 681
  - live tiles (Windows desktop), 734
  - loading, troubleshooting, 507
  - locator apps, 439-441
  - log errors, 506
  - managing, 878
  - Microsoft Store, 442
  - moving app icons, 442
  - organizing, 442
  - piracy, 973, 1026
  - process IDs, listing, 801
  - QR codes, 442
  - repairing, 859
  - rogue antivirus apps, 1003
  - SDK, 442
  - side loading, 442
  - side-by-side apps (Windows), 832
  - synchronizing, 594, 859
  - system requirements, 858
  - troubleshooting, 505-507, 859, 864, 893
  - uninstalling, 442
  - virtual apps, cloud computing, 594
  - WiFi analyzers, 464
  - Windows 7 taskbar, pinning apps to, 739
  - Windows apps, disabling, 891

- Windows Firewall, 1010
  - alert options, 1011
  - allowing programs through, 1011
  - profiles, 1012
  - troubleshooting, 1012-1013
  - verifying operation, 1011
- Windows installations, 857-860
- apt-get command (Linux), 944, 947-948
- APU (Accelerated Processing Units), 82
- AR (Augmented Reality) headsets, 428
- Arch website, 939
- arithmetic logic units. *See* ALU
- ARP (Address Resolution Protocol), 694
- arrays, adding, 875
- articles/knowledge bases, 1062
- artifacts, troubleshooting, 148
- aspect ratios (displays), 541
- asset tags, inventory management, 1063
- assistants (digital), 683
- asynchronous transmissions, 575-576
- ATA (AT Attachment), 261
- ATAPI (AT Attachment Packet Interface), 261
- ATM (Asynchronous Transfer Mode), network connectivity, 706
- Atom Intel processors, 84
- attenuation (antennas), 661
- attitudes (positive), technicians, communication skills, 237, 350-351, 1069
- attrib command, 779, 782
- ATX connectors, 189
- ATX motherboards, 101
- ATX power supplies, 185-188
- audio
  - 2.0 audio subsystems, computer design, 540
  - 2.1 audio subsystems, computer design, 540
  - Android settings, 490
  - Apple Digital AV adapters, 444
  - Apple iOS settings, 490
  - audio beeps (POST codes), 546-547
  - computer design, 540
  - digitized sound, 327
  - headphones, 334
  - headsets, 19, 330
  - laptops, troubleshooting, 490
  - microphones, 19, 329, 540
    - laptop displays, 493, 498
    - unauthorized activation, 502
  - mobile devices, troubleshooting, 513
  - motherboard speakers, 324
  - muting, 329
  - ODD, 325, 334
  - ports, 50, 59, 324-326
  - resolution, 327
  - sound cards, 333-334, 540
    - 8-bit sound cards, 326
    - 16-bit sound cards, 327
    - 24-bit sound cards, 327
  - analog to digital conversions, 326
  - frequency response, 327
  - installing, 328
  - Windows, 328-329
- Sound setting (macOS, System Preferences), 928
- sound waves, 326
- speakers, 330-334, 540, 683
- troubleshooting, 322, 329, 333-334, 854
- voice-enabled smart speakers, 683
- VoIP, 329
- audio/video editing workstations, 530, 538
- auditing, 988
- AUP (Acceptable Use Policies), 960, 973, 1064
- authentication, 981
  - Android, 457
  - authentication servers, 693, 972
  - authenticator apps, 966
  - biometrics, 966-968
  - EAP, 1018
  - Kerberos protocol, 971
  - logical security, 968
  - multifactor authentication
    - logical security, 968
    - physical security, 966
  - open authentication, 1018
  - physical security, 961
  - RADIUS, 966
  - shared key authentication, 1018
  - single-factor authentication, physical security, 966
  - software tokens, 966
  - SSO, network security, 980
  - TACACS, 966
  - TPM, 963, 971
  - two-factor authentication, physical security, 966
  - WEP authentication, 946
- Authenticator apps, mobile devices, 500
- authorization, 963, 981
- Auto-Detect feature (BIOS), 271
- auto-switching power supplies, 184
- automatic disk checking, 785
- Automatic Update, 846-848
- automatically loading programs from startup, stopping, 883

- automating
  - installations, 842-843
  - tasks via scripts, 803
- automobiles, mobile device synchronization, 456
- AutoPlay function, disabling, 1001
- AutoRun function, disabling, 1001
- auxiliary fans
  - installing, 189-190
  - power consumption, 195
- Available Physical Memory field (Task Manager Performance tab), 231-232

## B

---

- back side buses, 76
- Back to My Mac (iCloud), 923
- backbone (networks), 694
- backdoor attacks, network security, 979
- backlights, laptop displays, 492
- backout plans (change management cycle), 1065
- backup operators, 981
- backups, 542-543, 760-761
  - Android Backup Service, 460
  - Android devices, 459-460
  - Apple iOS devices
    - iCloud, 461
    - iTunes, 462
  - Backup and Restore utility (Windows 7), 849
- batteries, 1054-1059
  - cloud storage, 998-999
  - critical applications, 998
  - data backups, 998-999
    - Android devices, 460
    - centralized data storage, 1000
    - offsite data storage, 1000
  - differential, 999
  - directories, 802
  - File History, 849
  - file-level backups, 999
  - files, 460, 802
  - folders, Android devices, 460
  - full, 999
  - Google Drive, 460
  - hard drives, 998-999
  - iCloud, 461
  - image-level backups, 999
  - incremental backups, 999
  - iTunes, 462
  - Linux, 943
  - local storage, 998
- macOS
  - disk backup requirements, 925
  - Time Machine, 924-925
- mobile devices
  - Android devices, 459-460
  - Apple iOS devices, 461-462
  - remote backups, 455
  - Windows devices, 462
- OneDrive, 462
  - photos, Android devices, 460
  - remote backups, mobile devices, 455
  - restore points, 849
  - testing, 998
- Ubuntu, 943
- video, Android devices, 460
- wbadmin command, 802
- Windows devices
  - backing up before Windows OS installations, 840
  - OneDrive, 462
  - Windows registry, 759, 848
  - xcopy command, 802
- backward compatibility, 731
- badges (security), 962
- bags (antistatic), 164, 1049
- bandwidth
  - buses, comparisons, 97
  - cable modems, 584
  - DSL modems, 585
  - networks, 694
- barcode scanners, 18, 335-336, 346, 1093
- barcodes, inventory management, 1063
- basebands, 437, 694
- baseline reports, 901
- basic disk partitions, 838
- basic disks (Windows Disk Management), 280
- basic input/output system. *See* BIOS
- basic storage (Windows Disk Management), 280
- BAT (batch) file extension, 747, 804
- batch files, 804
- batteries. *See also* power supplies, batteries
  - backups, 1054-1059
  - cleaning, 178
  - CMOS, 123
  - digital cameras, 342
  - disposal of/recycling, 1046-1048
  - fuel cells, 473
  - laptops, 471-474
  - life of, 511
  - Li-ion batteries, 473, 504, 1047-1048
  - lithium regulations, 504

- mobile devices, 428-430
- motherboards, 123-124
- recycling programs, 124
- swollen batteries, 511
- troubleshooting, 511
- zinc-air, 473
- baud, 576
- BCD store, configuring, 782-783
- bcdedit command, 782-783
- BD-R drives, 315
- BD-RE drives, 315
- BD (Blu-ray Discs), 314
  - cleaning, 323
  - handling, 322
  - region codes, 317-318
- belts, inkjet printers, 365
- best practices, OS, 952
- bidirectional printing, 363
- biometrics, 966
  - biometric devices, configuring, 346-347
  - biometric locks, 963
  - facial recognition devices, 967-968
  - hand scanners, 967
  - retinal scanners, 967
  - voice recognition devices, 967
- BIOS (Basic Input/Output System), 10
  - ACPI settings, 192-193
  - advanced BIOS options, 120
  - AMI BIOS/UEFI chips, audio beeps (POST codes), 546
  - Auto-Detect feature, 271
  - boot orders, updating in Windows installations, 843
  - boot process, 544-545
  - Boot Sequence, changing, 122
  - CMOS, 123-126
  - configuring, 119-122, 271, 1144
  - Disable Execute Bit, 121
  - drive encryption, 121
  - error messages (POST codes), 547-548
  - exit options, 122
  - flash, 118
  - flashing the BIOS, 124-125
  - functions, 116
  - hard drive configuration, 271
  - hardware configuration, 132
  - Hardware Monitor, 121
  - iGPU, 121
  - interface configuration, 121
  - intrusion detection/notification, 121
  - LoJack, 121
  - motherboards, 549
  - on-board NIC, 671
  - passwords, 970-971
  - Phoenix BIOS/UEFI chips, audio beeps (POST codes), 547
  - POST, 116, 228, 235
  - power configuration, 121
  - RAID configuration, 284
  - recovery methods, 125
  - SATA ports, enabling, 268
  - secure boot, 121
  - security, 126, 970-971
  - Setup program, 117
  - TPM, 121
  - troubleshooting, 149
  - UEFI, 116-122
    - flashing the UEFI, 124-125
    - hardware configuration, 132
    - recovery methods, 125
    - troubleshooting, 149
    - updating, 126
    - upgrading, 124-125
    - virtualization, 121, 590
- BIOS ROM checksum error—System halted message, 547
- bit depth, scanners, 337
- BitLocker, 732, 1000
- BitLocker To Go, 1000
- bits, 21-22
- black/blank screens, troubleshooting, 884
- Blackblaze, 290
- blacklists/whitelists, 676, 1010
- blackouts (electricity), 1051
- blank pages, printing (printer issues), 404
- blank screen on bootup, 103
- Bloom's Taxonomy, 528
- blue screens, troubleshooting, 864
- Bluetooth, 444, 448
  - Bluetooth setting (macOS, System Preferences), 928
  - cell phone headsets, 652
  - input devices, 60
  - installing, 446
  - laptop cards, replacing, 487
  - local printer connections, 388
  - mobile devices, troubleshooting, 514-515
  - networks, 651-652
  - printers, networking, 397-398
  - USB-to-Bluetooth dongles, 446
- blue-violet laser technology, Blu-ray drives, 314, 317

- Blu-ray Discs (BD), 314
  - cleaning, 323
  - handling, 322
  - region codes, 317-318
- Blu-ray drives, 314-315, 317-318
- BMP (bitmap) extension, 747
- BNC connectors, 40
- Bonjour print servers, 399
- boot options, 120
- boot orders, Windows installations, 843
- boot partitions, NTFS, 278
- boot process
  - bcdedit command, 782-783
  - boot partitions, 881
  - bootree command, 783-784
  - defined, 724
  - network boots, 880
  - PXE, 880
  - Safe Boot (System Configuration utility), 890-891
  - Services tab (System Configuration utility), 891
  - Startup tab (System Configuration utility), 891
  - system files, 880-881
  - Tools tab (System Configuration utility), 892
  - troubleshooting, 896
  - Windows
    - Advanced Boot Options menu, 887-889
    - optimizing performance, 881-882
    - overview of, 880-881
    - reboots, 898
    - troubleshooting, 882-883
- boot sectors, 280
- Boot Sequence, changing, 122
- boot volumes, 281, 880
- bootloaders, 952
- bootrec command, 290, 783-784
- bootups
  - BIOS/UEFI security, 971
  - blank screen on bootup, 103
  - Boot Camp (macOS), 934
  - cold boots, 116
  - configuring, 120
  - continuous reboots, 103
  - DBR, 280
  - inspection, 177
  - Linux, 939
  - MBR, 278
  - multiboots, Windows, 833
  - reboots, troubleshooting, 197
  - Safe mode
    - macOS, 929
    - Windows installations, 844
  - secure boots, configuring, 121
  - security, 971
  - Startup Disk setting (macOS, System Preferences), 929
  - troubleshooting, 197, 295, 544-545
  - warm boots, 117, 551
- botnets, 976-979
- bps (Bits Per Second), 576
- BranchCache, 733
- Bridged mode (virtual NIC), 673
- bridges, 652, 1095
- bright spots, 145
- brightness, projectors, 341
- broadband networks, 694
- broadcast addresses, 648, 1087
- brownouts (electricity), 1051
- browsers
  - browsing history, 599
  - browsing tabs, 599
  - encryption, 608
  - hijacked browsers, 608-610
  - Internet Explorer 11, 597-608
  - performance, 610
  - pop-ups, 609
  - redirecting browsers, 608
  - rootkits, 608
  - slow browsers, 610
  - troubleshooting, 608-610
  - updating, 608
- brute force attacks, network security, 979
- BSA (Business Software Alliance), 1026
- BSOD (blue screen of death), 103, 146
  - troubleshooting, 548
  - Windows updates, 886
- Btrfs file system (Linux), 942
- bubble jet printers. *See* inkjet printers
- buffered memory, 217, 317
- burned-in images, troubleshooting, 147
- burning discs, 317
- burning smells, troubleshooting, 198
- burnout (technician skills), avoiding, 907-908
- buses
  - AGP speed, 77
  - back side, 76
  - bandwidth comparisons, 97
  - DIB, 80
  - external data, 73

- front side, 76
- HyperTransport, 80
- internal data, 73
- PCIe speed, 76
- PCI speed, 76
- performance, 74
- speeds, 76
- business processes, documentation, 1064
- buying/payments
  - apps, 724
  - credit card readers, 428, 431
  - licenses, 843
  - memory, 224-226
  - mobile payment services, 441
  - mobile wallets, 441
  - NFC/tap pay devices, 450
  - OS licenses and virtualization, 591
  - PCI, 975
  - power supplies, laptops, 471
  - software licenses, 973
  - surge protectors, 1053
- BYOD (Bring Your Own Device), 960
- bytes, 21-22

## C

- c command (macOS), 934
- CA (Certificate Authority), digital security certificates, 1008
- CAB (cabinet) file extension, 747
- cabinets (network), 636
- cable locks, 499, 963
- cable modems
  - bandwidth, 584
  - cable TV and, 581
  - connectivity, 581-582
  - downstream transmissions, 584
  - Ethernet ports, 582
  - fiber networks, 583
  - hardware requirements, 584
  - NIC connectivity, 581
  - ports, 582
  - speeds, 584
  - troubleshooting, 691
  - upstream transmissions, 584
  - USB connectivity, 582
- cable strippers, 631, 638
- cable testers, 633, 638
- cable TV and cable modems, 581

- cables
  - 568A/B cabling standard, 56
  - active cables, 38
  - Apple Digital AV adapters, 444
  - Cat 3 UTP cables, 628
  - Cat 5 cables, 54-55
  - Cat 5e cables, 54-55
  - Cat 6 cables, 54-55
  - Cat 7 cables, 54-55
  - coaxial cables, 40-41
  - computer design, 537-538
  - connecting, 170, 265
  - crossover, 629-631
  - DSL modems/cable connectivity, 586
  - DVI cables, 37
  - Ethernet cables
    - Cat 5 cables, 54-55
    - Cat 5e cables, 54-55
    - Cat 6 cables, 54-55
    - Cat 7 cables, 54-55
    - plenum cables, 56
    - PVC cables, 56
    - STP cables, 55
    - UTP cables, 54-55, 628
  - external cables, removing, 168
  - fiber cables, 56-57, 641
  - fiber-optic cables, 583
  - IDE cables, 260
  - internal cables, removing, 169-172
  - labeling, 635
  - ladder racks, 638
  - management systems, 636
  - managing, 1040
  - network cabinets, 636
  - network connectivity, 706
  - passive cables, 38
  - PATA cables, 260
  - PATA IDE, 265
  - plenum cables, 56
  - power cables, removing, 168
  - projectors, 340
  - PVC cables, 56
  - reassembling, 176
  - ribbon cables, 170
  - SAS cables, 264
  - SATA cables, 260, 263, 267
  - SCSI cables, 264
  - serial cables, 53
  - STP cables, 55
  - straight-through, 629

- T568A cabling standard, 56, 629
- T568B cabling standard, 56, 629
- Thunderbolt cables, 49
- tools
  - cable strippers, 631, 638
  - cable testers, 633, 638
  - crimpers, 631-633, 638
  - loopback plugs, 638
  - multimeters, 639
  - punch-down tools, 639
  - tone generators, 639
  - toner probes, 639
- troubleshooting, 638-639
- twisted-pair
  - corporate environments, 634
  - plenum, 628
  - PVC, 628
  - RJ-11 connectors, 629
  - RJ-45 connectors, 629-633
  - STP, 627
  - terminating, 629-633
  - UTP, 627-630, 634
- USB cables, 43, 46
- USB-C cables, 42
- UTP cables, 54-55, 628
- VGA cables, 37
- voice-grade cables. *See* Cat 3 UTP cables
- wiring racks, 637
- CAC (Common Access Cards), 348
- Cached field (Task Manager Performance tab), 233
- cached passwords, synchronization, 456
- Cached Physical Memory field (Task Manager Performance tab), 231
- cache memory, 77
  - data access hierarchy, 77
  - SRAM, 213, 228-229
- CAD (Computer Aided Design) design workstations, 529, 538
- calibrating
  - mobile device screens, 440
  - print heads, 382
  - touchscreens, 498
- calls (mobile device OS), 441
- CAM (Computer Aided Manufacturing) design workstations, 529, 538
- cameras
  - camcorders, 344
  - digital cameras
    - batteries, 342-344
    - file formats, 343, 355
    - memory card readers, 344
    - resolution, 342
    - storage, 343-344
    - troubleshooting, 344
  - security cameras, installing, 682
  - smart cameras, 421-423
  - webcams, 19, 344
    - laptop displays, 493, 498
    - unauthorized activation, 502
- Cancel button (Windows dialog boxes), 744
- capacitive touchscreens, 496
- capacitors, 13-104, 182
- capturing files, 8
- card readers
  - credit card readers, 428, 431
  - magnetic card readers, 19, 428, 431
  - smart card readers, 424, 487
- carriages, inkjet printers, 365
- cars, mobile device synchronization, 456
- cartridges (ink), 363-364, 387
  - CIS, 379
  - inkjet printers, 365-366
  - laser printers, 409
  - recycling, 379
  - refilling, 379-380
  - replacing, 384
  - toner, 370-371, 380
  - troubleshooting, 409
- CAS latency, memory, 225
- cases
  - cleaning, 178
  - computer design, 538
  - form factors, 186, 538
  - removing, 168
- Cat 3 UTP cables, 628
- Cat 5 cables, 54-55
- Cat 5 UTP cables, 628
- Cat 5e cables, 54-55
- Cat 5e UTP cables, 628
- Cat 6 cables, 54-55
- Cat 6 UTP cables, 628
- Cat 6a UTP cables, 628
- Cat 7 cables, 54-55
- Cat 7 UTP cables, 628
- CCFL (Cold Cathode Fluorescent Lamps), laptop displays, 492-495
- CD (Compact Discs), 314-316
  - burning, 317
  - CDs & DVDs setting (macOS, System Preferences), 928

- cleaning, 323, 327
  - handling, 322
  - Linux bootups, 939
- cd command, 774, 784, 934-935
- CD drives, 314, 317
- CD-ROM discs, 315
- CD-RW drives, 315
- CDFS (Compact Disk File System), 273, 838
- CDMA (Code Division Multiple Access), 694
- cell phones. *See* smartphones
- cell tower analyzers, 465
- cellular cards, 469
- cellular networks, 451
  - connectivity, 448, 588, 706
  - WWAN configurations, 677
- CentOS website, 939
- centralized data storage, 1000
- certificate-based credentials, 867
- certificates of destruction (document security), 965
- certifications, 5-6
- CF (CompactFlash) cards, 343, 424-426
- change management
  - backout plans, 1065
  - business process documentation, 1064
  - change boards, 1064
  - documenting changes, 1065
  - end-user acceptance, 1065
  - plans for change, 1064
  - purpose of change, 1064
  - scope of change, 1065
- channel ID
  - AP, 657-659, 676
  - Zigbee devices, 679
- charging
  - batteries, troubleshooting, 511
  - laser printers, 368
  - USB ports, 46
- charms (Windows desktop), 734-735, 832
- charts/flowcharts, troubleshooting, 555-558
- checkboxes (Windows), 744
- checking disks, 784-785
- checkpoints (virtualization), 590
- children
  - exploitation, incident reports, 1026
  - parental controls, 1013
- chip readers, 19
- chipsets
  - defined, 100
  - manufacturers, 100
  - motherboard design, 536
- chkdsk command, 290, 784
- chkntfs command, 785
- chmod command (macOS), 935-937
- chown command (macOS), 935
- Chrome OS, 423, 729
- CIDR (Classless Inter-Domain Routing), 650
- CIFS (Common Internet File System), 694, 697
- cipher command, 785, 1002
- CIS (Continuous Ink Systems), 379
- CL modules (memory), mixing, 226
- CL ratings, memory, 225
- clamping speed, surge protectors, 1052
- clamping voltage, surge protectors, 1052
- clean installations, 462, 833-834
- clean rooms, 1058
- cleaning
  - adapters, 178
  - aerosol cans, disposal, 179
  - batteries, 178
  - cases, 178
  - discs, 323
  - displays, 178
  - inside of computers, 178-179
  - keyboards, 17, 178
  - laser lenses (ODD), 323
  - laser printers, 368
  - LCD monitors, 177
  - mice, 17
  - monitors, 178
  - MSDS, 179
  - optical lenses, 178
  - printers, 178, 381-386
  - scanners, 338
  - SDS, 179
  - touchpads, 178
- cleaning blades (laser printers), 369
- cleaning pads (laser printers), 369
- clearing commands, 786
- CLI (Command Line Interfaces), 724-725
  - Linux
    - copying data, 948-950
    - finding files, 951
    - missing GRUB/LILO, 952
    - network configuration, 945-946
    - obtaining software, 947-948
    - shutting down systems, 944-945
    - viewing processes, 947
- client-side DHCP (Dynamic Host Configuration Protocol), 667
- client-side DNS (Domain Name Service), 669



- clients (thick/thin), 673-675
- clips (fans/heat sinks), 91-92
- clock speed, 76
- clocking, 78
- Close button (Windows dialog boxes), 744
- closed source OS, 423
- closing
  - command prompts, 1106
  - laptops, 494, 509
- cloud computing, 593
  - advantages of, 597
  - cloud-based apps, 594
  - community clouds, 596
  - DaaS, 594
  - deploying cloud services, 595-596
  - email, 594
  - file storage, 594
  - hybrid clouds, 596
  - IaaS, 594
  - iCloud
    - Apple iOS device synchronization, 458
    - backups, 461
  - measured services, 597
  - metered services, 597
  - mobile devices, synchronization, 456
  - network controllers, 594
  - non-metered services, 597
  - on-demand access, 597
  - PaaS, 594
  - printing, 399-400
  - private clouds, 595-596
  - public clouds, 596
  - rapid elasticity, 597
  - resource pooling, 597
  - SaaS, 594
  - servers, 733
  - shared resources, 597
  - storage, 252, 993, 998-999
  - synchronization apps, 594
  - virtual apps, 594
  - virtual desktops, 594
  - virtual NIC, 594
- cls command, 786
- clusters, 274
  - FAT16 partitions, 275
  - FAT32 partitions, 275
  - lost clusters, locating, 290
  - NTFS partitions, 275-276
- cmdlets (PowerShell), 821
- CMOS (Complementary Metal-Oxide Semiconductor)
  - clearing, 125-126
  - CMOS battery failed/error message, 547
  - CMOS checksum error—Defaults loaded message, 547
  - CMOS timer error message, 547
  - defined, 123
  - password jumper, 126
  - power, 123
- coaxial cables, 40-41
- cold boots, 116
- collation (printer configuration), 391
- collection controlled loops. *See* for loops
- color
  - color depth (displays), 855
  - incorrect color patterns, troubleshooting, 144
  - inkjet printers, 365-366
  - printing in wrong color (printer issues), 408
- COM (command) file extension, 747
- combination screwdrivers, 166
- [command name] /? command, 782
- command command, 786
- command prompt (Windows), 1110, 1122
  - accessing, 770-771, 786
  - administrative privileges, 771
  - attrib command, 779, 782
  - bcdedit command, 782-783
  - bootrec command, 783-784
  - cd command, 774, 784
  - chkdsk command, 784
  - chkntfs command, 785
  - cipher command, 785
  - closing, 771, 1106
  - cls command, 786
  - [command name] /? command, 782
  - command command, 786
  - common commands list, 781
  - copy command, 778-779, 786
  - defrag command, 786
  - del command, 778, 787
  - Device Manager, running from prompt, 780
  - dir command, 774-776, 787
  - directories
    - attrib command, 779
    - copy command, 778-779
    - copying, 778-779
    - copying files, 778-779
    - creating, 777
    - del command, 778
    - md command, 777

- rd command, 777
- removing, 777
- removing files, 778
- robocopy command, 778
- root directory, 771-773
- subdirectory, 772
- type command, 778
- viewing attributes of, 779
- viewing file attributes, 779
- viewing files, 778
- xcopy command, 778
- disable command, 787
- diskpart command, 788
- dism command, 788
- drives, mapping, 703
- dxdiag command, 788
- enable command, 789
- exit command, 789
- expand command, 789
- explorer command, 789
- format command, 790
- gpreresult command, 790
- gpupdate command, 790-791
- help command, 791
- help, finding, 781
- ipconfig command, 791
- md command, 777, 792
- mmc command, 792
- more command, 792
- msconfig command, 793
- msinfo32 command, 793
- mstsc command, 793
- navigating, 774-776
- nbtstat command, 793
- net command, 794
- net use command, 794
- net user command, 794-795
- netdom command, 795
- netstat command, 795-796
- notepad command, 796
- nslookup command, 796
- operation requires elevation messages, 803
- overview of, 771
- permissions and, 996
- ping command, 796-797
- rd command, 777, 797
- regedit command, 797
- regsvr32 command, 797
- ren command, 798
- robocopy command, 778, 798
- running System Restore, 887
- Safe Mode with Command Prompt, 888
- services.mmc command, 798
- set command, 799
- sfc command, 799
- shutdown command, 800
- syntax, 771
- systeminfo command, 800
- taskkill command, 800
- tasklist command, 801
- telnet command, 801
- tracert command, 801
- type command, 778, 802
- wbadmin command, 802
- wscript command, 802
- xcopy command, 778, 802
- command switches, 775
- commands
  - administrative privileges, 803
  - attrib command, 782
  - bcdedit command, 782-783
  - bootrec command, 783-784
  - cd command, 784
  - chkdsk command, 784
  - chkntfs command, 785
  - cipher command, 785
  - clearing, 786
  - cls command, 786
  - [command name] /? command, 782
  - command command, 786
  - common commands accessible from command prompt, 781
  - copy command, 786
  - defrag command, 786
  - del command, 787
  - dir command, 726, 787
  - disable command, 787
  - diskpart command, 788
  - dism command, 788
  - dxdiag command, 788
  - enable command, 789
  - exit command, 789, 1106
  - expand command, 789, 1106
  - explorer command, 789
  - format command, 790
  - gpreresult command, 790, 1110
  - gpupdate command, 790-791
  - help command, 791
  - help information, displaying, 782
  - hop command, 726

- ipconfig command, 791-792
- learning, reasons for, 780
- listsvc command, 787
- md command, 792
- mmc command, 792
- more command, 792
- msconfig command, 793
- msinfo command, 793
- msinfo32 command, 1122
- mstsc command, 793
- nbtstat command, 793
- net command, 794
- net use command, 794
- net user command, 794-795
- netdom command, 795
- netstat command, 795-796
- notepad command, 796
- nslookup command, 796
- output, displaying one page at a time, 776
- ping command, 796-797
- pwd command, 944
- rd command, 797
- regedit command, 797
- regsvr32 command, 797
- ren command, 798
- robocopy command, 798
- services.mmc command, 798
- set command, 799
- sfc command, 799
- shutdown command, 800
- systeminfo command, 800
- taskkill command, 800
- tasklist command, 801
- telnet command, 801
- tracert command, 801
- type command, 802
- user privileges, 803
- using, tips before, 779
- wbadmin command, 802
- wildcards, 778
- writing in NotePad, 780
- wscript command, 802
- xcopy command, 802
- comments (Windows scripting), 812
- commercial software licenses, 973
- Commit (GB) field (Task Manager Performance tab), 232
- commitments, making, 1073
- Committed field (Task Manager Performance tab), 232
- communication skills, 1066
  - commitments, making, 1073
  - confidential/private materials, handling, 1075-1076
  - conflict management, 1073-1075
  - cultural sensitivity, 1070
  - customer service, 1066, 1073-1075
  - distractions, avoiding, 1072-1073
  - feedback, 1074
  - geek speak, 1069
  - grooming/appearance, 1067
  - jargon, 1069
  - listening skills, 1070
  - meeting expectations, 1075
  - organization, 1068
  - personal integrity, 1073
  - positive attitudes, 1069
  - proper language, 1067-1069
  - punctuality, 1071
  - time management, 1072
- community clouds, 596
- Compact Disk File System (CDFS), 273
- comparison operators (==), 814
- compartment covers, laptops, 475
- compatibility
  - apps, troubleshooting, 731
  - backward compatibility, 731
  - forward compatibility, 731
  - software, troubleshooting, 731
  - upward compatibility, 731
- Compatibility mode (Windows), 233, 836
- compiled languages, 808
- compiled programs, defined, 803
- complexity of passwords, 971
- compliance
  - policies, 1064
  - software, 730
- component/RGB video analog ports, 340
- component handling/storage procedures, 1049-1050
- Component Services, 862
- composite video ports, 340
- compound conditions (Windows scripting), 817
- compressed air, 178, 385, 1044
- compressed file (ZIP) extension, 747
- compression, Windows files/folders, 752
- computer design, 528
  - audio subsystems, 540
  - audio/video editing workstations, 530, 538
  - Bloom's Taxonomy, 528
  - cables, 537-538
  - CAD design workstations, 529, 538

- CAM design workstations, 529, 538
- cases, 538
- cooling systems, 536
- display subsystems, 541-542
- energy efficiency, 535
- gaming PC, 529, 538
- graphic design workstations, 529, 538
- green (environmental) design, 535
- home servers, 534, 538
- industrial computer, 534
- mobile computer, 535
- motherboards, 536-537
- NAS devices, 531-532
- power supplies, 537-538
- standard thick client workstations, 533, 538
- storage subsystems, 539-540
- thick client workstations, 533, 538
- thin client workstations, 533, 538
- virtualization workstations, 532, 538
- Computer Management Console, 861-862
- computers
  - adding to domains, 665
  - naming, 664
  - viewing through networks, 981
- conditioning rollers (laser printers), 368-369
- conference calls and video, 580
- conferencing features (displays), 541
- confidential/private materials, handling, 1075-1076
- configuration change options, 122
- configuring
  - ACPI, 121
  - adapters, 132-133
  - alternative configurations, 668
  - AP (wireless), 675
  - barcode scanners, 346
  - BCD store, 782-783
  - biometric devices, 346-347
  - BIOS, 119-122, 271, 1144
  - BIOS/UEFI, 271
  - booting options, 120
  - cellular configurations, WWAN, 677
  - CMOS memory, 123-126
  - digitizers, 348
  - Disable Execute Bit, 121
  - DNS, 1005-1007
  - drive encryption, 121
  - email, mobile devices, 453-455
  - end-user device configuration
    - addressing, 665-669
    - overview of, 664
  - file/folder attributes, 752
  - fingerprint readers, 346-347
  - game controllers, 347
  - hardware, 132
  - Hardware Monitor, 121
  - Hyper-Threading, 120
  - I/O addresses, 127, 130-131
  - IDE, 121
  - iGPU, 121
  - intrusion detection/notification, 121
  - IP addresses, statically configuring, 666
  - IRQ, 127, 130
  - joysticks, 347
  - Last Known Good Configuration (Advanced Boot Options menu), 888
  - Linux networks, 945-946
  - LoJack, 121
  - memory addresses, 127, 131
  - microphones, 329
  - motherboard batteries, 123
  - motherboards, 173
  - motion sensors, 348
  - networks, mobile devices, 448
  - number lock key, 120
  - passwords, 120
  - PCI/PnP, 121
  - PCIe, 121
  - peripherals, 120
  - printers, 376, 389-391
  - processors, 120
  - RAID, 282-283
  - routers (wireless), 675
  - SATA, 121
  - secure boot, 121
  - serial ports, 575-577
  - server-based networks, 622
  - smart card readers, 348
  - storage devices, 265-267
  - system configuration information, viewing, 800
  - System Configuration utility (msconfig command), 889
    - Safe Boot, 890-891
    - Services tab, 891
    - Startup tab, 891
    - Tools tab, 892
  - system resources, defined, 126
  - TPM, 121, 1144
  - Ubuntu networks, 945-946
  - UEFI, 119-122, 271
  - USB options, 120

- video, 120
- virtual memory, 229, 288
- virus protection, 120
- VM, 234
- VPN, 1014-1015
- Windows, 908
  - device drivers, 851
  - overview of, 850
- wireless APs, 675
- wireless routers, 675
- Z-Wave devices, 679-680
- Zigbee devices, 678-679
- conflict management, 1073-1075
- Connections tab (Internet Explorer 11, Internet Options window), 598, 605
- connectivity
  - cable modems, 581-582
  - cables, 37, 40-41, 168-172, 176, 265
    - 568A/B cabling standard, 56
    - Cat 5 cables, 54-55
    - Cat 5e cables, 54-55
    - Cat 6 cables, 54-55
    - Cat 7 cables, 54-55
    - Ethernet cables, 54-56
    - fiber cables, 56-57
    - IDE cables, 260
    - PATA cables, 260
    - plenum cables, 56
    - projectors, 340
    - PVC cables, 56
    - SAS cables, 264
    - SATA cables, 260, 267
    - SCSI cables, 264
    - serial cables, 53
    - STP cables, 55
    - T568A cabling standard, 56
    - T568B cabling standard, 56
    - Thunderbolt cables, 49
    - USB-C cables, 42
    - UTP cables, 54-55
  - connectors, 38-40, 58, 169-172, 176
    - 24-pin motherboard connectors, 185
    - ATX connectors, 189
    - ATX power supplies, 185-186
    - D-shell connectors, 34
    - mini-DIN connectors, 34
    - Y connectors, 187
  - converters, 47
  - Data Sources (ODBC), 878-879
  - HDMI connectors, 444
  - hubs, 46
  - mobile connectors, 444-448
  - networks
    - ATM, 706
    - cables, 706
    - cellular connections, 706
    - dial-up connections, 706
    - DSL, 706
    - Frame Relay, 706
    - ISDN, 706
    - limited connectivity, 689-690
    - line-of-sight wireless connections, 706
    - local connectivity, 685
    - MetroE connections, 706
    - satellite connections, 706
    - T1 connections, 706
    - T3 connections, 706
    - troubleshooting, 684-685, 689-690
  - port replicators, 468
  - ports, 41
    - audio ports, 50, 59
    - defined, 34
    - DisplayPort, 467
    - eSATA ports, 51, 59
    - Ethernet ports, 51-52
    - integrated motherboard ports, 57-58
    - Lightning ports, 49-50, 59
    - male/female ports, 34
    - mini DisplayPort, 467
    - mobile devices, 443
    - modem ports, 52
    - network ports, 51
    - serial ports, 53, 59
    - Thunderbolt ports, 49-50, 59
    - USB ports, 42-50, 59
    - video ports, 35-40, 58
  - printers, 402-403
  - processors, 80
  - projectors, 340
  - remote networks, device connectivity testing, 796-797
  - SATA, 267
  - synchronization, 457
  - speakers, 332
  - storage device design considerations, 539
  - USB cables, 43, 46
  - USB connectors, 44, 48
  - USB ports, 134-137
  - video connectors, 37
  - video ports, 39-41, 58
  - wireless input devices, 59-60

- connectors
  - 24-pin motherboard connectors, 185
  - ATX connectors, installing, 189
  - ATX power supplies, 185-186
  - BNC connectors, 40
  - dual-link DVI connectors, 36
  - DVI connectors, 37, 58
  - DVI-A connectors, 58
  - DVI-D connectors, 36, 39, 58
  - DVI-I connectors, 36, 39
  - front panel connectors, 171
  - IDE connectors, 171
  - mini-HDMI connectors, 38
  - PATA/SATA motherboard, 261
  - reassembling, 176
  - removing, 169-172
  - SAS connectors, 262
  - SATA connectors, 171, 262
  - SCSI connectors, 262
  - USB connectors, 44
  - video, 37
  - Y connectors, 187
- Console (macOS), troubleshooting kernel panic, 931
- constructs (Windows scripting), 813
- contacts, synchronization, 457
- content filtering, 1016
- Content tab (Internet Explorer 11, Internet Options window), 598, 603-604
- context menus (Windows), 745
- continuity checks, 182-183
- continuous reboots, 103
- contrast ratios (displays), 541
- Control Panel (Windows), 754
  - configuring Windows, 850
  - Network and Sharing Center, 698-701
  - Windows 7
    - categories, 755-757
    - utilities, 754
  - Windows 8 utilities, 754
- control panel assembly (laser printers), 370
- controllers (game), 19, 347-348
- convergence, 580
- convert command, 837
- converters
  - power converters, 186-187
  - USB A-to-USB B converters, 47
  - USB-to-Ethernet converters, 47
- converting partitions, 274
- cooling systems
  - airflow/ventilation, 190
  - air vents, 189
  - computer system design, 536
  - fans, 86-87, 92, 189
    - installing, 190
    - power consumption, 195
  - heat sinks, 86-87, 190
  - Li-ion batteries, 473
  - power supplies, 189
  - processors
    - airflow, 190
    - auxiliary fans, installing, 189
    - fans, 86-87, 92
    - heat pipes, 86
    - heat sinks, 86-87
    - installation clips, 91-92
    - liquid cooling systems, 86
    - overclocking, 91
    - passive cooling, 86
    - phase-change cooling, 86
    - thermal paste, 86-88
    - vapor cooling, 86
- copper media (twisted-pair)
  - corporate environments, 634
  - plenum, 628
  - PVC, 628
  - RJ-11 connectors, 629
  - RJ-45 connectors, 629-633
  - STP, 627
  - terminating, 629-633
  - UTP, 627-630, 634
- copy command, 778-779, 786
- copying
  - data
    - in Linux, 948-950
    - in Ubuntu, 948-950
  - directories, 778-779, 802
  - files, 752-754, 786, 798, 802
    - from directories, 778-779
    - to CD/DVD, 317
  - folders, 752-754
- Core i3 Intel processors, 84
- Core i5 Intel processors, 83
- Core i7 Intel processors, 83
- Core i7/i5 vPro processors, 84
- Core i9 processors, 83
- Core m3 processors, 84
- Core X processors, 83

corporate OS (Operating Systems), 731

BitLocker encryption, 732

BranchCache, 733

domains, 732

EFS, 733

Media Center, 732

security

BitLocker encryption, 732

EFS, 733

workgroups, 732

corporate Windows deployments

activation clocks, 842

licensing, 843

tools, 842

Cortana virtual assistant (Windows), 742, 832

counters, 903

cp command (macOS), 934-936

cps (Characters Per Second) ratings, 361

CPU (Central Processing Units). *See also* processors

CPU THRM Throttling power setting (ACPI), 193

CPU Warning Temperatures power setting (ACPI), 193

heating, 103

sockets, 85-86

speeds, 77

throttling, 77, 90, 193

crashes

apps, troubleshooting, 893

proprietary crash screens, 297, 548

creased paper (printer issues), 404

Credential Manager, 866-867

adding credential to Windows, 868

editing credentials, 870

removing credentials from Windows, 869

credentials

certificate-based credentials, 867

Credential Manager, 866-869

deleting, 869

generic credentials, 867

stored credentials, security, 867

user accounts, 866

web credentials, 867

credit card readers, 428, 431

crimpers, 631-633, 638, 1099

critical applications, backups, 998

critical recovery documents, 1000

crossover cables, 629-631

CRT (Cathode Ray Tube) monitors, 36, 1046

Crucial website, 224

CSMA/CD (Carrier Sense Multiple Access/Collision Detection), Ethernet networks, 640

cultural sensitivity, 1070

current (electricity), 182-184

current (technician skills), staying, 762

customer service, 1066

conflict management, 1073-1075

irate customers, handling, 559-560

trust, building, 1028

Custom mode (virtual NIC), 673

customizing

update notifications, 848

Windows desktop, 735

cutters (diagonal), 166

cylinders (hard drives), 256

## D

---

D-Link access point, 1150

D-shell connectors, 34

DaaS (Desktop as a Service), 594

Dash (Ubuntu), 940-941

data

backups, 998-1000

Android devices, 460

centralized data storage, 1000

offsite data storage, 1000

DEP, 1002-1003

leaks, mobile devices, 501-502

migration, 835

regulated data, end-user security, 974-975

security, DEP, 1002-1003

storage, AD, 986

transfers, 664, 835

transmission limits, mobile devices, 503

data bits, 577

Data Link layer (OSI model), 644

data packets, verifying paths, 801

Data Sources (ODBC), 878-879

data types (Windows scripting, variables), 810

Date & Time setting (macOS, System Preferences), 929

date/time settings, Windows, 841

DB-9 ports. *See* serial devices, serial ports

DBR (DOS Boot Record), 280

DC (Direct Current), 180, 189

DC jacks, replacing, 489

dd command (Linux), 944, 948-950

DDoS (Distributed Denial of Service) attacks, 979

DDR (Double Data Rate), 215

DDR2 (Double Data Rate 2), 215

- DDR3 (Double Data Rate 3), 215-218
- DDR3L (Double Data Rate 3L), 215
- DDR4 (Double Data Rate 4), 215
- DDR4L (Double Data Rate 4L), 215
- dead pixels, troubleshooting, 145
- Debian website, 939
- debris/dust, UPS/SPS battery backups, 1057
- Debugging Mode (Advanced Boot Options menu), 888
- decision structures (Windows scripting)
  - dual-alternative decision structures, 814-815
  - examples of, 816-817
  - multiple alternative decision structures, 815-816
  - relational operators, 813
  - single-alternative decision structures, 814
- declaring variables (Windows scripting), 809
- decoders, 322
- decrypting email, troubleshooting, 507
- Deep S4/S5 power setting (ACPI), 193
- default folders, 748
- default gateways, 668-669
- default printers, configuring, 389-390
- defrag command, 786
- defragmenting
  - hard drives, 235, 292-293, 786, 877
  - SSD, 293
- del command, 778, 787
- Delay Prior to Thermal power setting (ACPI), 193
- deleting
  - AD accounts, 986
  - credentials, 869
  - files, 787
    - manually deleting, 1005
    - removable media, deleting, 737
  - partitions, 278
- denatured alcohol, cleaning printers, 178
- density control blades (laser printers), 368-370
- DEP (Data Execution Prevention), 728, 1002-1003
- deploying
  - cloud services, 595-596
  - corporate Windows deployments, 842-843
  - image deployments, Windows, 833
- design
  - computer design
    - audio subsystems, 540
    - audio/video editing workstations, 530, 538
    - Bloom's Taxonomy, 528
    - cables, 537-538
    - CAD design workstations, 529, 538
    - CAM design workstations, 529, 538
    - cases, 538
    - cooling systems, 536
    - display subsystems, 541-542
    - energy efficiency, 535
    - gaming PCs, 529, 538
    - graphic design workstations, 529, 538
    - green (environmental) design, 535
    - home servers, 534, 538
    - industrial computers, 534
    - mobile computers, 535
    - motherboards, 536-537
    - NAS devices, 531-532
    - power supplies, 537-538
    - standard thick client workstations, 533, 538
    - storage subsystems, 539-540
    - thick client workstations, 533, 538
    - thin client workstations, 533, 538
    - virtualization workstations, 532, 538
  - storage devices, design components, 539-540
- desk controllers, projectors, 341
- desktops
  - Desktop & Screen Saver setting (macOS, System Preferences), 928
  - environmental enclosures, 1057
  - mobile devices, synchronization, 456
  - remote desktops, 1015
  - Remote Desktop Services, 674-675
  - storage cards, 424
  - virtual desktops, 594
- Windows
  - charms, 734-735
  - customizing, 735
  - icons, 733, 736
  - organizing, 735
  - paths, 736
  - Recycle Bin, 737
  - shortcuts, 736
  - Start screen, 734
  - tiles, 734-736
  - wallpaper schemes, 736
- Windows 7
  - notification area, 740
  - pinning apps to taskbar, 739
  - shutting down, 739
  - Start button, 738-739
  - taskbar, 737
- Windows 8
  - search function, 740
  - Start screen, 740-741
  - tiles, 741



- Windows 8.1
  - search function, 740
  - Start screen, 740-741
- Windows 10
  - Cortana search feature, 742
  - search function, 742
  - Start screen, 742
  - Task View, 743
  - wireless networks, 651
- destroying hard drives, 1002
- destruction (document security), certificates of, 965
- Details tab (Task Manager), 894
- developing cylinders (laser printers), 368-370
- device drivers
  - defined, 9
  - digital signatures, 853
  - roll back device drivers
    - accessing, 856
    - Administrator rights, 855
  - Windows
    - configuring, 851
    - installing, administrator rights, 853
- Device Manager
  - audio devices, troubleshooting, 854
  - exclamation points (!), 149
  - hardware verification, 148
  - installing devices, 852-854
  - interrupts, 128
  - IRQ, 130
  - running from command prompt, 780
  - smart card readers, 349
  - troubleshooting, 149, 854, 873
  - USB devices
    - installing, 134
    - troubleshooting, 136
  - user account management, 873
- Devices and Printers Control Panel (Windows), installing devices, 852
- DFS (Dynamic Frequency Selection), AP channel ID, 660
- DHCP (Dynamic Host Configuration Protocol), 696
  - alternative configurations, 668
  - client-side DHCP, 667
  - default gateways, 669
  - end-user device configuration, addressing, 666-667
  - reservations, 667
  - servers, 666-667, 693
  - wireless APs, 676
- diagnostics
  - diagnostic displays (motherboards), 549
  - DirectX, 788
  - hardware, 548-549
  - Memory Diagnostics tool (Windows), 234
  - POST cards, 548
  - UEFI, 548-549
- diagonal cutters, 166
- dialog boxes (Windows), 743
  - Apply button, 744
  - Cancel button, 744
  - Close button, 744
  - drop-down menus, 745
  - help, 745
  - OK button, 744
  - radio buttons, 744-745
  - tabs, 744
- dial-up networks, 574, 706
- DIB (Dual Independent Buses), 80
- Dictation & Speech setting (macOS, System Preferences), 929
- dictionary attacks, 972, 979
- differential backups, 999
- digital assistants, 683
- digital cameras
  - batteries, 342-344
  - camcorders, 344
  - file formats, 343, 355
  - memory card readers, 344
  - resolution, 342
  - security cameras, installing, 682
  - smart cameras, 421-423
  - storage, 343-344
  - troubleshooting, 344
  - webcams, 19, 344, 493, 498, 502
- digital media, DRM, 973
- digital modems, 579
- digital phone lines versus analog phone lines, 578
- digital security certificates, 1008
- digital signals, 35
- digital signatures, device drivers, 853
- digitized sound, 327
- digitizers
  - installing, 348
  - laptop displays, 493
- dim displays, troubleshooting, 509
- dim images, troubleshooting, 145
- DIMM (Dual In-line Memory Modules), 213-218, 221-228
- DIP (Dual In-line Package) chips, 213
- dir command, 726, 774-776, 787
- Direct Connect (AMD), 80
- directional antennas, 660

- directories. *See also* files; folders
  - AD, managing domains, 795
  - attrib command, 779
  - backups, 802
  - copying, 778-779, 786, 802
  - creating, 777
  - del command, 778
  - dir command, 787
  - diskpart command, 788
  - format command, 790
  - gpreresult command, 790
  - md command, 777
  - permissions, 969
  - rd command, 777
  - removing, 777-778, 797
  - renaming, 798
  - root directories, 771-773
  - subdirectories, 772
  - type command, 778
  - viewing attributes of, 779
  - xcopy command, 778
- DirectX
  - APIs, 329
  - diagnostics, 322, 788
  - troubleshooting, 322, 334
- dirt removal, 178-179
- Disable Automatic Restart on System Failure (Advanced Boot Options menu), 888
- disable command, 787
- Disable Drive Signature Enforcement (Advanced Boot Options menu), 888
- Disable Early Launch Anti-Malware Protection (Advanced Boot Options menu), 888
- Disable Execute Bit, 121
- disabling
  - AD accounts, 986
  - AutoPlay function, 1001
  - AutoRun function, 1001
  - drivers, 787
  - guest accounts, 982
  - interfering software, Windows OS installations, 841
  - services, 787, 895
  - unused ports, 962, 969
  - Windows applications, 891
- disappearing files, troubleshooting, 1004
- disassembly
  - adapters, 167, 173
  - all-in-one computers, 176
  - cables, 168-172
  - case removal, 168
  - connectors, 169-172
  - grounding problems, 162-165
  - hard drives, 173
  - laptops, 466, 475
  - motherboards, 174-175
  - power supplies, 198
  - preparing for, 167-168
  - storage devices, 173
  - tools, 165-167
- disk caches, 229-230, 287-289
- disk checking, 784-785
- Disk Cleanup tool, 291-292, 877
- disk formatting, 790
- disk imaging
  - corporate Windows deployments, 842
  - dism command, 788
  - MDT, 842
  - re-arming activation clocks, 842-843
  - reimaging hard drives, 842
  - SIM, 842
  - Sysprep, 842
  - WDS, 842
- disk maintenance, 876-877
- disk management, 273, 838
  - arrays, adding, 875
  - basic disks, 280
  - basic storage, 280
  - boot volumes, 281
  - drive letters, assigning/changing, 875
  - dynamic disks, 281
  - dynamic status state, 297
  - dynamic storage, 281
  - extending partitions, 875
  - GParted disk management tool (Ubuntu), 941, 949-950
  - hard drives, adding, 875
  - initializing, 875
  - mounting, 270, 875, 933
  - RAW volumes, 281
  - shrink partitions, 875
  - simple volumes, 281
  - spanned volume, 281
  - splitting partitions, 875
  - status states, 297-298
  - storage, 874-876
  - striped volumes, 281
  - system volumes, 281
  - Windows Disk Management, 273, 280-281, 838
- disk mirroring, 284
- disk striping, 283-284

- Disk Utility (macOS), 933
- diskpart command, 273, 279, 788
- dism command, 788
- DisplayPort, 38-39, 58, 467
- displays
  - aspect ratios, 541
  - backlights, 492
  - BSOD, 548
  - CCFL, 492-495
  - cleaning, 177-178
  - color depth, 855
  - computer design, 541-542
  - conferencing features, 541
  - contrast ratios, 541
  - Displays setting (macOS, System Preferences), 928
  - laptops, 491-492
    - digitizers, 493
    - inverters, 493, 499
    - microphones, 493, 498
    - removing displays, 495-496
    - repairing, 494
    - resolution, 495
    - webcams, 493, 498
    - WiFi antennas, 493
  - LCD, 492-495
  - LED, 492, 495
  - multiple displays, 339, 541
  - OLED, 492-494
  - orientation, 493
  - proprietary crash screens, 548
  - refresh rates, 855
  - resolution, 855
  - rotating/removable screens, 493
  - TFT, 492
  - touchscreens, 510
    - calibrating, 498
    - capacitive touchscreens, 496
    - IR touchscreens, 496
    - performance, 511
    - replacing, 496
    - resistive touchscreens, 495-496
    - surface wave touchscreens, 496
  - troubleshooting, 144-148, 509-510
  - types of, 541
  - video adapters, 541
  - Windows installations, 855
- disposal
  - aerosol cans, 179
  - batteries, 1046-1048
  - CRT monitors, 1046
  - electronics, 1045
  - mobile devices, 1046
  - monitors, 148
  - smartphones, 1046
  - tablets, 1046
  - toner, 1048-1049
- distended capacitors, 103-104
- distorted geometry, troubleshooting, 146
- distorted images, troubleshooting, 144
- distractions, avoiding, 1072-1073
- distro websites (Linux), 939
- DLL (Dynamic Link Library) extension, 747, 797
- DLP (Data Loss Prevention), 969
- DLP (Digital Light Processing), projectors, 341
- DMZ (Demilitarized Zones), 676, 1010
- DNAT (Destination NAT), wireless APs, 677
- DNS (Domain Name Service), 696
  - client-side DNS, 669
  - configuring, 1005-1007
  - end-user device configuration, addressing, 669
  - security, 1005, 1007
  - servers, 669, 687, 693
  - troubleshooting, 796
- DOC/DOCX (Microsoft Word) extension, 747
- Dock (macOS GUI), 919-920
- Dock setting (macOS, System Preferences), 928
- docking stations, 428-430, 468
- documentation
  - ADF, 18
  - business processes, 1064
  - change boards (change management), 1064
  - change documentation (change management cycle), 1065
  - critical recovery documents, 1000
  - incident reports, 1025-1026, 1040-1041, 1062-1063
  - inventory management documentation, 1063
  - IT documentation
    - incident reports, 1062-1063
    - inventory management documentation, 1063
    - knowledge bases/articles, 1062
    - network topology diagrams, 1060
    - policies, 1063-1064
  - MSDS, 179, 1041
  - PATA IDE storage devices, 266
  - plans for change (change management), 1064
  - policies, 1063-1064
  - recovery documents, 1000
  - SDS, 179, 1041
  - security, 965

- shredding, 965
- troubleshooting documents, creating, 554
- domain controllers, 732
- domains, 621, 625, 841
  - accessing, 732
  - adding computers to, 665
  - AD domains, managing, 795
  - corporate OS, 732
  - domain controllers, 665
  - managing, 794-795
  - security, 980
- dongles
  - USB-to-Bluetooth dongles, 446
  - USB-to-RJ-45 dongles, 444
  - USB-to-WiFi dongles, 448
- door locks (physical security), 683, 962
- DoS (Denial of Services) attacks, 979
- dot matrix printers. *See* impact printers
- double-sided/duplex printing (printer configuration), 391
- double-sided memory, 217
- double-tap gestures, 435
- downstream transmissions, cable modems, 584
- Doze Mode power setting (ACPI), 193
- DPI (Dots Per Inch), printers, 364-366
- draft mode (inkjet printers), 365
- DRAM (Dynamic RAM), 212-215
- drawing/illustration pads. *See* digitizers
- drivers
  - disabling, 787
  - enabling, 789
  - installing, 132-133
  - listsvc command, 789
  - load-alternate third-party drivers, 839
  - software drivers, troubleshooting, 144
  - viewing, 789
- drives
  - adding, 875
  - arrays, 282
  - buffers, storage device design considerations, 540
  - drive letters, 745, 875
  - drive not recognized errors, 293
  - DVD drives, 11
  - encryption, configuring, 121
  - external storage drives, 19
  - hard drives, 11, 262, 284-285, 294-295, 540
  - ODD, 540
  - optical drives, 11
  - PATA, 265-266
  - partitions (volumes), 837-838
  - SATA, 269
    - status, storage management, 874
  - DRM (Digital Rights Management), 973
  - drop-down menus (Windows dialog boxes), 745
  - DRV (Device Driver) extension, 747
  - DSL (Digital Subscriber Lines)
    - ADSL, 584-585
    - DSL modems, 584
      - bandwidth, 585
      - cable/modem connectivity, 586
      - phone filters, 586
      - ports, 585
      - troubleshooting, 691
    - G.SHDSL, 585
    - HDSL, 585
    - network connections, 706
    - PDSL, 585
    - SDSL, 585
    - UDSL, 585
    - VDSL, 585
    - xDSL modems, 584
  - DSL Reports website, 585
  - dual Molex-to-PCIe power converters, 186
  - dual-alternative decision structures, 814-815
  - dual-boot systems (macOS), 731
  - dual-channel memory, 220-223
  - dual-core processors, 80
  - dual-link DVI connectors, 36
  - dual-rail power supplies, 194
  - dual-voltage, 188
    - memory, 217, 482
    - power supplies, 184
  - dumpster diving, 965
  - duplex/double-sided printing (printer configuration), 391
  - duplexes (NIC), 671-672
  - duplexing assemblies (printers), 360, 376
    - inkjet printers, 365
    - laser printers, 370
  - dust/air filter masks (safety equipment), 1044
  - dust/debris, UPS/SPS battery backups, 1057
  - DVD (Digital Video Disc), 314-316
    - burning, 317
    - CDs & DVDs setting (macOS, System Preferences), 928
    - cleaning, 323, 327
    - decoders, 322
    - handling, 322
    - Linux bootups, 939
    - region codes, 317-318

- DVD drives, 11, 314
  - decoders, 322
  - region codes, 317-318
- DVD-ROM discs, 315
- DVD-RW DL drives, 315
- DVD-RW drives, 315
- DVI (Digital Visual Interface) ports, 36-37
- DVI cables, 37
- DVI connectors, 37, 58
- DVI-A connectors, 58
- DVI-D connectors, 36, 39, 58
- DVI-I connectors, 36, 39
- DVI-to-HDMI adapters, 41
- DVI-to-VGA adapters, 41
- dxdiag command, 143, 322, 788
- dye sublimation printers, 366
- dynamic disks
  - managing, 281
  - partitions, 838
- dynamic status state (disk management), 297
- dynamic storage (disk management), 281

## E

---

- e-clips (laser printers), 385
- e-readers, 421-422
- EAP (Extensible Authentication Protocol), 1018
- earrings (smart), 426
- Easy Transfers, 835
- EB (Exabytes), 24
- ECC (Error Correcting Code), memory, 217-218
- ECP (Electronic Control Packages), laser printers, 370
- edit command, 845
- editing
  - variables (Windows)
    - environment variables, 805
    - scripting variables, 809
  - Windows registry, 759-760
  - workstations (audio/video), 530, 538
- effective permissions, 995-996
- EFS (Encrypting File System), 733, 1001
- EIDE (Enhanced IDE), 259
- elasticity (rapid), cloud computing, 597
- electricity
  - AC/DC, 180
  - amps (amperes), 182
  - blackouts, 1051
  - brownouts, 1051
  - capacitors, 182
  - continuity checks, 182-183
  - current, 182
  - fire safety, 1041
  - line conditioners, 1053
  - meter readings, 183
  - ohms, 182-183
  - power
    - consumption, 194-195
    - measuring, 182
    - power supplies, 184
  - resistance, 182
  - safety, 182-183
  - sags, 1051
  - spikes, 1050
  - standby power, 181
  - surge protectors, 1051-1053
  - surges, 1050
  - troubleshooting, 1050-1051
  - voltage, 181-182
    - 115 V vs 220 V input voltage, 184
    - DC, 189
    - dual-voltage, 188
    - dual-voltage power supplies, 184
    - watts, 182
- electromagnetic interference (EMI), 165
- electronic disposal/recycling, 1045
  - batteries, 1046-1048
  - CRT monitors, 1046
  - mobile devices, 1046
  - smartphones, 1046
  - tablets, 1046
- electronic key cards, 961
- email
  - cloud computing, 594
  - decrypting, troubleshooting, 507
  - Exchange Online, 454
  - filtering, 969
  - hijacked accounts, 1007
  - IMAP, 453
  - mail servers, 693
  - MIME, 454
  - mobile devices, 453-455
  - POP3, 453
  - S/MIME, 454
  - security, 1007
    - filtering, 969
    - policies, 961
  - SMTP, 453
  - spam, 1007
  - SSL, 453
  - troubleshooting, 507

- embedded systems, 694
- emergency notifications (mobile device OS), 441
- emergency procedures (security policies), 961
- EMI (Electromagnetic Interference), 165
- emptying Recycle Bin, 737
- emulators (virtualization), 591
- Enable Boot Logging (Advanced Boot Options menu), 888
- enable command, 789
- Enable Low-Resolution Video (640-480) (Advanced Boot Options menu), 888
- encryption
  - AES, 651, 671, 1001
  - BitLocker, 732, 1000
  - BitLocker To Go, 1000
  - defined, 963
  - drive encryption, 121
  - EFS, 733, 1001
  - files, 753, 785, 1001
  - folders, 753, 785, 1001
  - full device encryption, 1000-1001
  - NIC (wireless), 670
  - subfolders, 1001
  - TKIP, 670
  - TPM, 121
  - web browsers, 608
  - WEP, 670, 1019-1020
  - wireless NIC, 670
  - WPA, 670
  - WPA2, 670
  - WPA2 with AES, 671
- end-of-life concerns (software), 730
- end-point management servers, 693, 1016
- end-user acceptance (change management cycle), 1065
- end-user device configuration
  - addressing, 665
    - alternative IP addresses, 668
    - APIPA, 667
    - default gateways, 668-669
    - DHCP, 666-667
    - DNS, 669
    - statically configuring IP addresses, 666
  - overview of, 664
- end-user education (security)
  - AUP, 973
  - domains, 980
  - licensing software/apps, 973
  - regulated data, 974-975
  - security threats
    - access attacks, 979
    - backdoor attacks, 979
    - botnets, 979
    - brute force attacks, 979
    - DDoS attacks, 979
    - dictionary attacks, 979
    - DoS attacks, 979
    - malware, 975-978
    - MITM attacks, 979
    - phishing, 978
    - rainbow table attacks, 979
    - reconnaissance attacks, 980
    - replay attacks, 980
    - Smurf attacks, 980
    - social engineering attacks, 972, 978
    - spoofing attacks, 980
    - TCP/IP hijacking, 980
    - trapdoor attacks, 979
    - vulnerability scanners, 980
    - zero day attacks, 980
    - zombie attacks, 980
    - workgroups, 980
- energy absorption/dissipation, surge protectors, 1052
- energy efficiency, computer design, 535
- Energy Saver setting (macOS, System Preferences), 928
- ENERGY STAR, computer design, 535
- Enhanced IDE (EIDE), 259
- entry control rosters (physical security), 963
- environment variables (Windows scripting)
  - accessing, 805
  - creating, 807
  - editing paths of, 805
  - viewing, 807
- environmental concerns (green)
  - computer design, 535
  - impact guidelines, 1045
  - monitors, 196
  - recycled paper and printers, 375
- environmental enclosures, 1057
- EoP (Ethernet over Power), 641
- EPEAT rating system, computer design, 535
- EPS (Encapsulated Postscript File) extension, 747
- equality operators (==), 814
- erasable-bond paper and printers, 375
- erase lamps (laser printers), 368-370
- erasing hard drives, 933, 1001
- error checking tools, 290, 877
- error codes (printers), 402
- error messages
  - POST error messages, 123, 547-548
  - reviewing (troubleshooting), 543
  - troubleshooting, 543-548

- eSATA (External SATA), 264
  - brackets, 138
  - cards, 138, 268
  - drives, partitions, 276
  - installing devices, 269-270
  - ports, 51, 59
  - unmounting devices, 270
- ESCD (Extended System Configuration Data), 132
- ESD (Electrostatic Discharge), 165
  - antistatic bags, 164
  - atmospheric conditions, 162
  - component handling/storage, 1049
  - defined, 162
  - effects of, 162
  - ESD mats, 164, 1049
  - ESD straps, 162-163, 1049
  - self-grounding methods, 164, 1049
- Ethernet
  - cables
    - Cat 5 cables, 54-55
    - Cat 5e cables, 54-55
    - Cat 6 cables, 54-55
    - Cat 7 cables, 54-55
    - plenum cables, 56
    - PVC cables, 56
    - STP cables, 55
    - UTP cables, 54-55
  - hubs, 626
  - MetroE network connections, 706
  - networks
    - 10BaseT standard, 641
    - 10GBaseER standard, 641
    - 10GBaseLR standard, 641
    - 10GBaseLX4 standard, 641
    - 10GBaseSR standard, 641
    - 10GBaseT standard, 641
    - 100BaseT standard, 641
    - 1000BaseLX standard, 641
    - 1000BaseSX standard, 641
    - 1000BaseT standard, 641
    - CSMA/CD, 640
    - EoP, 641
    - Fast Ethernet, 695
    - full duplex, 640-641
    - half-duplex, 640-641
- NIC
  - installing, 139
  - star topologies, 626
- PoE
  - PoE injectors, 657
  - switches, 657
- ports, 51-52, 59, 582
- star topologies, 626-627
- switches, 626, 657
- USB-to-Ethernet converters, 47
- wired Ethernet networks, projectors, 341
- ethics (work) and technicians, 410
- EULA (End-User Licensing Agreements), 973
- event logging (auditing), 988
- Event Viewer, 863
  - application logs, 864-865
  - filters, 864
  - forwarded events logs, 865
  - security logs, 865
  - setup logs, 865
  - symbols, 865-866
  - system logs, 864-865
  - troubleshooting, 866
  - vendor-specific logs, 865
- exabytes (EB), 24
- Exchange Online, mobile device email configuration, 454
- exclamation points (!), Device Manager, 149
- execute disable and DEP, 1003
- EXE (Executable) file extension, 747
- exFAT (FAT64) file systems, 839
- exFAT file systems, 273
- exit command, 789, 1106
- exit options (BIOS/UEFI), 122
- expand command, 789, 1106
- expansion slots, 14-15, 93
  - AGP, 95
  - bus bandwidth comparisons, 97
  - covers and EMI/RFI, 165
  - laptops, 469-470
  - M.2 expansion cards, 470
  - NVMe cards, 470
  - PCI, 94
  - PCIe, 96-99
  - types, 94
- expectations, meeting, 1075
- expiration dates (passwords), 972
- explorer command, 789
- exposing phase (laser printers), 368
- ExpressBus drives, 343
- ext3 file systems, 274, 839, 942
- ext4 file systems, 274, 839, 942
- extended partitions, 276, 838
- Extended System Configuration Data (ESCD), 132

- extenders (wireless), 656
- extending partitions, 282, 875
- extensible software, 731
- extensions (files), 746-748
- Extensions setting (macOS, System Preferences), 928
- external cables, removing, 168
- external connectivity
  - cables, 40-41, 168
  - connectors, 34, 39-40, 58
  - ports, 34-35, 39-41, 58
- external data buses, 73
- external hard drives, 484, 880
- external modems, 574
- external monitors, troubleshooting, 509
- external networks option (VM), 591
- External SATA. *See* eSATA
- external shared resources (cloud computing), 597
- external speakers, 331, 428-429
- external storage drives, 19

## F

- facial recognition devices, 500, 967-968
- factory recovery partitions, 833
- factory resets
  - Android devices, 460
  - mobile devices, 500-501
- faded print (printer issues), 404
- failed logins, 501, 972, 983
- failed password attempts, 972
- failed print jobs, troubleshooting, 407
- failed status state (disk management), 297
- fails to start errors (services), troubleshooting, 895
- failures to boot, troubleshooting, 882
- fans, 86-87
  - auxiliary fans
    - installing, 189-190
    - power consumption, 195
  - BIOS setting, 120
  - installing, 91-92, 189-190
  - power consumption, 195
  - power supplies, 189
  - processors, 92
  - troubleshooting, 197-199
- Fast Ethernet, 695
- FAT (File Allocation Tables), 279
- FAT file systems, 273
- FAT16 file systems, 838
- FAT16 partitions, 275
- FAT32 file systems, 273, 839

- FAT32 partitions, 275
- FAT64 (exFAT) file systems, 839
- fault tolerance, 285
  - BIOS configuration settings, 284
  - hardware, configuring, 282
  - hot swapping, 284
  - levels, 283-284
  - software, configuring, 283
- faxing, VoIP interference, 581
- FCBGA (Flip Chip Ball Grid Array) sockets, 85
- FCM (Flash Cache Modules), 258, 283
- FDDI (Fiber Distributed Data Interface), 695
- Fedora website, 939
- feed assemblies, thermal printers, 371
- feedback (communication skills), 1074
- feeders/trays (printers), 365, 375-376, 402
- female ports, 34
- FFBDIMM (Fully Buffered DIMM), 217
- fiber cables, 56-57, 641
- fiber networks, cable modems, 583
- fiber-optic cables, 583
- FIFO serial ports, 577
- filaments (plastic), 3D printers, 373-374
- File Allocation Tables (FAT), 279
- File Explorer. *See also* Windows Explorer
  - drive letters, 745
  - files
    - display options, 997
    - indexes, 751
    - searches, 751
    - structure of, 772
  - paths, 748-749
  - view options, 749-750
- File History, 849
- file servers, 693
- file systems
  - APFS, 934
  - CDFS, 273
  - defined, 273
  - exFAT, 273
  - ext3, 274
  - ext4, 274
  - FAT, 273
  - FAT16, 275
  - FAT32, 273-275
  - HFS, 274
  - HFS+, 934
  - Linux, 941-942
  - NFS, 274
  - NTFS, 273-278



- partitioning drive space (Windows installations), 837
- volume structure, 279
- types, determining, 273
- Windows file systems, 279, 838-839
- files
  - attributes, 752, 779, 996
  - backups, 460, 760-761, 802
  - .bat files, 804
  - batch files, 804
  - capturing, 8
  - compressing, 752
  - copying, 752-754, 786, 798, 802
  - defined, 725, 731
  - deleting, 737, 787, 1005
  - directories
    - attrib command, 779
    - copy command, 778-779
    - copying files, 778-779
    - creating, 777
    - del command, 778
    - md command, 777
    - rd command, 777
    - removing, 777
    - removing files, 778
    - robocopy command, 778
    - root directories, 771-773
    - subdirectories, 772
    - type command, 778
    - viewing files, 778-779
    - xcopy command, 778
  - disappearing files, troubleshooting, 1004
  - .dll files, registering, 797
  - encryption, 753, 785, 1001
  - extensions, 746-748
  - File Explorer display options, 997
  - file-level backups, 999
  - filenames, 745-746
  - formats, 355
  - indexing, 751
  - libraries, 746
  - moving, 752-754
  - paths, 736, 748-749
  - permissions, 989, 1004
  - print to file option (virtual printing), 378
  - .psl files, 804
  - .py files, 804
  - quarantined files, 1005
  - recovering, 290, 1000
  - removable media, deleting, 737
  - renaming, 798
  - saving, 748, 760-761
  - scripting files, 804
  - searches, 751
  - security, 991, 1005
  - .sfc files, 845
  - .sh files, 804
  - shared files, 995
  - storage, cloud computing, 594
  - swap, 289
  - system files, 880, 1004
  - text files, 8
    - scripts as, 803-805
    - viewing, 792, 802
  - uncompressing, 789, 1106
  - .vbs files, 804
  - viewing attributes of, 779
  - Windows Explorer display options, 997
- film scanners, 335
- filtering
  - content, 1016
  - email, 969
  - Event Viewer, 864
  - MAC addresses, 1022
  - privacy, 963
- filters/masks (air), 178
- Finder (macOS GUI), 919
- finger-based gestures (macOS GUI), 922
- fingerprint readers/locks, 346-347, 500, 967
- fire extinguishers, 1041
- firewalls, 644, 968
  - antimalware software and, 1009
  - antivirus software and, 1009
  - DMZ, 1010
  - port forwarding, 1011
  - port triggering, 1011
  - Windows Firewall, 1010
    - alert options, 1011
    - allowing programs through, 1011
    - profiles, 1012
    - troubleshooting, 1012-1013
    - verifying operation, 1011
  - wireless networks, 1017
- firmware
  - AP and, 1023
  - defined, 10
  - mobile devices, security, 500
  - printers, 404
  - radio firmware updates, 437

- UEFI, 116-122
  - ACPI settings, 192-193
  - AMI BIOS/UEFI chips, audio beeps (POST codes), 546
  - boot process, 545
  - configuring, 271
  - diagnostics, 548-549
  - error messages (POST codes), 547-548
  - flashing the UEFI, 124-125
  - hard drive configuration, 271
  - hardware configuration, 132
  - Phoenix BIOS/UEFI chips, audio beeps (POST codes), 547
  - RAID configuration, 284
  - recovery methods, 125
  - troubleshooting, 149
  - updating, 126
- updating, 124-126
- wireless AP, 676
- fitness apps, synchronization, 455
- fitness monitors, 426-427
- five-wire resistive touchscreens, 496
- flash BIOS, 118, 124-125
- flash drives, Linux bootups, 939
- flash memory
  - CF, 343
  - defined, 424
  - FCM, 258
  - internal memory, viewing, 424
  - MMC, 343
  - NAND, 257
  - removing, 236
  - security, 236
  - SSD, 483-485
  - thumb drives, 236
  - troubleshooting, 236
  - USB flash drives, 235-236
- flashing the BIOS/UEFI, 124-125
- flashlights, 166
- flatbed scanners, 18, 335-337
- flick gestures, 435
- flickering displays, troubleshooting, 145, 510
- floating-point numbers (Windows scripting, variables), 810
- flow control, serial ports, 577
- flowcharts (troubleshooting), 555-558
- FM2 sockets, 86
- FM2+ sockets, 86
- folders
  - app organization, 442
  - attributes, 752
  - backups, 760-761
  - compressing, 752
  - copying, 752-754
  - default, 748
  - defined, 725
  - directory folders, creating, 792
  - encryption, 753, 785, 1001
  - File Explorer display options, 997
  - hidden shared folders, 998
  - home folder (AD), data storage, 986
  - indexing, 751
  - moving, 752-754
  - naming, 745-746
  - paths, 736
  - Public, 992
  - redirecting, AD, 986
  - saving, 760-761
  - searches, 751
  - security, 991
  - share permissions, 988-991
  - shared folders, 866, 995-996
    - access denied messages, 992
    - AD accounts, 988
    - hidden shared folders, 998
    - mapping to shares, 703-704
    - Sharing tab, 702-703
  - subfolders, 746
  - Windows Explorer display options, 997
- following up with customers (troubleshooting), 554
- for loops (Windows scripting), 819-820
- Force Quit (macOS), 926
- force stopping apps, 442
- foreign status state (disk management), 297
- format command, 790, 1002
- Form Factor field (Task Manager Performance tab), 233
- form factors
  - cases, 186, 538
  - hard drives, 253
  - motherboards, 101-102, 186, 536-537
  - power supplies, 185-186
- formatting
  - disks, 790
  - files, 355
  - full formats, 279
  - hard drives, 272, 279-280, 790, 838, 1001
  - passwords, 972
  - quick formats, 279
  - text files, 8
- forward compatibility, 731
- forwarded events logs (Event Viewer), 865

forwarding ports, 1011  
 four-wire resistive touchscreens, 496  
 Frame Relay, network connections, 706  
 Free Physical Memory field (Task Manager Performance tab), 231  
 freeware, 973  
 frequencies  
   defined, 24  
   frequency response  
     sound cards, 327  
     speakers, 331  
   RFI, 165  
 Friend, Ernie, 552  
 front panel connectors, 171  
 frozen mobile devices, troubleshooting, 512  
 FSB (Front Side Buses), 76  
 FTP (File Transfer Protocol), 696  
 fuel cells (laptops), 473  
 full backups, 999  
 full control NTFS permission, 995  
 full device encryption, 1000-1001  
 full duplex Ethernet, 640-641  
 full formats, 279, 838  
 full system functionality (troubleshooting), verifying, 554  
 fuser assemblies (laser printers), 368-370  
 fuser cleaning pads/fuser wands (laser printers), 385  
 fuses  
   continuity checks, 183  
   replacing, 184  
 fusing rollers (laser printers), 370, 386  
 FX processors, 84

## G

G.SHDSL (G.Symmetric High-speed DSL), 585  
 gadgets, 730  
 gain (antennas), 662  
 game controllers, 19, 347-348  
 game ports, 59  
 games  
   accelerometers, 439  
   apps, 439  
   game pads, 428-429  
   gyroscopes, 439  
 gaming PC, 529, 538  
 garbled characters (printer issues), 403  
 gateways (default), 668-669  
 GB (Gigabytes), 22-24  
 GDDR (Graphics Double Rate) modules, 141  
 GDPR (General Data Protection Regulation), 975  
 geek speak (communication skills), 1069  
 general-purpose cleansers, 178  
 general-purpose cloths, cleaning cases, 178  
 general-purpose GPU (GPGPU), 82  
 General setting (macOS, System Preferences), 928  
 General tab  
   Internet Explorer 11, Internet Options window, 598-600  
   Properties dialog, troubleshooting with, 149  
 generic credentials, 867  
 Gentoo website, 939  
 geotracking apps, 439-441  
 gestures  
   macOS GUI, 922  
   mobile devices, 434-435  
 ghost cursors (trackpads), troubleshooting, 509  
 ghost images (printing issues), troubleshooting, 409  
 GHz (Gigahertz), 73  
 GIF (Graphics Interchange Format) extension, 337, 747  
 glass (scanners), 338  
 glasses  
   safety glasses/goggles, 178, 1043  
   wearable technology, 426-427  
 gloves (safety equipment), 1043  
 gold contact cleaners, 178  
 Google  
   Android synchronization, 457  
   Chrome OS, 423, 729  
 Google Cloud Print, 400  
 Google Drive, 460  
 Google/Inbox, mobile device email configuration, 454  
 Google Play, 442  
 government regulations  
   local government regulations, workplace safety, 1040  
   OSHA  
     environmental impact guidelines, 1045  
     fire safety, 1041  
     MSDS, 1041  
     personal safety, 1044  
     SDS, 1041  
     technical field kits, 1043-1044  
     toxic waste handling, 1044  
 GParted disk management tool (Ubuntu), 941, 949-950  
 GPGPU (General Purpose GPU), 82  
 gresult command, 790, 988, 1110  
 GPS (Global Positioning Systems), 420-421, 439, 448  
   security, 500  
   troubleshooting, 514  
 GPT (GUID Partition Tables), 279, 838

- GPU (Graphical Processing Units), 140
  - GPGPU, 82
  - iGPU, 82, 121
- gpupdate command, 790-791, 988
- graphic design workstations, 529, 538
- graphical interface fails to load errors, 883
- grayware, incident reports, 1026
- green (environmental) concerns
  - computer design, 535
  - monitors, 196
  - motherboards, 101
  - processors, 101
  - recycled paper and printers, 375
- grep command (macOS), 935, 938
- grooming/appearance (communication skills), 1067
- grounding, 1050
  - antistatic bags, 1049
  - EMI, 165
  - ESD, 162-165, 1049
  - RFI, 165
  - self-grounding, 164, 1049
- group policies, 987-988
  - refreshing settings, 790-791
  - viewing, 790, 1110
- groups
  - AD groups, adding users to, 984
  - Administrators, 981
  - backup operators, 981
  - Guest, 981
  - Local Users and Groups tool (Windows), 870-871
  - Network Configuration Operators, 982
  - Offer remote Assistance Helper, 982
  - Performance Log Users, 982
  - power users, 982
  - Power Users groups, 871
  - users, 982
- GRUB (Grand Unified Boot Loader), 952
- GSM (Global System Mobile), 695
- guards (security), 962
- Guest groups, 981
- guest users, 981-982
- GUI (Graphical User Interfaces), 724-726
  - launchers and, 441
  - macOS, 919-922
  - Unity (Ubuntu), 940-941
- gyroscopes, gaming apps, 439

## H

---

- half-duplex Ethernet, 640-641
- hand scanners (biometrics), 967
- handheld scanners, 335
- Handles field (Task Manager Performance tab), 231
- handshaking, serial ports, 577
- Hard disk install failure message, 547
- hard drives
  - 1.8 inch hard drives, 483
  - 2.5-inch hard drives, 253, 483
  - 3.5-inch hard drives, 253
  - adding, 875
  - backups, 998-999
  - BIOS configuration, 271
  - caching (printers), 401
  - clusters, 274-276
  - cylinders, 256
  - defined, 11
  - defragmenting, 235, 292-293, 786, 877
  - destroying, 1002
  - disk caches, 287-289
  - Disk Management tool, 838
  - drive arrays, 282
  - drive letters, 279, 745, 875
  - drive not recognized errors, 293
  - drive status, storage management, 874
  - erasing, 1001
  - eSATA, unmounting, 270
  - external hard drives, 484, 880
  - FAT, 279
  - fault tolerance, 284-285
  - form factors, 253
  - formatting, 790
    - full formats, 838
    - low-level format utility, 1001
    - quick formats, 838
  - head crashes, 255
  - hibernation mode, 280
  - high-level formatting, 272, 279-280
  - HPA, 278
  - hybrid drives, 483
  - IDE, 262-264
  - imaging, 842
  - installing, 293-298
  - interfaces, 258-264
  - internal fixed disks, 880
  - internal hard drives
    - laptops, 484
    - partitions, 880

- JBOD, 281
- lack of space, 235
- laptops, 467, 483-485
- Linux, partitioning drives, 948-950
- low-level formatting, 272
- macOS
  - APFS, 934
  - erasing drives, 933
  - HFS+, 934
  - mounting drives, 933
  - partitioning drives, 934
  - repairing drives, 933
- magnetic, 254-256
- maintenance, 876-877
- mapping, 688
  - from command prompts, 703
  - to shares, 703-704
- mechanical drives, 483, 486
- mounting, 270, 875, 933
- MTBF, 255
- NAS drives, 259
- noisy, 486
- optimizing, 877
- overwriting, 1001
- paging files, 229
- parallel interfaces, 259
- partitions, 272-273, 277-282, 745, 788
  - boot partitions, 278, 881
  - boot volumes, 880
  - converting, 274
  - deleting, 278
  - extended partitions, 276, 875
  - FAT16 partitions, 275
  - FAT32 partitions, 275
  - GPT, 279
  - NTFS partitions, 275-276
  - primary partitions, 276
  - recovery partitions, 833
  - shrink partitions (disk management), 875
  - splitting partitions (disk management), 875
  - system partitions, 278
  - system volumes, 880
- PATA, 265-266
- PATA IDE, power consumption, 195
- performance, 235, 290, 297, 877
- platters, 254
- preparations, 272
- preventive maintenance, 290-293
- RAID, 282-284, 298
- read/write failures, 297
  - reimaging, 842
  - removing, 173, 285, 484
  - repairing/recovering, 783-784
  - replacing, 484
  - RPM, 255
  - SATA, 195, 267-270
  - sectors, 256
  - SSD, 257, 483-485
  - storage device design considerations, 540
  - swap files, 229
  - tracks, 255
  - troubleshooting, 235, 255, 290-298
  - Ubuntu, partitioning drives, 948-950
  - upgrading, 235, 485
  - virtual memory, 229-230, 288-289
  - Virtual PC hard disk space, 592
  - volumes, 276
  - Windows
    - formatting hard drives, 838
    - planning drive space, 837
    - recovery partitions, 833
  - wiping, 1001
  - writing to, 254
- hard resets, mobile devices, 504-505
- hardware
  - cable modems, 584
  - configuring, 132
  - defined, 9
  - diagnostics, 548-549
  - drivers, load alternate third-party drivers, 839
  - errors, troubleshooting, 550
  - laptops, 466
  - troubleshooting, 549
  - Windows installation requirements, 839
- Hardware Monitor, configuring, 121
- Hardware Reserved field (Task Manager Performance tab), 233
- hardware tokens, 962-964
- HDCP (High-Bandwidth Digital Content Protection), 40
- HDI (Head-to-Disk Interference), 255
- HDMI (High-Definition Multimedia Interface)
  - connectors, 444
  - DVI-to-HDMI adapters, 41
  - ports, 38-39, 58
- HDSL (High bit-rate DSL), 585
- head crashes, 255
- headers (OSI model), 643
- headphones, 334, 513

- headsets, 19, 330, 429
    - AR headsets, 428
    - cell phone headsets, 652
    - VR headsets, 18, 428
  - healthy status state (disk management), 297
  - heat pipes, 86
  - heat sinks, 86-87
    - airflow, 190
    - installing, 91-92
  - heat spreaders, 215
  - heavy lifting, 25
  - help
    - commands, finding help for, 782
    - net help command, 688
    - PowerShell, 821
    - Windows dialog boxes, 745
  - help command, 791
  - hertz, defined, 24
  - hexa-core processors, 80
  - HFS (Hierarchical File Systems), 274, 839
  - HFS+ (Hierarchical File System Plus), macOS support, 934
  - hibernation mode
    - ACPI, 192
    - hard drives, 280
    - RAM, 280
  - hidden shared folders, 998
  - hidden shares, 991-992
  - high resource utilization (mobile devices), 505
  - high voltage power supplies (laser printers), 370
  - high-level formatting, hard drives, 272, 279-280
  - hijacked email accounts, 1007
  - hijacked web browsers, 608-610
  - hijacking TCP/IP, 980
  - history, web browsing, 599
  - Hkey\_Classes\_Root subtree, 759
  - Hkey\_Current\_Config subtree, 759
  - Hkey\_Current\_User subtree, 759
  - Hkey\_Local\_Machine subtree, 758
  - Hkey\_Users subtree, 758
  - HLP (Help) file extension, 747
  - hold gestures, 435
  - home folder (AD), data storage, 986
  - home networks, 625
  - home server computers, 534, 538
  - HomeGroups, 621-623, 841
    - creating, 704-706
    - passwords, 972
  - hop command, 726
  - host addresses, 647
  - host machines, virtualization, 590
  - Host-only mode (virtual NIC), 673
  - hosted hypervisors. *See* Type 2 hypervisors
  - Hot Key Power On power setting (ACPI), 193
  - hot swapping, RAID drives, 284
  - hotfixes, 846
  - hotspots, 449, 587
  - HPA (Host Protected Area), 278
  - HT (Hyper-Threading Technology), 79
  - HTML (Hypertext Markup Language), 695
  - HTTP (Hypertext Transfer Protocol), 696
  - HTTPS (HTTP over SSL), 697
  - hubs
    - defined, 626
    - Ethernet, 626
    - self-powered hubs, 46
    - switches versus, 626
    - USB hubs, 46, 136
  - humidity
    - component handling/storage, 1049
    - UPS/SPS battery backups, 1059
    - paper, 375
  - humility (technician skills), 953
  - hybrid clouds, 596
  - hybrid drives, 483
  - hybrid SSD, 258
  - Hyper-V, 592, 832
  - hyperthreading, 79, 120
  - HyperTransport, 80
  - hypervisors, 590-591
- 
- I**
- I/O (Input/Output) addresses, 127, 130-131
  - I/O shields, 174
  - IaaS (Infrastructure as a Service), 594
  - iCloud (macOS), 922, 928
    - Apple iOS device synchronization, 458
    - Back to My Mac, 923
    - backups, 461
    - mobile device email configuration, 454
    - screen-sharing, 923-924
  - ICMP (Internet Control Message Protocol), 695, 980
  - icons, Windows desktop, 733, 736
  - ID cards
    - magnetic card readers, 19, 428, 431
    - process ID, listing, 801
    - RFID, security, 962

- IDE (Integrated Drive Electronics), 259-261
  - cables, 260
  - configuring, 121
  - connectors, 171
  - eSATA, 264
  - PATA, 261-262, 265-266
  - SATA, 261-263
- identifying problems (logical troubleshooting), 543
- IDS (Intrusion Detection Systems), 1016
- IEEE 802.11 wireless standards, 447-448
- ifconfig command, 686, 945-946
- iGPU (integrated GPU), 82, 121
- illustration/drawing pads. *See* digitizers
- image deployments, Windows, 833
- image management software, 674
- images
  - distorted images, troubleshooting, 144
  - print to image option (virtual printing), 378
  - system images, 760-761
- imaging
  - backups, 999
  - corporate Windows deployments, 842
  - dism command, 788
  - MDT, 842
  - re-arming activation clocks, 842-843
  - reimaging hard drives, 842
  - SIM, 842
  - Sysprep, 842
  - WDS, 842
- imaging drums (laser printers), 370
- IMAP (Internet Message Access Protocol), 453, 697
- IMEI (International Mobile Equipment Identity), 435-436
- impact printers
  - advantages, 363
  - bidirectional printing, 363
  - defined, 361
  - feeders/trays, 375
  - maintenance, 381
  - overheating, 363
  - paper, 363
  - print heads, 361-363
  - printheads, 361
  - print ribbons, 361
  - print wires, 361
  - re-inking, 380
  - troubleshooting, 407-408
- impersonation (social engineering attacks), 978
- IMSI (International Mobile Subscriber Identity), 436
- In Use field (Task Manager Performance tab), 232
- in-place upgrades, Windows, 833-846
- incident reports, 1025-1026, 1040-1041, 1062-1063
- incineration (document security), proof of, 965
- incorrect color patterns, troubleshooting, 144
- incremental backups, 999
- indexing files/folders, 751
- indicator lights
  - POST, 116
  - printers, 402
- industrial computers, 534
- INF (Information) file extension, 747
- infconfig command (Linux), 944
- information technology (IT)
  - certifications, 5-6
  - skills, 6-8
- Infrared (IR) wireless input devices, 60
- infrastructure mode
  - wireless networks, 654
  - wireless printers, 398
- inherited permissions, 995
- INI (Initialization) file extension, 747
- Initialize Disk option (disk management), 298
- initializing
  - disk management, 875
  - variables (Windows scripting), 810
- ink cartridges, 363-365, 387
  - CIS, 379
  - inkjet printers, 366
  - laser printers, 409
  - recycling, 379
  - refilling, 379-380
  - replacing, 384
  - toner, 370-371, 380
  - troubleshooting, 409
- Ink setting (macOS, System Preferences), 928
- inkjet printers, 376
  - alternatives, 366
  - belts, 365
  - carriages, 365
  - color printing, 365-366
  - defined, 361
  - disadvantages, 366
  - duplexing assemblies, 365
  - ink cartridges, 363-365
  - maintenance, 381-383
  - modes, 365
  - optimized DPI, 366
  - paper trays/feeders, 365
  - power supplies, 365
  - print heads, 363-364, 382
  - refilling cartridges, 379

- rollers, 365
- stabilizer bars, 365
- stepper motors, 365
- troubleshooting, 408
- input (Windows scripting), 808
- input devices
  - cameras/webcams, 19
  - game controllers, 19
  - headsets, 19
  - keyboards, 16-18, 58
    - laptops, 478-481
    - Num Lock indicator lights, 507
    - ports, 34-35
    - special function keys, 480-481
    - sticking keys, 508
    - troubleshooting, 507-508
  - mice, 16-18, 34-35, 58
  - microphones, 19
  - signature pads, 19
  - touchpads, 19, 479
  - trackpads, 509
  - wireless, 59-60
- installing
  - adapters, 15, 132-135
  - apps, 442
    - troubleshooting, 506
    - Windows installations, 857-860
  - ATX connectors, 189
  - automated installations, 842-843
  - barcode scanners, 346
  - biometric devices, 346-347
  - Bluetooth, mobile devices, 446
  - clean installations, 462, 833-834
  - devices in Windows
    - audio devices, 854
    - Device Manager, 852-854
    - Devices and Printers Control Panel, 852
    - displays, 855
    - troubleshooting installations, 855-857
  - digital assistants, 683
  - digitizers, 348
  - door locks (smart), 683
  - drivers, 132-133
  - eSATA
    - brackets, 138
    - cards, 138
    - drives, 269-270
  - fans, 91-92, 189-190
  - fingerprint readers, 346-347
  - game controllers, 347
  - hard drives, 293-298
  - heat sinks, 91-92, 190
  - joysticks, 347
  - light switches (smart), 681
  - memory, 227-228, 234
    - buying memory, 224-226
    - laptops, 482
    - overview of, 226
    - planning installations, 214-226
    - researching memory, 224-226
    - types of memory to install, 220-223
  - motion sensors, 348
  - NIC, 139, 671
  - ODD, 319-321
  - PATA
    - cables, 265
    - devices, 265-266
  - printers, 389, 393, 403
    - local printers, 388
    - USB printers, 386-388
  - processors, 88-90
  - RAM, 234
  - remote network installations, Windows, 833
  - repair installations, Windows, 833
  - SATA drives, 267-270
  - security cameras, 682
  - smart card readers, 348
  - software, Windows installations, 857-860
  - sound cards, 328
  - speakers, voice-enabled smart speakers, 683
  - SSD, 270-271, 299
  - storage devices, 293-298
  - thermostats (smart), 680-681
  - thick clients, 675
  - thin clients, 674-675
  - unattended installations, Windows, 833
  - USB devices, 134-135
  - USB ports (extra), 48
  - video adapters, 143
  - voice-enabled smart speakers, 683
  - Windows, 832. *See also* preinstalling, Windows
    - backups before Windows OS installations, 840
    - clean installations, 833-834
    - device drivers, 853
    - disabling interfering software, 841
    - image deployments, 833
    - overview of, 841-842
    - phases of, 841
    - planning drive space, 837
    - refresh option, 833



- remote network installations, 833
- repair installations, 833, 845-846
- restore option, 833
- security scans, 840
- setup log files, 845
- troubleshooting installations, 843-845
- unattended installations, 833
- verifying installations, 843
  - with older OS, 881
- wireless AP, 1023-1024
- wireless NIC, 671
- ZTI, 833
- integers (Windows scripting, variables), 810
- integrated motherboard ports, 57-58
- integrated peripherals, configuring, 120
- integrity, personal, 1073
- Intel HT. *See* hyperthreading
- Intel processors, 83-84
- interference (antennas), 661
- interfering software, disabling in Windows OS installations, 841
- intermittent device failures, troubleshooting, 550-551
- internal cables, removing, 169-172
- internal data buses, 73
- internal fixed disks, 880
- internal hard drives
  - laptops, 484
  - partitions, 880
- internal modems, 574
- internal networks option (VM), 591
- internal shared resources, cloud computing, 597
- internal speakers, 331
- internal USB connectors, 48
- Internet
  - connectivity. *See* connectivity
  - content filtering, 1016
  - convergence, 580
  - dial-up networks, 574
  - end-point management servers, 1016
  - fiber networks, cable modems, 583
  - IDS, 1016
  - IPS, 1016
  - ISP, 586
  - modems
    - 56 kbps modems, 577-579
    - cable modems, 581-584, 691
    - connectivity, 574
    - dial-up networks, 574
    - digital modems, 579
    - digital versus analog phone lines, 578
    - DSL modems, 584-586, 691
    - external modems, 574
    - internal modems, 574
    - phone line isolators, 587
    - phone line limits, 578
    - preventive maintenance, 587
    - satellite modems, 586-587
    - surge protectors, 587
    - xDSL, 584
  - PSTN, 579-581
  - security, 1003
    - blacklists, 1010
    - digital security certificates, 1008
    - DMZ, 1010
    - DNS configuration, 1005-1007
    - email, 1007
    - end-point management servers, 1016
    - firewalls, 1009
    - IDS, 1016
    - IPS, 1016
    - MBSA, 1004
    - proxy servers, 1008-1009
    - removing malware, 1004-1005
    - UPnP, 1010
    - UTM systems, 1016
    - whitelists, 1009
    - Windows Defender, 1004
  - serial communication, 575-577
  - UTM systems, 1016
  - VoIP, 579-581
  - web browsers, 599
  - wireless connectivity, 589
- Internet Accounts setting (macOS, System Preferences), 928
- Internet calling (mobile device OS), 441
- Internet Explorer 11, Internet Options window, 597
  - Advanced tab, 599, 607-608
  - Connections tab, 598, 605
  - Content tab, 598, 603-604
  - General tab, 598-600
  - Privacy tab, 598, 602-603
  - Programs tab, 599, 606-607
  - Security tab, 598, 601
- Internet layer (TCP/IP model), 645, 697
- interpolation, scanners, 337
- interpreted programs, defined, 803
- Interrupt Requests. *See* IRQ
- interrupts
  - Device Manager, 128-130
  - IRQ, 127, 130

- MSI/MSI-X, 128
- PCI, 127-128
- PCIe, 127-128
- Intruder detection error message, 547
- intrusion detection/notification, configuring, 121
- invalid status state (disk management), 298
- inventory management, 180, 1063
- inverters, laptop displays, 493, 499
- IOPS (Input/Output Operations Per Second), 540
- IoT (Internet of Things), smart devices, 677
  - digital assistants, 683
  - door locks, 683
  - light switches, 681
  - security cameras, 682
  - thermostats, 680-681
  - voice-enabled smart speakers, 683
  - Z-wave, 678-680
  - Zigbee, 678-679
- IP (Internet Protocols), 645
  - alternative configurations, 668
  - alternative IP addresses, 668
  - assigning the same address to multiple devices, 666
  - broadcast addresses, 648
  - changing, 666
  - IPv4 addresses, 646-650
  - IPv6 addresses, 646
  - NAT, 1014
  - network numbers, 647
  - statically configuring, 666
  - subnet masks, 1085-1087
  - VoIP, 579-581
- ipconfig command, 686, 791-792
- IPS (Intrusion Prevention Systems), 1016
- IR (Infrared), 451, 496
- irate customers, handling, 559-560
- IRQ (Interrupt Requests)
  - Device Manager, 130
  - multiple-device port assignments, 127
- ISDN (Integrated Services Digital Network), 579, 706
- isotropic antennas, 661
- ISP (Internet Service Providers), 586
- IT documentation
  - incident reports, 1062-1063
  - inventory management documentation, 1063
  - knowledge bases/articles, 1062
  - network topology diagrams, 1060
  - policies, 1063-1064
- iTunes
  - Apple iOS device synchronization, 459
  - apps, 442
  - backups, 462

- ITX motherboards, 101
- iwconfig command (Linux), 944
- iWork (macOS), 922

## J

---

- jailbreaking mobile devices, 503
- jams (printers), 383, 403
- jargon (communication skills), 1069
- JBOD (Just a Bunch of Disks), 281
- jewelry, personal safety, 1044
- joysticks, 347
- JPEG (Joint Photographic Experts Group) files, 337, 343
- JPG (Joint Photographic Experts) extension, 747
- jumpers, 124-126

## K

---

- Kali website, 939
- KB (Kilobytes), 22-24
- Kerberos protocol, 971
- kernels
  - defined, 10
  - kernel panic (macOS), troubleshooting, 931
  - Linux, 727, 939
- key fobs, security, 962
- Keyboard error or no keyboard present message, 547
- Keyboard is locked out—Unlock the key message, 547
- keyboards, 16
  - cleaning, 17, 178
  - Keyboard setting (macOS, System Preferences), 928
  - KVM switches, 19, 339
  - laptops
    - repairing, 478
    - special function keys, 480-481
  - Num Lock indicator lights, 507
  - number lock key, configuring, 120
  - ports, 34-35
  - PS/2 ports, 58
  - special function keys, 480-481
  - sticking keys, 508
  - troubleshooting, 17-18, 507-508
- Keychain Access (macOS), 932
- keyloggers, 976
- keys
  - electronic key cards, 961
  - KMS, licensing, 843
- keywords, scripting languages, 809
- kids
  - exploitation, incident reports, 1026
  - parental control, 1013

kill command (macOS), 935  
 killing (stopping) processes/tasks, 800, 893  
 Kingston Technology website, 224  
 KMS (Key Management Service), licensing, 843  
 knives (Swiss army), 166  
 knowledge bases/articles, 1062  
 KVM (Keyboard, Video, Mouse) switches, 19, 339

## L

---

L1 caches, 77  
 L2 caches, 77  
 L3 caches, 77  
 labeling network cables, 635  
 ladder racks, 638  
 Language & Region setting (macOS, System Preferences), 928  
 languages  
   compiled languages, 808  
   scripting languages, 804, 808-809  
   Windows language settings, 841  
 LAN (Local Area Networks), 620  
   Wake on LAN feature, 192-193, 672  
   WLAN, 620, 1017, 1150  
 laptops, 466  
   batteries, 471-474, 504, 1047-1048  
   Bluetooth, 446, 487, 514-515  
   cellular cards, 469  
   closing, 494, 509  
   DC jacks, replacing, 489  
   disassembly, 466, 475  
   displays, 177, 491  
     backlights, 492  
     CCFL, 492-495  
     digitizers, 493  
     inverters, 493, 499  
     LCD, 492-495  
     LED, 492, 495  
     microphones, 493, 498  
     OLED, 492-494  
     orientation, 493  
     removing, 494-496  
     repairing, 494  
     resolution, 495  
     rotating/removable screens, 493  
     TFT, 492  
     troubleshooting, 509-510  
     webcams, 493, 498  
     WiFi antennas, 493  
   docking stations, 468  
   environmental enclosures, 1057  
   expansion slots, 469-470  
   external devices, 467-468  
   GPS, troubleshooting, 514  
   hard drives, 467, 483-485  
   hardware, 466  
   headphones, troubleshooting, 513  
   keyboards  
     repairing, 478  
     special function keys, 480-481  
   lid close detectors, 494, 509  
   memory, 481-482  
   microphones, 493, 498  
   miniPCIe cards, 469  
   modem cards, 469  
   monitors, 467  
   motherboards, repairing, 476  
   networks, troubleshooting, 513  
   NIC, 488  
   optical drives, 467, 486  
   port replicators, 468  
   power supplies  
     buying, 471  
     fuel cells, 473  
     Li-ion batteries, 473, 504, 1047-1048  
     performance, 473-474  
     removing, 473  
     troubleshooting, 511-513  
     zinc-air batteries, 473  
   processors, replacing, 477  
   removing  
     displays, 494-496  
     touchscreens, 496  
   repairs  
     Bluetooth cards, 487  
     DC jacks, 489  
     displays, 494-499  
     hard drives, 483-486  
     keyboards, 478  
     memory removal/installation, 482  
     microphones, 498  
     motherboards, 476  
     processors, 477  
     smart card readers, 487  
     sound, 490  
     touchpads, 479  
     touchscreens, 496  
     video cards, 491  
     webcams, 498  
     WiFi cards, 487

- rotating/removable screens, 493
- security
  - antimalware software, 499
  - antivirus software, 499
  - cable locks, 499
  - cameras, 502
  - data transmission limits, 503
  - factory resets, 500-501
  - failed logins, 501
  - GPS tracking, 500
  - jailbreaking, 503
  - leaked data, 501-502
  - microphones, 502
  - physical laptop locks, 499
  - remote wipes, 500
  - rooting, 503
  - sandboxes, 499
  - system lockouts, 501, 894
  - unauthorized access, 501
  - unauthorized tracking, 501
  - updates, 500
  - upgrades, 500
  - USS, 499
  - wireless connectivity, 499
- smart card readers, replacing, 487
- sound, troubleshooting, 490
- speakers, troubleshooting, 490, 513
- storage
  - hard drives, 483-485
  - optical drives, 486
  - smart card readers, 487
  - storage cards, 424
- temperature changes, 472
- touchpads, repairing, 479
- touchscreens, removing, 496
- traveling with, 504
- troubleshooting
  - Bluetooth, 487, 514-515
  - DC jacks, 489
  - displays, 494-499, 509-510
  - GPS, 514
  - hard drives, 483-485
  - headphones, 513
  - inverters, 499
  - keyboards, 478
  - memory, 482
  - microphones, 498
  - motherboards, 476
  - networks, 513
  - optical drives, 486
  - power supplies, 511-513
  - processors, 477
  - smart card readers, 487
  - sound, 490
  - speakers, 513
  - touchpads, 479
  - touchscreens, 496
  - video cards, 491
  - webcams, 498
  - WiFi cards, 487
  - wireless connectivity, 513-514
- video cards, replacing, 491
- webcams, 493, 498
- WiFi antennas, 493
- WiFi cards, replacing, 487
- wireless antennas, 488, 660
- wireless cards, 469
- wireless connectivity
  - troubleshooting, 513-514
  - wireless WAN connectivity, 589
- large-format inkjet printers, 366
- laser lenses (ODD), cleaning, 323
- laser printers, 376
  - charging, 368
  - cleaning, 368-369
  - compressed air, 385
  - conditioning rollers, 368-369
  - control panel assembly, 370
  - defined, 361
  - density control blades, 368-370
  - developing cylinders, 368-370
  - duplexing assemblies, 370
  - e-clips, 385
  - ECP, 370
  - erase lamps, 368-370
  - exposing phase, 368
  - fuser assemblies, 368-370
  - fuser cleaning pads/fuser wands, 385
  - fusing rollers, 370, 386
  - ghost images, troubleshooting, 409
  - high voltage power supplies, 370
  - imaging drums, 370
  - imaging process, 368-369
  - ink cartridges, 384
  - main motors, 370
  - maintenance, 383-386
  - memory upgrades, 380
  - noises, 369
  - overheating, 385
  - ozone gas, 385

- parts, 367-370
- pickup rollers, 370
- power supplies, 369-370
- primary (main) corona, 370
- printing process, 367
- raster imaging process, 368
- registration assemblies, 370
- safety, 367
- scanner units, 370
- separation pads, 370
- spilled toner, 371
- streaks, troubleshooting, 409
- toner cartridges, 370-371, 380, 409
- transfer belts, 368
- transfer coronas, 368-370, 385
- transfer pads, 368
- transfer rollers, 368
- troubleshooting, 385, 404, 408-409
- UPS, 1055
- vertical lines, troubleshooting, 409
- write-black, 369
- write-white, 369
- Last Known Good Configuration (Advanced Boot Options menu), 888
- latency, networks, 687
- Launcher (Ubuntu), 940
- launchers (mobile device OS), 441
- launching apps, 858
- Launchpad (macOS GUI), 920-921
- LCD monitors, 145-147, 177, 492-495
- LDAP (Lightweight Directory Access Protocol), 697, 1117
- leaked data, mobile devices, 501-502
- LED (Light-Emitting Diodes), 492, 495, 549
- legacy systems, 694
- less command (macOS), 935, 938
- LGA (Land Grid Array) sockets, 85
- LGA 1150 sockets, 86
- LGA 1151 sockets, 86
- LGA 1155 sockets, 86
- LGA 1156 sockets, 86
- LGA 2011 sockets, 86
- LGA 2066 sockets, 86
- libraries, 746, 993
- licensing
  - corporate Windows deployments, 843
  - KMS, 843
  - software/apps, 973
- lid close detectors (laptops), 494, 509
- lifting techniques (personal safety), 25, 1044
- light printing (printer issues), 408
- light switches (smart), 681
- Lightning ports, 49-50, 59, 443
- lights (indicator), POST, 116
- Lightweight Directory Access Protocol (LDAP), 697, 1117
- Li-ion batteries, 473, 504, 1047-1048
- LILO (Linux Loader), 952
- limited connectivity (networks), 689-690
- line conditioners, 1053
- line-of-sight networks, 588, 706
- link-local addresses, 646
- lint-free cloths, 178
- Linux
  - backups, 943
  - best practices, 952
  - bootloaders, 952
  - bootups, 939
  - CLI
    - copying data, 948-950
    - finding files, 951
    - missing GRUB/LILO, 952
    - network configuration, 945-946
    - obtaining software, 947-948
    - shutting down systems, 944-945
    - viewing processes, 947
  - commands, 944-951
  - distros, 939
  - file systems, 941-942
  - GRUB, 952
  - hard drives, partitioning, 948-950
  - kernel, 727, 939
  - LILO, 952
  - managing, 941-943, 949-950
  - open source code, 727
  - preinstalling packages, 948
  - root users, 936
  - security (logical), 970
  - Ubuntu
    - backups, 943
    - CLI, 944-952
    - GParted disk management tool, 941, 949-950
    - Software Updater tool, 942
    - Ubuntu Software Center, 942
    - Unity GUI, 940-941
  - updating, 942-943
  - user forums, 951
  - websites, 951
- liquid cooling systems, 86
- liquid crystal displays. *See* LCD monitors
- list folder contents NTFS permission, 995
- listening skills, 1070

- listsvc command, 787-789
- lithium-ion batteries. *See* Li-ion batteries
- live tiles (Windows desktop), 734
- LMS (Learning Management Systems), 596
- load alternate third-party drivers, 839
- loading
  - apps, troubleshooting, 507
  - graphical interface fails to load errors, 883
  - programs at startup, stopping, 883
- local area networks. *See* LAN
- local connectivity (networks), 685
- local government regulations, workplace safety, 1040
- local printers, installing, 388
- local resources (networks), security, 685
  - AD, 732, 983-986
  - authentication, 981
  - authorization, 981
  - user management, 981-983
- local security policies (AD), 987
- local shares, 991
- local storage, backups, 998
- Local Users and Groups tool (Windows), 870-871
- locate command (Linux), 944, 951
- location tracking (unauthorized), 501
- locator apps, 439-441
- lock screens (mobile devices), 435
- lockouts (system), 501, 894
- locks
  - biometric locks, 963
  - cable locks, 499, 963
  - door locks
    - physical security, 962
    - smart door locks, 683
  - facial recognition locks, mobile devices, 500
  - fingerprint locks, mobile devices, 500
  - Lock Computer option, 983
  - passcode locks, mobile devices, 500
  - physical laptop locks, 499
  - screen locks, 500, 972, 983
  - screen savers/locks, 972
  - server locks, 963
  - swipe locks, mobile devices, 500
  - USB locks, 963
- log entries, reviewing (troubleshooting), 543
- logging events (auditing), 988
- logging servers, 693
- logical drives, 276-277
- logical operators (Windows scripting), 817
- logical partitions, 838
- logical security
  - ACL, 969
  - antimalware, 968
  - antivirus, 968
  - authentication, 968
  - BIOS/UEFI passwords, 970-971
  - directory permissions, 969
  - DLP, 969
  - email, filtering, 969
  - firewalls, 968
  - Linux, 970
  - passwords, 968, 971-972
  - ports, 969
  - screen savers/locks, 972
  - trusted/untrusted sources, 970
  - user ID, 972
  - VPN, 969
- logical troubleshooting
  - establishing theory of probable cause
    - boot process, 544-545
    - diagnostics, 548-549
    - documentation, 554
    - error messages, 545-548
    - hardware errors, 550
    - implementing preventive measures, 554
    - intermittent device failures, 550-551
    - plans of action, 554
    - POST codes, 545-547, 550
    - software errors, 551
    - testing theories to determine cause, 551-553
    - verifying full system functionality, 554
  - identifying problems, 543
- logins (failed), mobile devices, 501
- logistics, audio subsystems and computer design, 540
- logons
  - logon scripts, AD user accounts, 985
  - time restrictions, workgroups, 982
  - Windows, 733
- LoJack
  - BIOS/UEFI security, 971
  - configuring, 121
- long touch gestures, 435
- loopback plugs, 550, 638
- loops (Windows scripting), 813, 817
  - for loops, 819-820
  - while loops, 818-819
- lost clusters, locating, 290
- lost mode, mobile devices, 500
- loud noises, troubleshooting, 197
- low memory errors (printer issues), 404

low RF signals, wireless networks, 664  
 low-level formatting, hard drives, 272, 404  
 ls command (macOS), 934-937  
 LTE (Long Term Evolution) networks, 451, 588  
 lumens, projectors, 341

## M

---

M.2 expansion cards, 470

M.2 slots, 121

M.2 SSD, 260

MAC addresses, 645

ARP, 694

filtering, 1022

formats of, 646

machine code, 808

macOS, 727, 918

Activity Monitor, 930

APFS, 934

Apple ID, 923

App Store, 923-924

apps, 439-442

backups, 924-925

best practices, 952

Boot Camp, 934

commands, 934-938

computers, adding to domains, 665

Console, 931

desktop, 919

Disk Utility, 933

Dock, 919-920

dual-boot systems, 731

Finder, 919

Force Quit, 926

gestures, 922

GUI

desktop, 919

Dock, 919-920

Finder, 919

gestures, 922

Launchpad, 920-921

menu bar, 920

Mission Control, 920

Spotlight, 920

hard drives, 933-934

HFS+, 934

iCloud, 922-924

iWork, 922

kernel panic, 931

Keychain Access, 932

Launchpad, 920-921

macOS distributions by release number/name, 918

managing

Safe mode, 929

System Preferences, 927-929

manual, accessing, 938

menu bar, 920

Mission Control, 920

POSIX, 919

printers in macOS environments

installing, 393

viewing print histories, 394

Remote Disc, 926

Safe mode, 929

shells, 919

Spotlight, 920

System Information, 931

System Preferences, 927-929

system restores, 924-925

system updates, 924

Terminal, 926, 934

Time Machine, 924-925

touchscreens, calibrating, 498

troubleshooting

Force Quit, 926

kernel panic, 931

Safe mode, 929

spinning pinwheels, 930

System Preferences, 927-929

Terminal, 926

updates, 924

utilities, 930-934, 938

magnetic card readers, 19, 428, 431

magnetic hard drives, 254-256

magnetic screwdrivers, 166

mail servers, 693

main motors (laser printers), 370

mainboards. *See* motherboards

maintenance. *See also* troubleshooting

APs, 676

hard drives, 290-293, 876-877

keyboards, 17

kits, 178

mice, 17

modems, 587

ODDs, 322-323

OS, 906

preventive maintenance, 177-180

printers, 380-386

- projectors, 342
- scanners, 338
- maintenance counters, laser printers, 385
- maintenance kits, laser printers, 384
- male ports, 34
- malware
  - antimalware, 968
    - Disable Early Launch Anti-Malware Protection (Advanced Boot Options menu), 888
    - firewalls and, 1009
    - mobile devices, 499
  - end-user education, 975-978
  - mobile devices, 464
  - removing, 1004-1005
- man command (macOS), 935, 938
- MAN (Metropolitan Area Networks), 620
- managed switches, 626
- managing
  - apps, 878
  - cables, 636, 1040
  - change management, 1064-1065
  - conflict management, 1073-1075
  - Disk Management tool, 838
  - domains, 794-795
  - dynamic disks, 281
  - end-point management servers, 693, 1016
  - image management software, 674
  - inventory management, 1063
  - Linux, 941-943, 949-950
  - macOS, 927-929
  - MDM, policies, 1017-1018
  - memory, 234-235
  - mobile devices, MDM, 463-464
  - patches, 997-998
  - services, 878
  - storage, 908
  - storage devices. *See* disk management
  - time, 1072
  - throttling, 90
  - updates, 997-998
  - users, 981-984. *See also* AD
  - UTM systems, 1016
- mantraps (physical security), 963-964
- manually deleting files, 1005
- manuals, macOS, 938
- MAPI (Messaging Application Programming Interface), 454
- mapping
  - from command prompts, 703
  - hard drives, 688
  - network printers, 692
  - ports, 1014
  - to shares, 703-704
- Marketplace (Amazon), 442
- marking subsystem (printers), 360
- masks (dust/air filter), 178, 1044
- master devices, 265
- mats (ESD), 164
- mATX motherboards, 101
- MB (Megabytes), 22-24
- MBR (Master Boot Record), 278, 545
- MBSA (Microsoft Security Analyzer), 1004
- MCBF (Mean Cycles Between Failure), 317
- md command, 777, 792
- MDM (mobile device management), 463-464, 1017-1018
- mdsched, 234
- MDT (Microsoft Deployment Toolkit), corporate Windows deployments, 842
- measured services, cloud computing, 597
- mechanical drives, 483, 486
- Media Center (Windows), 732
- media (digital), DRM, 973
- memory
  - access time, 224-225
  - buffer, 317
  - buffered memory, 217
  - buying, 224-226
  - cache memory, 77, 213, 228-229
  - CAS latency, 225
  - CD-ROM discs, 315
  - CF cards, 424-426
  - chips/modules, 213
  - CL modules, mixing, 226
  - CL ratings, 225
  - CMOS, 123-126
  - DDR, 215
  - DDR2, 215
  - DDR3, 215-218
  - DDR3L, 215
  - DDR4, 215
  - DDR4L, 215
  - DIMM, 213-218, 221-228
  - DIP chips, 213
  - double-sided, 217
  - DRAM, 212-215
  - dual-channel, 220-223
  - dual-voltage, 217, 482
  - DVD-ROM discs, 315
  - ECC, 217-218
  - features of, 216-217



- FFBDIMM, 217
- flash memory, 235-236, 257-258, 424
  - CF, 343
  - MMC, 343
  - SSD, 483-485
- heat spreaders, 215
- installing, 227-228, 234
  - buying memory, 224-226
  - overview of, 226
  - planning installations, 214-226
  - researching memory, 224-226
  - types of memory to install, 220-223
- laptops, 481-482
- limitations of, 219
- managing, 234-235
- memory addresses, 127, 131
- memory card readers, 344
- memory cards, 424
- Memory Diagnostics tool (Windows), 234
- memory optimal error message, 547
- Memory size decrease error message, 547
- Memory Sticks, 343
- Memory test fail message, 547
- module types, 214-218
- monitoring Windows, 231-233
- motherboards
  - chip support, 215
  - design, 536
  - maximums, 220
- multicore processor access, 80
- non-ECC, 217
- non-parity, 217-218
- NVMe, 260
- OS requirements, 218-220
- pages, 229, 289
- parity, 217
- performance, 224-225, 228, 235
- physical packaging, 213
- planning installations
  - buying memory, 224-226
  - determining how much memory to install, 218-223
  - memory features, 216-217
  - memory module types, 214-218
  - OS requirements, 218-220
  - overview of, 226
  - researching memory, 224-226
- POST error codes, 228
- printers, 380, 404
- quadruple-channel, 223
- RAM, 13, 142, 212-213, 222, 234, 289, 424
  - adding to hard drives, 235
  - hibernation mode, 280
  - Hyper-V client, 592
  - OS limitations, 727
  - Virtual PC, 592
- refreshing, 213
- registered, 217
- removing, 227-228
- requirements, 213, 219
- researching, 224-226
- ROM, 212, 315
- safety, 227
- sample advertisements, 224-225
- SDRAM, 215
- shared system, 142
- SIMM, 213
- single-sided, 217
- smart card readers, 424, 487
- SODIMM, 213, 481-482
- software instructions, fetching, 213
- SPD, 217
- speed, 224-225
- SRAM, 213, 228-229
- storage cards, 424
- thermal sensors, 217
- triple-channel, 223
- troubleshooting, 228, 234-235, 901-902
- types of, 13-15, 220-223
- unbuffered, 217
- upgrading, 218, 228, 235
- video, 141-142
- virtual memory, 229-230, 288-289, 901-902
- wear leveling, 257
- Windows Memory Diagnostics, 885
- write amplification, 257
- XMP, 217
- mentoring skills, 611
- menu bar (macOS GUI), 920
- meter rules (electricity), 181
- metered services, cloud computing, 597
- MetroE (MetroEthernet), network connections, 706
- Metro UI, 832
- mice
  - cleaning, 17
  - KVM switches, 19
  - optical mice, 16
  - ports, 34-35
  - PS/2 ports, 58
  - troubleshooting, 17-18

- micro-ATX motherboards, 101
- micro-ATX power supplies, form factors, 185
- micro-USB ports, 45, 443
- microphones, 19
  - computer design, 540
  - laptop displays, 493, 498
  - laptops, troubleshooting, 490
  - mobile devices, troubleshooting, 490
  - unauthorized activation, 502
  - Windows, 329
- microprocessors. *See* processors
- microSD (Secure Digital) memory cards, 424
- Microsoft HomeGroups, 621-623, 704-706
- Microsoft Paint (PNG) extension, 747
- Microsoft Store, 442
- Microsoft Upgrade Advisor, 840
- MIDI (Musical Instrument Digital Interface) audio ports, 59, 324
- migration (data), 835
- MIME (Multipurpose Internet Mail Extensions), email
  - configuration on mobile devices, 454
- MIMO (Multiple Input/Multiple Output) antennas, 651, 663
- mini DisplayPort, 467
- mini-DIN connectors, 34
- mini-HDMI connectors, 38
- miniPCIe cards, 469
- miniPCI/PCIe adapters, 469
- miniSD (Secure Digital) memory cards, 424
- mini-USB ports, 45, 443
- Mint website, 939
- mirroring (disk), 284
- Mission Control setting (macOS, System Preferences), 920, 928
- MITM (Man-in-the-Middle) attacks, 979
- mITX motherboards, 101
- mkdir command (macOS), 934
- MLC (Multi-Level Memory Cells), 257
- mmc command, 792
- MMC (Microsoft Management Console), 861
  - opening, 798
  - starting, 792
- MMC (multimedia cards), 343
- MMS (Multimedia Message Service), 451
- mobile connectivity. *See also* connectivity
  - cellular, 588
  - mobile hotspots, 587
  - tethering, 588
  - WiMAX
    - line-of-sight networks, 588
    - WiBro, 589
  - wireless broadband, 588
- mobile connectors, 444-448
- mobile devices, 535
  - accessories, 428
  - Android OS, 729
  - applying, 431
  - apps, 439, 442
  - backups
    - Android devices, 459-460
    - Apple iOS devices, 461-462
    - remote backups, 455
    - Windows devices, 462
  - batteries, 428-430
  - Bluetooth, 444
    - installing, 446
    - troubleshooting, 514-515
  - cell phones, 438
  - CF cards, 424-426
  - Chrome OS, 729
  - disassembly, 475
  - displays, 177, 509-510
  - disposal of/recycling, 1046
  - e-readers, 421-422
  - email, 453-455
  - firmware, security, 500
  - full device encryption, 1000-1001
  - GPS, 420-421, 514
  - hard resets, 504-505
  - headphones, troubleshooting, 513
  - iOS, 729
  - lock screen, 435
  - lost mode, 500
  - malware, 464
  - MDM, 463-464, 1017-1018
  - mobile storage, 424, 487
  - networks
    - configuring, 448
    - troubleshooting, 513
  - notification areas, 432
  - optical drives, replacing, 486
  - OS, 423, 432-435, 439-441, 729
  - phablets, 421-422. *See also* smartphones; tablets
  - ports, 443
  - power supplies, troubleshooting, 511-513
  - protective covers, 428-430
  - screens
    - calibration, 440
    - protective covers, 428-430
  - security
    - antimalware, 464, 499
    - antivirus software, 499

- app scanners, 464
- Authenticator apps, 500
- cable locks, 499
- cameras, 502
- cell tower analyzers, 465
- data transmission limits, 503
- facial recognition locks, 500
- factory resets, 500-501
- failed logins, 501
- fingerprint locks, 500
- firmware, 500
- GPS tracking, 500
- jailbreaking, 503
- leaked data, 501-502
- lost mode, 500
- microphones, 502
- passcode locks, 500
- physical laptop locks, 499
- PIN, 500
- remote wipes, 500
- rooting, 503
- sandboxes, 499
- screen locks, 500
- security patterns, 500
- swipe locks, 500
- system lockouts, 501, 894
- unauthorized access, 501
- unauthorized tracking, 501
- updates, 500
- upgrades, 500
- USS, 499
- WiFi analyzers, 464
- wireless connectivity, 499
- smart cameras, 421-423
- smart card readers, 424, 487
- smartphones, 420-422, 435. *See also* phablets
  - apps, 439-442
  - baseband updates, 437
  - IMEI numbers, 435-436
  - IMSI, 436
  - PRI, 437
  - PRL, 437
  - radio firmware updates, 437
  - SIM cards, 436
- soft resets, 504
- sound, troubleshooting, 490
- speakers, troubleshooting, 513
- synchronization, 455
  - Android devices, 457
  - Apple iOS devices, 458-459
  - cars, 456
  - clouds, 456
  - connection types, 457
  - desktops, 456
- tablets, 420-421, 439-442. *See also* phablets
- traveling with, 504
- troubleshooting
  - app installations, 506
  - app log errors, 506
  - Bluetooth, 514-515
  - displays, 509-510
  - email, 507
  - GPS, 514
  - hard resets, 504-505
  - headphones, 513
  - high resource utilization, 505
  - keyboards, 507-508
  - loading apps, 507
  - networks, 513
  - power supplies, 511-513
  - soft resets, 504
  - speakers, 513
  - trackpads, 509
  - wireless connectivity, 513-514
- unlocking, 435
- waterproofing, 428
- wearable devices, 420, 426
- wired connectivity, 443-444
- wireless connectivity
  - Airplane Mode, 448
  - Bluetooth, 444-448
  - cellular connectivity, 448, 451
  - GPS, 448
  - hotspots/tethering, 449
  - IEEE 802.11 wireless standards, 447-448
  - IR, 451
  - NFC, 450
  - RFID tags, 449
  - security, 499
  - troubleshooting, 513-514
  - VPNs, 452
- mobile docking stations, 428-430
- mobile USB ports, 443
- mobile wallets, 441
- modems
  - 56 kbps modems, 577-579
  - cable modems
    - bandwidth, 584
    - cable TV and, 581
    - connectivity, 581-582

- downstream transmissions, 584
  - Ethernet ports, 582
  - fiber networks, 583
  - hardware requirements, 584
  - NIC connectivity, 581
  - ports, 582
  - speeds, 584
  - troubleshooting, 691
  - upstream transmissions, 584
  - USB connectivity, 582
- cards, 469
- connectivity, 574
- dial-up networks, 574
- digital modems, 579
- digital versus analog phone lines, 578
- DSL modems, 584
  - bandwidth, 585
  - cable/modem connectivity, 586
  - phone filters, 586
  - ports, 585
  - troubleshooting, 691
- external modems, 574
- internal modems, 574
- maintenance, 587
- phone line isolators, 587
- phone line limits, 578
- ports, 52, 59
- satellite, 586-587
- surge protectors, 587
- troubleshooting, 691
- xDSL, 584
- modify NTFS permission, 995
- Molex-to-SATA power converters, 186
- monitoring
  - memory, Windows, 231-233
  - performance, 904
- monitor wipes, 178
- monitors, 10
  - aspect ratios, 541
  - black/blank screens, troubleshooting, 884
  - cables, 37
  - cleaning, 178
  - computer design, 541-542
  - conferencing features, 541
  - contrast ratios, 541
  - CRT monitors, disposal of/recycling, 1046
  - disposal rules, 148
  - energy-efficiency, 196
  - external monitors, troubleshooting, 509
  - laptops, 467
  - LCD monitors, cleaning, 177
  - multi-monitor taskbars (Windows), 832
  - multiple monitors, 541
  - proprietary crash screens, 548
  - screen savers, 200
  - troubleshooting, 198
  - types of, 541
  - video adapters, 541
  - video connectors, 37
  - video ports, 35, 41
    - DisplayPort, 38
    - DVI ports, 36-37
    - HDCP ports, 40
    - HDMI ports, 38-39, 58
    - S-Video ports, 36
    - VGA ports, 36-37
  - voltage, 182
- more command, 792
- motherboards
  - adapters, 14-15, 58, 167, 173
  - antistatic measures, 103
  - ATX, 101
  - audio ports, 50, 59, 324-326
  - batteries, 123-124
  - BIOS, 116-126, 132, 149, 192-193, 271, 284, 544-545
  - cables, 169-172
  - chipsets, 100, 536
  - computer design, 536-537
  - configuring, 173
  - connectors, 169-172, 185
    - ATX connectors, 189
    - D-shell connectors, 34
    - mini-DIN connectors, 34
    - USB connectors, 48
  - defined, 13
  - diagnostic displays, 549
  - distended capacitors, 103-104
  - eSATA ports, 51, 59
  - expansion slots, 14-15, 93-98, 469-470
  - form factors, 101-102, 186, 536-537
  - green (environmental) concerns, 101
  - grounding problems, 162-165
  - I/O shields, 174
  - integrated ports, 57-58
  - ITX, 101
  - laptops, repairing, 476
  - LED, 549
  - locating, 13
  - mATX, 101
  - memory, 536

- CAS latency, 225
- chip support, 215
- CL ratings, 225
  - dual-channel, 220, 223
- micro-ATX, 101
- mITX, 101
- modem ports, 52
- Nano-ITX, 101
- network ports, 51-52
- onboard video cards, 140
- overheating, 103
- PAE, 230
- PATA/SATA connectors, 261
- Pico-ITX, 101
- ports, 34-35
- POST codes, 551
- power consumption, 195
- power supplies, 185
- processors, 24, 72-92, 101, 120, 130, 189-190, 536
- reassembling, 176
- removing, 174-175
- replacing, 102-103
- retaining clips, 175
- riser cards, 94
- serial ports, 53, 59
- sound card installations, 328
- speaker ports, 324
- standoffs, 174
- troubleshooting, 103-104
- types of, 101
- UEFI, 545
- upgrading, 102-103
- motion sensors, 348
- mounting hard drives, 270, 875, 933
- mouses
  - KVM switches, 339
  - Mouse setting (macOS, System Preferences), 928
- MOV files, 344
- MOV (Metal Oxide Varistors), surge protectors, 1051
- moving
  - app icons, 442
  - files/folders, 752-754
- MPG (movie clip) extension, 747
- msconfig command, 793
- MSDS (Material Safety Data Sheets), 179, 1041
- MSI (Message Signaled Interrupt), 128
- MSI-X, 128
- msinfo32 command, 793, 1122
- mstsc command, 793, 905
- MTBF (Mean Time Between Failures), 255, 317
- MU-MIMO (multi-user MIMO) antennas, 651, 664
- multiboots, Windows, 833
- multicore processors, 80-85
- multifactor authentication
  - logical security, 968
  - physical security, 966
- multimedia devices
  - audio ports, 324-326
  - BD, 314
    - cleaning, 323
    - handling, 322
    - region codes, 317-318
  - BD-R drives, 315
  - BD-RE drives, 315
  - biometric devices, 346-347
  - camcorders, 344
  - CD, 314-316
    - burning, 317
    - cleaning, 323, 327
    - handling, 322
  - CD drives, 314, 317
  - CD-ROM discs, 315
  - CD-RW drives, 315
  - defined, 314
  - digital cameras, 342-344, 355
  - digitizers, 348
  - DVD drives, 314
    - decoders, 322
    - region codes, 317-318
  - DVD-ROM discs, 315
  - DVD-RW DL drives, 315
  - DVD-RW drives, 315
  - DVD, 314-316
    - burning, 317
    - cleaning, 323, 327
    - decoders, 322
    - handling, 322
    - region codes, 317-318
  - fingerprint readers, 346-347
  - game controllers, 347
  - headphones, 334
  - headsets, 330
  - joysticks, 347
  - KVM switches, 339
  - memory card readers, 344
  - microphones, configuring, 329
  - MMS, 451
  - motion sensors, 348

- ODD, 314
    - audio, 325, 334
    - buffer memory, 317
    - burning discs, 317
    - connections, 318-319
    - copying files to discs, 317
    - device failures, 317
    - factor numbers, 316
    - installing, 319-321
    - interfaces, 318-319
    - laser lenses, 323
    - MCBF, 317
    - MTBF, 317
    - PATA connectivity, 320
    - preventive maintenance, 322-323
    - random access time, 317
    - region codes, 317-318
    - testing installations, 321
    - transfer speeds, 315
    - troubleshooting, 321-322
  - optical writable media, 315-317
  - projectors, 340-342
  - scanners, 335-338, 346
  - smart cameras, 421-423
  - smart card readers, 348
  - sound cards, 333-334
    - 8-bit sound cards, 326
    - 16-bit sound cards, 327
    - 24-bit sound cards, 327
    - analog to digital conversions, 326
    - frequency response, 327
    - installing, 328
    - Windows, 328-329
  - speakers, 324, 330-334
  - webcams, 344
  - multi-mode fiber cables, 56-57, 641
  - multi-monitor taskbars (Windows), 832
  - multimeters, 166, 639
  - multiple alternative decision structures, 815-816
  - multiple displays, same display for multiple computers, 339
  - multiple OS, virtualization, 592
  - multiple-device ports, IRQ assignments, 127
  - multipurpose ports
    - Lightning ports, 49-50, 59
    - Thunderbolt ports, 49-50, 59
    - USB ports, 42, 59
      - Alternate Mode, 44
      - charging USB ports, 46
      - installing extra USB ports, 48
      - micro-USB ports, 45
      - mini-USB ports, 45
      - sleep-and-charge USB ports, 46
      - speeds, 42
      - USB 2.0 ports, 42
      - USB 3.0 ports, 42
      - USB 3.2 ports, 50
      - USB-C ports, 49
      - USB-PD ports, 43
  - multithreading, 79
  - multi-touch gestures, mobile devices, 434-435
  - muting audio, 329
  - mutual authentication for multiple services, 457
  - mv command (macOS), 934-936
- ## N
- 
- naming
    - computers, 664
    - folders, 745-746
    - variables (Windows scripting), 809
    - Windows files, 745-746
  - NAND flash memory, 257
  - nano command (macOS), 935, 938
  - Nano-ITX motherboards, 101
  - nanometers and processor technology, 536
  - NAS (Network-Attached Storage) devices, 259, 531-532
  - NAT (Network Address Translation), 677, 695, 1014
  - NAT mode (virtual NIC), 673
  - Nautilus (Ubuntu), 940
  - nbtstat command, 793
  - needle-nose pliers, 166
  - NetBIOS, 697
  - NetBT (NetBIOS over TCP/IP), 697
  - net /? command, 703
  - net command, 688, 794
  - net computer command, 688
  - net config command, 688
  - .NET Core and PowerShell, 821
  - net help command, 688
  - net share command, 688
  - net start command, 688
  - net stop command, 688
  - net use command, 688, 794
  - net user command, 688, 794-795
  - net view command, 688
  - netdom command, 688, 795
  - netdom add command, 688
  - netdom join command, 688
  - netdom remove command, 688
  - netdom renamecomputer command, 688

- netdom reset command, 688
- netdom resetpwd command, 688
- netdom verify command, 688
- netstat command, 696, 795-796
- Network Access layer (TCP/IP model), 645, 697
- Network and Sharing Center (Control Panel), 698-701
- network boots, 880
- network cable testers, 1095
- Network Configuration Operators group, 982
- network controllers, cloud computing, 594
- network interface cards. *See* NIC
- Network layer (OSI model), 644
- network numbers, IP addresses, 647
- networking printers, 407
  - accessing networks, 399
  - Bluetooth, 397-398
  - print servers, 398-399
  - Windows environments, 395
  - wireless networks, 397-398
- Network setting (macOS, System Preferences), 928
- networks
  - 3G, 588
  - 4G, 588
  - 5G, 588
  - adapters, 791-792
  - AP, 676
  - ARP, 694
  - auditing, 988
  - backbone, 694
  - bandwidth, 694
  - basebands, 694
  - Bluetooth, 651-652
  - broadband, 694
  - broadcast addresses, 648
  - cabinets, 636
  - cables
    - crossover, 629-631
    - fiber, 641
    - labeling, 635
    - ladder racks, 638
    - management systems, 636
    - network cabinets, 636
    - straight-through, 629
    - troubleshooting, 638-639
    - twisted-pair, 627-634
    - wiring racks, 637
  - CDMA, 694
  - CIFS, 694
  - computers, viewing, 981
  - configuring, mobile devices, 448
  - connectivity, 684-685, 689-690, 706
  - convergence, 580
  - copper media
    - crossover, 629-631
    - straight-through, 629
    - twisted-pair, 627-634
  - defined, 620
  - dial-up networks, 574
  - domains, 621, 625, 841
    - adding computers to, 665
    - corporate OS, 732
    - domain controllers, 665
    - managing, 794-795
    - managing AD domains, 795
    - security, 980
  - embedded systems, 694
  - end-user device configuration, 664-669
  - EoP, 641
  - Ethernet, 640-641, 695
  - external networks option (VM), 591
  - Fast Ethernet, 695
  - FDDI, 695
  - fiber, cable modems, 583
  - GSM, 695
  - home networks, 625
  - HomeGroups, 621-623, 704-706, 841
  - HTML, 695
  - hubs, 626
  - ICMP, 695
  - internal networks option (VM), 591
  - IP addresses, 645
    - assigning the same addresses to multiple devices, 666
    - changing, 666
    - IPv4 addresses, 646-650
    - IPv6 addresses, 646
    - statically configuring, 666
  - LAN, 192-193, 620
  - latency, 687
  - legacy systems, 694
  - line-of-sight, 588
  - link-local addresses, 646
  - LTE, 588
  - MAC addresses, 645-646
  - MAN, 620
  - mobile devices
    - configuring, 448
    - troubleshooting, 513
  - NAT, 695
  - Network and Sharing Center (Control Panel), 698-701

- NIC, 1140
  - duplexes, 671-672
  - Ethernet NIC, 631
  - Ethernet star topologies, 626
  - on-board NIC (BIOS/UEFI), 671
  - properties of, 671
  - QoS, 672
  - speed, 672
  - troubleshooting, 686
  - virtual NIC, 672-673
  - Wake on LAN feature, 672
  - wireless NIC, 670-671
- OSI model, 642
  - components of, 645
  - headers, 643
  - layers of, 643-644
  - mnemonic, 643
  - peer communication, 643
- PAN, 620
- PAT, 695
- patch panels, 634
- peer-to-peer networks, 621, 677
- POP, 695
- ports, 51-52
- printers, 691-692
- private IP addresses, 647
- protocols, 644
- public IP addresses, 647
- public networks, 625
- remote access protocols, 1015
- remote networks
  - accessing devices, 801
  - attaching devices, 794-796
  - device connectivity testing, 796-797
  - Remote Assistance, 905
  - Remote Desktop (mstsc command), 905
  - Remote Settings link, 905
  - Windows installations, 833
- requirements, 625
- resources, troubleshooting, 685
- security
  - access attacks, 979
  - AD, 732, 983-986
  - authentication, 981
  - authorization, 981
  - backdoor attacks, 979
  - botnets, 979
  - brute force attacks, 979
  - DDoS attacks, 979
  - dictionary attacks, 979
  - domains, 980
  - DoS attacks, 979
  - MITM attacks, 979
  - permissions, 988-996
  - rainbow table attacks, 979
  - reconnaissance attacks, 980
  - replay attacks, 980
  - Smurf attacks, 980
  - spoofing attacks, 980
  - SSO, 980
  - TCP/IP hijacking, 980
  - trapdoor attacks, 979
  - user management, 981-983
  - vulnerability scanners, 980
  - workgroups, 980
  - zero day attacks, 980
  - zombie attacks, 980
- server-based networks, 621-622
- servers, 692-693
- services, troubleshooting, 688
- shares
  - mapping to, 703-704
  - Sharing tab, 702-703
- smart devices, 677
  - digital assistants, 683
  - door locks, 683
  - light switches, 681
  - security cameras, 682
  - thermostats, 680-681
  - voice-enabled smart speakers, 683
  - Z-wave, 678-680
  - Zigbee, 678-679
- SSL, 695
- subnet masks, 1085-1087
- switches, 626
- TCP, 695
- TCP/IP, 644, 1123
  - associated protocols/port numbers, 696-697
  - components of, 645
  - layers of, 645, 697
  - message formatting, 645
- thick clients, 673-675
- thin clients, 673-675
- topologies
  - defined, 625
  - diagrams, 1060
  - Ethernet star topologies, 626-627
- troubleshooting
  - cable modems, 691
  - connectivity, 684-685, 689-690



- DNS servers, 687
- DSL modems, 691
- ifconfig command, 686
- ipconfig command, 686
- net command, 688
- net computer command, 688
- net config command, 688
- net help command, 688
- net share command, 688
- net start command, 688
- net stop command, 688
- net use command, 688
- net user command, 688
- net view command, 688
- netdom add command, 688
- netdom command, 688
- netdom join command, 688
- netdom remove command, 688
- netdom renamecomputer command, 688
- netdom reset command, 688
- netdom resetpwd command, 688
- netdom verify command, 688
- NIC, 686, 689-690
- ping command, 684-686
- printers, 692
- services, 688
- slow transfer speeds, 687
- tracert command, 687
- unavailable resources, 685
- types of, 620
- UDP, 695
- updates, troubleshooting, 897
- VLAN, 649
- VoIP, 695
- VPN
  - configuring, 1014-1015
  - logical security, 969
- wall jacks, 634
- WAN, 620
- Windows networks, troubleshooting, 897
- wired Ethernet networks, projectors, 341
- wireless networks, 1095, 1150
  - 2.4 GHz frequency, 650
  - 5 GHz radio frequency, 650
  - ad hoc mode, 654
  - antennas, 660-664
  - AP, 652-661, 664, 675-677, 1022-1024
  - Bluetooth, 651-652
  - bridges, 652
  - components of, 652
  - data transfer speeds, 664
  - defined, 650
  - designing, 654-659
  - desktops, 651
  - infrastructure mode, 654
  - line-of-sight connections, 706
  - low RF signals, 664
  - NIC, 670-671
  - projectors, 341
  - routers, 652-654, 675-676
  - security, 1017-1025
  - site surveys, 662
  - smart devices, 677-683
  - standards, 651
  - troubleshooting, 1025
  - WiFi analyzers (wireless locators), 663
  - wireless NIC, 652-653
  - WWAN, 677
- WLAN, 620, 1017, 1150
- WMN, 620
- workgroups, 621-622, 841
  - passwords, 623
  - resource management, 624
  - security, 980
- work networks, 625
- WWAN, 620, 677
- NFC (Near Field Communication), 19, 60, 349, 450
- NFS (Network File Systems), 274, 839
- NIC (Network Interface Cards), 51
  - cable modems and, 581
  - duplexes, 671-672
  - Ethernet NIC, 631
  - Ethernet star topologies, 626
  - installing, 139
  - laptops, 488
  - on-board NIC (BIOS/UEFI), 671
  - properties of, 671
  - QoS, 672
  - speed, 672, 1140
  - troubleshooting, 686, 689-690
  - virtual NIC, 594, 672-673
  - Wake on LAN feature, 672
  - wireless NIC, 652-653, 670-671, 1019
- NLQ mode (inkjet printers), 365
- no OS found errors, troubleshooting, 845
- no power from power supplies, troubleshooting, 197-198
- noisy, 486
- non-ECC memory, 217
- non-metered services, cloud computing, 597
- noncompliant systems, security, 960

- Non-Paged Pool field (Task Manager Performance tab), 233
  - non-parity (memory), 217-218
  - non-video adapters, power consumption, 195
  - nonoverlapping ID channels, 658
  - Nonpaged Kernel Memory field (Task Manager Performance tab), 231
  - NOS (Network Operating System), 621
  - not initialized status state (disk management), 298
  - NOT operators (Windows scripting), 817
  - Notepad, 845
    - notepad command, 796
    - printing from, 406
    - starting, 796
    - writing commands in, 780
  - notifications
    - emergency notifications (mobile device OS), 441
    - mobile device OS, 432
    - Notifications setting (macOS, System Preferences), 928
    - update notifications, customizing, 848
    - WEA, 441
    - Windows desktop, 740
  - nslookup command, 687, 796
  - NTFS, 273, 839
    - boot partitions, 278
    - EFS, 1001
    - partitions, 275-276, 837
    - permissions, 989, 994-996
    - system partitions, 278
    - volume structure, 279
  - NTLDR is Missing errors, 844
  - NTP (Network Time Protocol), 697
  - Num Lock indicator lights (keyboards), 507
  - number lock key, configuring, 120
  - NVMe (Non-Volatile Memory Express), 260, 470
- O**
- 
- OCR (Optical Character Recognition), scanners, 337
  - octa-core processors, 80
  - ODBC (Open Database Connectivity), 878-879
  - ODD (Optical Disk Drives), 314
    - audio, 325, 334
    - buffer memory, 317
    - burning discs, 317
    - connections, 318-319
    - copying files to discs, 317
    - device failures, 317
    - factor numbers, 316
    - installing, 319-321
    - interfaces, 318-319
    - laser lenses, 323
    - MCBF, 317
    - MTBF, 317
    - PATA connectivity, 320
    - preventive maintenance, 322-323
    - random access time, 317
    - region codes, 317-318
    - storage device design considerations, 540
    - testing installations, 321
    - transfer speeds, 315
    - troubleshooting, 321-322, 334
  - OEM (Original Equipment Manufacturers), Windows OS transfers, 835
  - Offer Remote Assistance Helper group, 982
  - offline (errors) status state (disk management), 298
  - offline disk management status state, 298
  - offsite data storage, 1000
  - ohms, 182-184
  - OK button, Windows dialog boxes, 744
  - OLED (Organic LED), 492-494
  - omnidirectional antennas, 660-661
  - on-board NIC (BIOS/UEFI), 671
  - on-demand access, cloud computing, 597
  - onboard devices, configuration options, 120
  - onboard video cards, 140
  - ONE (Microsoft OneNote) file extension, 747
  - OneDrive, 462, 832
  - open authentication, 1018
  - open source code, Linux as, 727
  - open source OS, 423
  - open source software, 918, 973
  - operation requires elevation messages, 803
  - operating costs, software, 730
  - operating systems. *See* OS
  - operational procedures, 1040
    - component handling/storage, 1049-1050
    - electronic disposal/recycling, 1045-1048
    - toner disposal/recycling, 1048-1049
    - workplace safety
      - cable management, 1040
      - environmental impact guidelines, 1045
      - fire safety, 1041
      - incident reports, 1040-1041
      - OSHA, 1041-1045
      - personal safety, 1044
      - technical field kits, 1043-1044
      - toxic waste handling, 1044
  - optical discs, 880

- optical drives
  - cleaning kits, 178
  - defined, 11
  - laptops, 467
  - power consumption, 195
  - Remote Disc (macOS), 926
  - remotely accessing, 926
  - replacing, 486
- optical lenses, cleaning, 178
- optical mice, 16
- optical storage, 285
- optical writable media, 315-317
- optimized DPI (inkjet printers), 366
- optimizing, 120
  - hard drives, 877
  - OS, 952
  - processor speed, 76
  - Windows boot process, 881-882
- OR operators (Windows scripting), 817
- organization (communication skills), 1068
- organizing
  - apps, 442
  - Windows desktop, 735
- orientation
  - laptop displays, 493
  - printer configuration, 391
- OSHA (Occupational Safety and Health Administration)
  - environmental impact guidelines, 1045
  - fire safety, 1041
  - MSDS, 1041
  - personal safety, 1044
  - SDS, 1041
  - technical field kits, 1043-1044
  - toxic waste handling, 1044
- OSI (Open Systems Interconnect) model, 642-645
- OS (Operating Systems)
  - 32-bit OS, 727-728
  - 64-bit OS, 727-728
  - Android, 432-435, 729
    - APK, 442
    - apps, 439-442
    - backups, 459
    - Bluetooth, 446
    - factory resets, 460
    - Recovery Mode, 461
    - smart cameras, 421-423
    - synchronization, 457
  - Apple iOS, 432-435
    - backups, 461-462
    - Bluetooth, 446
    - resetting devices, 461
    - restoring devices, 461
    - smart cameras, 421-423
    - synchronization, 458-459
  - apps
    - macOS, 439-442
    - mobile devices, 439
    - buying, 724
  - backups, 760-761
  - boot process, 724
  - Chrome OS, 423, 729
  - CLI, 724-725
  - closed source OS, 423
  - command prompt, 725
  - corporate OS, 731-733
  - defined, 9, 724
  - DEP, 728
  - files, defined, 725
  - folders, defined, 725
  - GUI, 724-726
  - iOS, 729
  - kernels, 10
  - Linux, 727
  - macOS, 727, 918
    - Activity Monitor, 930
    - APFS, 934
    - Apple ID, 923
    - App Store, 923-924
    - apps, 439-442
    - backups, 924-925
    - best practices, 952
    - Boot Camp, 934
    - commands, 934-938
    - computers, adding to domains, 665
    - Console, 931
    - desktop, 919
    - Disk Utility, 933
    - Dock, 919-920
    - dual-boot systems, 731
    - Finder, 919
    - Force Quit, 926
    - gestures, 922
    - GUI, 919-920
    - hard drives, 933-934
    - HFS+, 934
    - iCloud, 922-924
    - iWork, 922
    - kernel panic, 931
    - Keychain Access, 932
    - Launchpad, 920-921

- macOS distributions by release number/name, 918
- managing, 927-929
- manual, accessing, 938
- menu bar, 920
- Mission Control, 920
- POSIX, 919
- printers in macOS environments, 393-394
- Remote Disc, 926
- Safe mode, 929
- shells, 919
- Spotlight, 920
- System Information, 931
- System Preferences, 927-929
- system restores, 924-925
- system updates, 924
- Terminal, 926, 934
- Time Machine, 924-925
- touchscreens, calibrating, 498
- troubleshooting, 926-931
  - updates, 924
  - utilities, 930-934, 938
- maintenance, 906
- memory requirements, 218-220
- mobile devices, 432-435, 439-441, 729
- no OS found errors, troubleshooting, 845
- NOS, 621
- open source OS, 423
- OS not found messages, 296
- OS X. *See* macOS
- overview of, 724
- patch management, 997-998
- proprietary systems, 727
- RAM limitations, 727
- security
  - account recovery, 1000
  - backups, 998-1000
  - BitLocker encryption, 1000
  - DEP, 728, 1002-1003
  - destroying hard drives, 1002
  - disabling AutoPlay/AutoRun functions, 1001
  - EFS, 1001
  - full device encryption, 1000-1001
  - OS vulnerabilities, 730
  - overwriting hard drives, 1001
  - patch management, 997-998
  - restores, 998-1000
  - update management, 997-998
  - wiping hard drives, 1001
- service packs, 758
- software
  - compatibility, 731
  - end-of-line concerns, 730
- troubleshooting
  - software compatibility, 731
  - updates, 730
- updates
  - managing, 997-998
  - troubleshooting, 730
- upgrades, Microsoft Upgrade Advisor, 840
- user interaction, 724
- vendor-specific OS, 423
- virtualization, 589-593
- Windows, 727, 908
  - Advanced Boot Options menu, 887-889
  - Aero, 832
  - app management, 878
  - attrib command, 782
  - backups, 840, 848-849
  - bcdedit command, 782-783
  - black/blank screens, 884
  - boot process, 880-883, 887-889, 896-898
  - bootrec command, 783-784
  - BSOD errors, 886
  - cd command, 784
  - charms, 734, 832
  - checkboxes, 744
  - chkdsk command, 784
  - chkntfs command, 785
  - cipher command, 785
  - cls command, 786
  - [command name] /? command, 782
  - command command, 786
  - command prompt, 770-803
  - compatibility mode, 836
  - Component Services, 862
  - compressing files/folders, 752
  - Computer Management Console, 861-862
  - configuring, 850-851, 889-892
  - context menus, 745
  - Control Panel, 754-757, 850
  - copy command, 786
  - copying files/folders, 752-754
  - corporate deployments, 842-843
  - Credential Manager, 866-870
  - data migration, 835
  - Data Sources (ODBC), 878-879
  - data transfers, 835
  - default folders, 748
  - defrag command, 786

- del command, 787
- deleting files, 737
- desktop, 733-735
- determining versions, 757
- device drivers, 851-853
- Device Manager, 780
- dialog boxes, 743-744
- dir command, 787
- disable command, 787
- disabling apps, 891
- disabling interfering software, 841
- Disk Cleanup tool, 877
- Disk Management tool, 838
- diskpart command, 788
- dism command, 788
- drive letters, 745
- drive partitions (volumes), 838
- drivers, 839
- drop-down menus, 745
- dxdiag command, 788
- enable command, 789
- encrypting files/folders, 753
- Error Checking tool, 877
- Event Viewer, 863-866
- exit command, 789
- expand command, 789
- explorer command, 789
- File Explorer, 772
- file extensions, 746-748
- file systems, 838-839
- file/folder attributes, 752
- format command, 790
- formatting hard drives, 838
- gpreresult command, 790
- gpupdate command, 790-791
- hardware installation requirements, 839
- help, 745, 791
- icons, 733, 736
- imaging, 788
- indexing files/folders, 751
- installing, 833-834, 840-846, 853. *See also* Windows, preinstalling
- installing apps, 857-860
- installing devices, 852-857
- installing, 832
- installing software, 857-860
- installing Windows with older OS, 881
- ipconfig command, 791
- launching apps, 858
- libraries, 746
- Local Users and Groups tool, 870-871
- logons, 733
- maintenance, 906
- md command, 792
- Metro UI, 832
- MMC, 861
- mmc command, 792
- more command, 792
- moving files/folders, 752-754
- msconfig command, 793
- msinfo32 command, 793
- mstsc command, 793
- multi-monitor taskbars, 832
- naming files/folders, 745-746
- nbtstat command, 793
- net command, 794
- net use command, 794
- net user command, 794-795
- netdom command, 795
- netstat command, 795-796
- networks, 897
- no OS found errors, 845
- notepad command, 796
- nslookup command, 796
- OEM and Windows OS transfers, 835
- OneDrive, 832
- overview of, 832
- partitions, 838
- paths, 736, 748-749
- performance, 900-904
- Performance Monitor, 903
- ping command, 796-797
- planning drive space, 837
- power options, 899
- PowerShell, 780
- preinstalling, 832-841. *See also* Windows, installing
- Print Management console, 879-880
- profiles, 896-897
- radio buttons, 744-745
- rd command, 797
- reboots, 898
- recovering OS, 760-761, 832, 884-886
- recovery discs, 760
- Recycle Bin, 737
- regedit command, 797
- registry, 758-760, 848
- regsvr32 command, 797
- reloading, 760, 845-846
- remote networking, 905

- removable media files, 737
  - ren command, 798
  - repair installations, 833, 845-846
  - Resource Monitor, 903-904
  - restoring OS, 760-761, 832, 884-887
  - robocopy command, 798
  - Safe mode boot option, 844
  - saving files, 748
  - scripting. *See* separate entry
  - searching for files/folders, 751
  - security scans before Windows OS installations, 840
  - service management, 878
  - service packs, 758
  - services, 895
  - services.mmc command, 798
  - set command, 799
  - setup log files, 845
  - sfc command, 799
  - Shadow Copy technology, 887
  - shares, 866
  - shortcuts, 736
  - shutdown command, 800
  - shutdowns, 898-899
  - side-by-side apps, 832
  - Start screen, 734
  - storage management, 874-877
  - subfolders, 746
  - synchronizing software, 859
  - System Configuration utility (msconfig command), 889-892
  - system images, 760-761
  - systeminfo command, 800
  - System Restore, 886-887
  - taskkill command, 800
  - tasklist command, 801
  - Task Manager, 892-894, 901-903
  - Task Scheduler, 862
  - telnet command, 801
  - textboxes, 744
  - tiles, 734-736
  - tracert command, 801
  - troubleshooting, 857, 864, 884-886, 895-904
  - troubleshooting audio devices, 854
  - troubleshooting device installing, 855-857
  - troubleshooting installations, 843-845
  - type command, 802
  - UAC, 832
  - updates, 843, 846-848
  - upgrades, 833-836, 841-846
  - user account management, 866-873
  - verifying installations, 843
  - versions of, 728-729
  - Virtual XP Mode, 836
  - wallpaper schemes, 736
  - wbadmin command, 802
  - Windows 7 desktop, 737-740
  - Windows 8 desktop, 740-741
  - Windows 8.1 desktop, 740-741
  - Windows 10 desktop, 742-743
  - Windows 10 Mobile, 423
  - windows, defined, 743
  - Windows Mobile OS, 423, 730
  - Windows Phone, 423
  - Windows RT, 423
  - Windows Store, 832
  - Windows Upgrade Advisor, 835
  - WinRE, 761, 776, 832, 884-886
  - wscript command, 802
  - xcopy command, 802
  - workstations, 729
  - out of memory errors, 234
  - output (Windows scripting), 808
  - output devices, 19
  - overclocking processors, 90-91
  - overheat shutdown situations, 148
  - overheating, 103
    - impact printers, 363
    - laser printers, 385
    - mobile devices, troubleshooting, 512-513
    - print heads, 363
    - troubleshooting, 198
  - Override enabled—Defaults loaded message, 547
  - oversized images/icons, troubleshooting, 145
  - overvoltage, troubleshooting, 1050
  - overwriting hard drives, 1001
  - ozone gas and laser printers, 385
- ## P
- 
- P2P (Peer-to-Peer), RDP, 1015
  - PaaS (Platform as a Service), 594
  - packaging memory, 213
  - packets (data), verifying paths, 801
  - PAE (Physical Address Extension), 230
  - Paged Kernel Memory field (Task Manager Performance tab), 231
  - Paged Pool field (Task Manager Performance tab), 233
  - pages (memory), 229, 289
  - paging files, 229

- PAN (Personal Area Networks), 620
- PAN ID (Zigbee devices), 679
- Panel (Ubuntu), 940
- paper (printers)
  - creased papers, 404
  - erasable-bond paper, 375
  - feeders/trays, 365, 375-376
  - feeds/trays, 402
  - humidity, 375
  - impact printers, 363
  - jams, 383, 403
  - options/properties, 376
  - pounds, 375
  - recycled paper, 375
  - special thermal paper, 371
  - storage tray/feeder upgrades, 380
  - troubleshooting, 383
  - weight, 375
- paper transport subsystem (printers), 360
- paper trays/feeders, 365, 375-376
- parabolic antennas, wireless networks, 663
- parallel hard drive interfaces, 259
- parallel ports, 59
- parental controls, 929, 1013, 1026
- parity
  - memory, 217
  - serial ports, 577
- partitioning
  - hard drives
    - Linux, 948-950
    - macOS, 934
    - Ubuntu, 948-950
- partitions (hard drives), 272-273, 277, 281, 745, 788
  - basic disk partitions, 838
  - boot partitions, 278, 881
  - boot volumes, 880
  - converting, 274
  - deleting, 278
  - dynamic disk partitions, 838
  - eSATA drives, 276
  - extended partitions, 276, 282, 838, 875
  - FAT16 partitions, 275
  - FAT32 partitions, 275
  - GPT, 279, 838
  - internal hard drive partitions, 880
  - logical partitions, 838
  - Mac dual-boot systems, 731
  - NTFS partitions, 275-276
  - primary partitions, 276, 838
  - recovery partitions, 833
  - resizing, 282
  - shrink partitions (disk management), 282, 875
  - splitting partitions (disk management), 282, 875
  - swap partitions, 838
  - system partitions, 278
  - Windows installations, planning hard drive space, 837
- passcode locks, mobile devices, 500
- passive cables, 38
- passive cooling, 86
- passwords
  - AD accounts, 986-988
  - Administrator accounts, 982
  - AP, 676, 1022
  - BIOS, 120, 970-971
  - cached passwords, synchronization, 456
  - CMOS jumper, 126
  - complexity, 971
  - expiration dates, 972
  - failed attempts, 972
  - formatting, 972
  - HomeGroups, 972
  - Kerberos protocol, 971
  - Keychain Access (macOS), 932
  - logical security, 968
  - passwd command (Linux), 944-945
  - password policies, 1064
  - power-on, BIOS/UEFI security, 971
  - rainbow table attacks, 979
  - reminders, 971
  - reusing, 972
  - security policies, 960
  - troubleshooting, Keychain Access (macOS), 932
  - UEFI, 970-971
  - wireless AP, changing, 676
  - wireless routers, changing, 676
  - workgroups, 623
- PAT (Port Address Translation), 695, 1014
- PATA (Parallel ATA), 259
  - cables, 260
  - installing PATA devices, 265-266
  - ODD connections, 320
  - physical installation, 265
- PATA IDE (Parallel ATA Integrated Drive Electronics), 262
  - hard drives, power consumption, 195
  - installing, 265
  - motherboard connectors, 261
- patch antennas, wireless networks, 663
- patch panels, 634
- patches (software), 551, 846, 997-998
- path loss. *See* attenuation

- path variables (Windows scripting), 805
- paths
  - drives, 736
  - files, 748-749
  - verifying, 801
  - Windows upgrade paths, 834
- payments
  - credit card readers, 428, 431
  - mobile payment services, 441
  - mobile wallets, 441
  - NFC/tap pay devices, 450
  - PCI, 975
- PB (petabytes), 24
- PC (Personal Computers), 9
  - cameras/webcams, 19
  - chip readers, 19
  - DVD drives, 11
  - external storage drives, 19
  - game controllers, 19
  - hard drives, 11
  - headsets, 19
  - home server PC, 538
  - keyboards, 16-19, 34-35
  - KVM switches, 19
  - magnetic readers, 19
  - mice, 16-19, 34-35
  - microphones, 19
  - monitors, 10
    - cables, 37, 40-41
    - connectors, 38-40, 58
    - CRT monitors, 36
    - ports, 35-41, 58
  - motherboards, 24
  - NFC devices, 19
  - optical drives, 11
  - power supplies, 10
  - printers, 18
  - projectors, 19
  - scanners, 18
  - signature pads, 19
  - smart card readers, 19
  - tap-to-pay devices, 19
  - touchpads, 19
  - types of, 9
  - VR headsets, 18
- PCI (Payment Card Information), 975
- PCI (Peripheral Component Interconnect)
  - bus speeds, 76
  - expansion slots, 94
  - PCI slots, 96-97
- PCI/PnP, configuring, 121
- PCIe (PCI Express)
  - bus speeds, 76
  - configuring, 121
  - dual Molex-to-PCIe power converters, 186
  - interrupts, 127-128
  - PCIe slots, 94-99
  - PCIe video cards, power consumption, 195
- PCX (Microsoft Paintbrush) extension, 747
- PDF (Portable Document Format) files, 337, 378, 747
- PDSL (Power line DSL), 585
- peer-to-peer networks, 621, 677
- performance
  - baseline reports, 901
  - batteries, 473-474
  - buses, 74
  - defragmenting hard drives, 786
  - hard drives, 235, 290, 297, 877
  - laptop batteries, 473-474
  - memory, 224-225, 228, 235
  - monitoring, 904
  - Performance Monitor, 903
  - Performance utility (Windows), 231-233
  - RAM, 213
  - slow performance, troubleshooting, 894, 900-904
  - software, 730
  - touchscreens, 511
  - troubleshooting, 900-904
  - video, 148
  - web browsers, 610
  - Windows boot process, 881-882
- Performance Log Users group, 982
- Performance tab
  - Task Manager, 893, 901-902
  - Windows 7 Task Manager, 231-232
  - Windows 8 Task Manager, 232-233
  - Windows 10 Task Manager, 232-233
- permissions
  - administrative shares, 991
  - command prompt and, 996
  - directory permissions, 969
  - effective permissions, 995-996
  - file attributes, 996
  - file permissions, 989, 1004
  - hidden shares, 991-992
  - inherited permissions, 995
  - libraries, 993
  - local shares, 991
  - NTFS permissions, 989, 994-996
  - Public folders, 992



- restrict user permissions, 988
- share permissions, 988-991
- personal computers. *See* PC
- personal integrity, 1073
- personal safety, 1044
- personal software licenses, 973
- PGA (Pin Grid Array) sockets, 85
- phablets, 421-422. *See also* smartphones; tablets
- phase-change cooling, 86
- PHI (Protected Health Information), 975
- phishing, 978, 1026
- Phoenix BIOS/UEFI chips, audio beeps (POST codes), 547
- phone communication skills (technicians), 300
- phone filters, DSL modems, 586
- phone line isolators, 587
- phone line limits (modems), 578
- photos. *See* cameras
- physical laptop locks, 499
- Physical layer (OSI model), 644
- physical security, 961
  - authentication, 961, 966-968
  - badge readers, 962
  - biometric locks, 963
  - biometrics, 966-968
  - cable locks, 963
  - document security, 965
  - door locks, 962
  - electronic key cards, 961
  - entry control rosters, 963
  - guards, 962
  - hardware tokens, 962-964
  - key fobs, 962
  - mantraps, 963-964
  - policies, 960
  - privacy filters, 963
  - RFID, 962
  - server locks, 963
  - smart cards, 962-963
  - TPM, 963, 971
  - tracking modules, 963
  - USB locks, 963
- pickup rollers (laser printers), 370
- Pico-ITX motherboards, 101
- PII (Personally Identifiable Information), 974
- PIN (Personal Identification Numbers), mobile devices, 500
- pin firing (printers), 363
- pinch gestures, 435
- ping command, 684-686, 796-797
- pinning apps to Windows 7 taskbar, 739
- pinwheels (spinning), 297, 548, 930
- pipelines (processors), 75
- piracy
  - apps, 973
  - incident reports, 1026
  - software, 973
- pixels (dead), troubleshooting, 145
- planars. *See* motherboards
- plans
  - backout plans (change management cycle), 1065
  - hard drive space, Windows installations, 837
  - plans for change (change management), 1064
  - plans of action (troubleshooting), establishing, 554
- plasma displays, burned-in images, 147
- plastic filaments (3D printers), 373-374
- platters (hard drives), 254
- plenum cables, 56, 628
- pliers (needle-nose), 166
- PM (Particulate Matter), UPS/SPS battery backups, 1057-1058
- PNG (Portable Network Graphics) files, 337
- PnP (Plug-and-Play)
  - troubleshooting, 132
  - UPnP, 1010
- PoE (Power Over Ethernet), 657
- pointer drift (trackpads), troubleshooting, 509
- polarity
  - continuity checks, 183
  - voltage, 181
- policies (documentation), 1063
  - AUP, 1064
  - group policies, 790-791, 987-988, 1110
  - local security policies, 987
  - MDM policies, 1017-1018
  - password policies, 1064
  - regulatory/compliance, 1064
  - security policies, 960-961, 973, 1064
- pooling resources (cloud computing), 597
- POP (Point of Presence), 695
- POP3 (Post Office Protocol version 3), 453, 697
- pop-ups, 609
- portable chargers, 428-430
- portable vacuums, 178
- ports
  - AGP, 95
  - audio, 50, 59
  - audio ports, 50, 59, 324-326, 540
  - cable modem ports, 582
  - component/RGB video analog, 340

- composite video, 340
- DB-9 ports. *See* serial devices, serial ports
- defined, 34
- DisplayPort, 39, 58, 467
- DSL modem ports, 585
- eSATA, 51, 59
- Ethernet, 51-52, 59, 582
- forwarding, 677, 1011
- game, 59
- HDMI ports, 39
- integrated motherboard ports, 57-58
- keyboards, 34-35
- Lightning ports, 49-50, 59, 443
- male/female ports, 34
- mapping, 1014
- mice ports, 34-35
- micro-USB ports, 443
- MIDI, 59
- mini DisplayPort, 467
- mini-USB ports, 443
- mobile devices, 443
- mobile USB ports, 443
- modem, 52, 59
- multiple-device ports, IRQ assignments, 127
- multipurpose ports
  - Lightning ports, 49-50, 59
  - Thunderbolt ports, 49-50, 59
  - USB ports, 42-50, 59
- network, 51-52
- parallel, 59
- PAT, 1014
- printers, 360, 404
- projector ports, 340
- proprietary vendor-specific ports, 443
- PS/2 keyboard, 58
- PS/2 mouse, 58
- PS/2 ports, 34-35
- replicators, 468
- RJ-11, 51
- RJ-45, 51
- RS-232 ports. *See* serial devices, serial ports
- S/PDIF, 59
- S-Video, 59
- SATA, enabling, 268
- security, 969
- serial, 53, 59, 575-577
- speaker ports, 324
- Thunderbolt ports, 49-50, 59
- triggering, 677, 1011
- troubleshooting, 550
- unused ports, disabling, 962, 969
- USB ports, 120, 337, 405
  - Alternate Mode, 44
  - charging USB ports, 46
  - defined, 42, 59
  - devices supported, 42
  - installing, 48, 134-135
  - micro-USB ports, 45
  - mini-USB ports, 45
  - sleep-and-charge USB ports, 46
  - smart card readers, 349
  - speeds, 42
  - troubleshooting, 136, 137
  - USB 2.0 ports, 42
  - USB 3.0 ports, 42
  - USB 3.2 ports, 50
  - USB-C ports, 49, 443
  - USB-PD ports, 43
- VGA ports, 39-41, 58
- video ports, 35, 41
  - DVI ports, 36-37
  - HDCP ports, 40
  - HDMI ports, 38-39, 58
  - S-Video ports, 36
  - VGA ports, 36-37
- POS (Point of Sale) systems. *See* smart card readers
- positive attitudes, maintaining (communication skills), 3, 237, 1069
- POSIX (Portable Operating System Interface), 919
- POST (Power-On Self-Test), 103, 116, 123, 552
  - codes, 234
    - audio beeps, 546-547
    - error messages, 547-548
    - troubleshooting, 545-547, 550-551
  - memory
    - error codes, 228
    - troubleshooting, 235
  - POST cards, hardware diagnostics, 548
- POTS (Plain Old Telephone Service), network connections, 706
- power cables, removing, 168
- Power on by Ring, Resume by Ring, or Wakeup power setting (ACPI), 193
- Power on Function power setting (ACPI), 193
- power ratings (speakers), 331
- power supplies, 10, 184
  - +1 V, 198
  - +5 V, 198
  - AC/DC, 180
  - ACPI, 121, 191-193

- air filters, 538
- ATX, 185-188
- auto-switching, 184
- batteries
  - backups, 1054-1059
  - charging, 511
  - cleaning, 178
  - disposal of/recycling, 1046-1048
  - life of, 511
  - Li-ion batteries, 473, 504, 1047-1048
  - recycling programs, 124, 1046-1048
  - SPS, 1055-1059
  - swollen batteries, 511
  - troubleshooting, 511
  - UPS, 1054-1059
- capacitors, 182
- choosing, 195-196
- computer design, 537-538
- continuity checks, 182-183
- converters, 186-187
- cooling, 189
- current, 182
- DC jacks, replacing, 489
- DC voltage distribution, 189
- digital cameras, 342
- disassembling, 198
- docking stations, 428-430, 468
- dual-rail power supplies, 194
- dual-voltage, 184, 188
- fans, 189
- form factors, 185-186
- frozen mobile devices, troubleshooting, 512
- fuel cells, 473
- inkjet printers, 365
- laptops
  - buying batteries, 471
  - fuel cells, 473
  - Li-ion batteries, 473, 504, 1047-1048
  - removing batteries, 473
  - tips for battery performance, 473-474
  - zinc-air batteries, 473
- laser printers, 369-370
- line conditioners, 1053
- measuring, 182
- meter readings, 183
- micro-ATX, 185
- mobile devices, 428-430
- motherboard, 123-124
- overheating, troubleshooting, 512-513
- portable chargers, 428-430
- power consumption, 194-195
- projectors, 342
- protection, 197
- purposes of, 188
- quality of, 195
- removing laptop batteries, 473
- replacing, 193-194
- resistance, 182
- safety, 25, 183
- SATA drives, 538
- sleep mode, 193
- SPS, 1055-1059
- standby, 181
- storage device design considerations, 539
- surges, 1050
- surge protectors, 197, 1051-1053
- testing, 198
- triple-rail power supplies, 194
- troubleshooting, 197-199, 511-513, 1050-1051
- upgrading, 193-194
- UPS, 1054-1059
- voltage, 181-182
- voltage checks, 198
- wattage, 193-194
- Windows power options, 899
- zinc-air batteries, 473
- power users, 871, 982
- powder-free gloves (safety equipment), 1043
- power-on passwords, BIOS/UEFI security, 971
- PowerShell, 820
  - cmdlets, 821
  - help, 821
  - opening, 780
  - .psl files, 804
- PPE (Personal Protective Equipment), 1043-1044
- PPGA (plastic pin grid array) sockets, 85
- PPP (Point-to-Point Protocol), 706
- PPT/PPTX (Microsoft PowerPoint) extension, 747
- predownloading Linux packages, 948
- Preferences (System), macOS, 927-929
- preferred roaming lists. *See* PRL
- prefix notation, subnet masks, 1086
- preinstalling Windows, 832-841. *See also* installing, Windows
- Presentation layer (OSI model), 644
- preventive maintenance. *See also* troubleshooting
  - adapters, 180
  - boot inspection, 177
  - defined, 177
  - displays, 177

- hard drives, 290-293
- implementing, 554
- inventory, taking, 180
- kits, 178
- LCD monitors, 177
- modems, 587
- ODD, 322-323
- printers, 381-386
- scanners, 338
- updates, 180
- vacuum cleaners, 179
- Windows, 906
- PRI (Product Release Instruction) updates, 437
- primary (main) corona (laser printers), 370
- Primary master hard disk fail message, 548
- primary partitions (hard drives), 276, 838
- Primary slave hard disk fail message, 548
- principle of least privilege, 991
- print drivers, Windows environments, 390-391
- print engine subsystems (printers), 360
- printers, 18
  - 3D printers, 361, 372-374
  - access denied messages, 407
  - blank pages, printing, 404
  - Bluetooth, 397-398
  - bubble jet printers. *See* inkjet printers
  - categories, 361
  - cleaning, 178
  - cloud printing, 399-400
  - configuring, 376, 391
  - connectivity, 402-403
  - creased paper, 404
  - data privacy, 401
  - default printers, configuring, 389-390
  - dot matrix. *See* impact printers
  - DPI printers, 364-366
  - duplexing assemblies, 360, 376
  - dye sublimation, 366
  - error codes, 402
  - faded print, 404
  - failed print jobs, troubleshooting, 407
  - feeds/trays, 402
  - firmware, 404
  - garbled characters, 403
  - hard drive caching, 401
  - impact printers, 361-363, 375, 380-381, 407-408
  - indicator lights, 402
  - ink cartridges, 379-380, 384, 387
  - inkjet printers, 361-366, 376, 379-383, 408
  - installing, 386-389, 393, 403
  - large-format inkjet, 366
  - laser printers, 361, 367-371, 376, 380, 383-386, 404, 408-409, 1055
  - light printing, troubleshooting, 408
  - local printers, 388
  - macOS environments, 393-394
  - maintenance, 380
  - mapping, 692
  - memory, 380, 404
  - networking, 395-399, 407
  - Notepad, printing from, 406
  - optimized DPI, 366
  - paper, 380
    - erasable-bond paper, 375
    - feeders/trays, 375-376
    - feeds/trays, 402
    - humidity, 375
    - jams, 383, 403
    - options/properties, 376
    - pounds, 375
    - recycled paper, 375
    - weight, 375
  - pin firing, 363
  - ports, 360, 404
  - print heads
    - bidirectional printing, 363
    - calibrating, 382
    - cps, 361
    - impact printers, 361-363
    - inkjet printers, 363-364
    - overheating, 363
    - pin firing, 363
    - replacing, 363
    - thermal printers, 371-372
  - print jobs
    - hard drive caching, 401
    - reordering, 390
    - troubleshooting, 407
  - print logs, troubleshooting, 407
  - Print Management console, 879-880
  - print servers, 398-399, 693
  - print spoolers, Windows environments, 392-393
  - print to file option (virtual printing), 378
  - print to image option (virtual printing), 378
  - print to PDF option (virtual printing), 378
  - print to XPS option (virtual printing), 378
  - print wires (impact printers), 361
  - Printers & Scanners setting (macOS, System Preferences), 928
  - queues, 390, 407

- rubber rollers, 404
- sensitive printed material, 360
- sharing, 395-399, 407, 691
- solid ink, 366
- subsystems, 360
- TCP/IP printing, 692
- test pages, printing, 390
- thermal printers, 361, 371-372, 386
- thermal wax transfer, 366
- toner cartridges, 387
- troubleshooting, 383-388, 402-409, 692, 880
- upgrading, 380, 404
- USB printers, 360, 386-388
- virtual printing, 377-378
- Windows environments, 388
  - default printers, 389-390
  - installing printers, 389
  - networking printers, 395
  - print drivers, 390-391
  - printer properties, 390
  - print spoolers, 392-393
  - sharing printers, 395
  - troubleshooting, 405-406
- wireless printers, 397-398
- privacy
  - confidential/private materials, handling, 1075-1076
  - filters, 963
  - GDPR, 975
  - PCI, 975
  - PHI, 975
  - PII, 974
  - printer data, 401
  - Privacy tab (Internet Explorer 11, Internet Options window), 598, 602-603
  - private clouds, 595-596
  - Security & Privacy setting (macOS, System Preferences), 928
- private IP addresses, 647
- privileges
  - commands, 803
  - principle of least privilege, 991
- PRL (Preferred Roaming Lists), 437
- proactive technicians, 707
- probable cause (troubleshooting), theory of, 544-551
- procedures
  - emergency procedures, security policies, 961
  - operational procedures, 1040
    - component handling/storage, 1049-1050
    - electronic disposal/recycling, 1045-1048
    - toner disposal/recycling, 1048-1049
    - workplace safety, 1040-1045
- process ID, 801
- processes
  - killing, 800
  - Linux processes, viewing, 947
  - Ubuntu processes, viewing, 947
- Processes field (Task Manager Performance tab), 232
- Processes tab (Task Manager), 893
- processing Windows scripts, 808
- processors
  - A-Series, 85
  - A-Series PRO, 85
  - ALU, 74
  - AMD, 84-85
  - APU, 82
  - Atom, 84
  - binary prefixes, 24
  - BIOS settings, 120
  - buses, 73-77, 80
  - cache memory, 77
  - clocking, 78
  - connections, 80
  - cooling, 86-87, 91-92, 189-190
  - Core i3, 84
  - Core i5, 83
  - Core i7, 83
  - Core i7/i5 vPro, 84
  - Core i9, 83
  - Core m3, 84
  - Core X, 83
  - defined, 72
  - dual-core, 80
  - FX, 84
  - GPUs, 82
  - green (environmental) concerns, 101
  - hexa-core processors, 80
  - Hyper-V client, 592
  - installing, 88-90
  - Intel processors, 83-84
  - IRQs, 127, 130
  - laptops, replacing, 477
  - motherboard design, 536
  - multicore processors, 80-85
  - nanometers, 536
  - octa-core processors, 80
  - overclocking, 90-91
  - pipelining, 75
  - power consumption, 195
  - quad-core processors, 80
  - register size, 73
  - Ryzen 3, 84

- Ryzen 5, 84
  - Ryzen 7, 84
  - Ryzen PRO, 84
  - Ryzen Threadripper, 84
  - single-core processors, 80
  - sockets, 85-86
  - software instructions, fetching, 213
  - speeds, 73, 76-77
  - threading, 79
  - throttling, 90
  - troubleshooting, 92
  - upgrading, 90
  - video processors, 140
  - Virtual PC, 592
  - product release instruction. *See* PRI
  - profiles
    - rebuilding, 896-897
    - slow profile loads, troubleshooting, 896-897
    - user, 758
  - Program Compatibility Wizard, 836
  - programs
    - paths, 736
    - Setup, 120, 1144
  - Programs and Features Control Panel (Windows), 859-860
  - Programs tab (Internet Explorer 11, Internet Options window), 599, 606-607
  - projectors, 19, 340-342
  - proof of incineration (document security), 965
  - proper language, communication skills, 1067-1069
  - Properties dialog (General tab), troubleshooting with, 149
  - proprietary crash screens, 297, 548
  - proprietary systems, 727
  - proprietary vendor-specific ports, 443
  - protective covers, mobile devices, 428-430
  - protocols
    - AFP, 696
    - CIFS, 697
    - DHCP, 696
    - DNS, 696
    - FTP, 696
    - HTTP, 696
    - HTTPS, 697
    - ICMP, Smurf attacks, 980
    - IMAP, 697
    - Kerberos, 971
    - LDAP, 697
    - NetBT, 697
    - network protocols, defined, 644
    - NTP, 697
    - POP3, 697
    - PPP, 706
    - RDP, 697, 1015
    - remote access protocols, 1015
    - SFTP, 697
    - SLP, 697
    - SMB, 697
    - SMTP, 697
    - SNMP, 697
    - SSH, 697, 1015
    - TCP, 695
    - TCP/IP, 644-645, 696-697, 980, 1123
    - Telnet, 697, 1015
    - TKIP, 1020
    - UDP, 695
    - WAPD, 1009
  - proxy servers, 693, 1008-1009
  - ps command (Linux), 944, 947
  - PS/2 keyboard ports, 58
  - PS/2 mouse ports, 58
  - PS/2 ports, 34-35
  - .psl files, 804
  - PSTN (Public Switched Telephone Networks), 579-581
  - public clouds, 596
  - Public folder, 992
  - public IP addresses, 647
  - public networks, 625
  - punch-down tools, 639
  - punctuality, 1071
  - purpose of change (change management cycle), 1064
  - PVC (Polyvinyl Chloride) cables, 56, 628
  - pwd command, 934-935, 944
  - PXE (Pre-Boot Execution Environment) boots, 880
  - Python, .py files, 804
- ## Q
- 
- QoS (Quality of Service)
    - NIC, 672
    - VoIP, 580
    - wireless APs, 676
  - QR (Quick Response) scanners, 18, 335
  - QR codes, 442
  - quad-core processors, 80
  - quadruple-channel memory, 223
  - qualities (technicians)
    - active listening skills, 2
    - positive attitude, 3
    - technical language familiarity, 3
  - quality (printer configuration), 391
  - quarantine files, 1005

queues (printers), 390, 407  
 quick formats, 279, 838  
 quitting applications, 926

## R

---

radio buttons (Windows dialog boxes), 744-745  
 radio firmware updates, 437  
 radio wireless input devices, 60  
 RADIUS (Remote Authentication Dial-in User Service), 966  
 RADSL (Rate-Adaptive DSL), 585  
 RAID (Redundant Array of Independent Disks), 282-285, 298-299  
 rainbow table attacks, 979  
 RAM (Random Access Memory)  
   adding, 234, 289  
   adding to hard drives, 235  
   defined, 13  
   DRAM, 212-213  
   hibernation mode, 280  
   Hyper-V client, 592  
   installing, 234  
   mobile devices, 424  
   OS limitations, 727  
   over 4GB, 222  
   performance, 213  
   ROM, compared, 212  
   SRAM, 213, 228-229  
   video, 142  
   virtual memory, 229-230  
   Virtual PC, 592  
 random access time (ODD), 317  
 ransomware, 976-977  
 rapid elasticity (cloud computing), 597  
 raster imaging process (laser printers), 368  
 RAW files, 343  
 RAW volumes (Windows Disk Management), 281  
 RCA jacks, 50  
 rd command, 777, 797  
 RDP (Remote Desktop Protocol), 697, 1015  
 re-arming activation clocks, 842-843  
 read & execute NTFS permission, 995  
 read NTFS permission, 995  
 read/write failures, 297  
 ReadyBoost, 882  
 reassembling  
   cables/connectors, 176  
   motherboards, 176  
 Reboot (Advanced Boot Options menu), 888

reboots  
   troubleshooting, 197  
   Windows reboots, 898  
 rebuilding profiles, 896-897  
 reconnaissance attacks, 980  
 recovering  
   account recovery options, 871  
   accounts, 1000  
   file recovery, 290, 1000  
   hard drives, 783-784  
   Windows OS (Operating Systems)  
     recovery discs, 760  
     reloadOS, 760  
     Safe Mode, 761  
     system images, 760-761  
     WinRE, 761, 832, 884-886  
 recovery discs, 760  
 Recovery Mode (Android), 461, 505  
 recovery partitions (Windows), 833  
 Recycle Bin (Windows Desktop), 737  
 recycling  
   batteries, 1045-1048  
   computer components, 535  
   CRT monitors, 1046  
   ink cartridges, 379  
   mobile devices, 1046  
   paper, 375  
   printers, 375  
   smartphones, 1046  
   tablets, 1046  
   toner, 1048-1049  
 Red Hat website, 939  
 redirecting  
   folders (AD), 986  
   web browsers, 608  
 refilling ink cartridges, 379-380  
 refresh rates (displays), 855  
 Refresh Your PC tool (Windows), 882  
 refreshing  
   group policy settings, 790-791  
   memory, 213  
   Windows installations, 833  
 regedit command, 797  
 regedit tool, 759, 849  
 regedt32 tool, 759  
 region codes (DVD/BD), 317-318  
 region settings (Windows), 841  
 register size (processors), 73  
 registered memory, 217  
 registering dll files, 797

- registration assemblies (laser printers), 370
- registry (Windows), 132
  - accessing registry editor, 797
  - backups, 759, 848
  - defined, 758
  - dll files, registering, 797
  - editing, 759-760
  - subtrees, 758-759
- regsvr32 command, 797
- regsvr32.exe command, 861
- regulated data, end-user security, 974-975
- regulatory/compliance policies, 1064
- reimaging hard drives (disk imaging), 842
- reinitializing antivirus software, 843
- relational operators (decision structures), 813
- Reliability Monitor, 904
- reloading
  - OS, 760
  - Windows, 845-846
- reminders (passwords), 971
- remote access
  - protocols, 1015
  - security policies, 961
- remote backups, mobile devices, 455
- remote controls, projectors, 341
- remote desktops
  - protocols, 1015
  - RDP, 1015
  - Remote Desktop Services, 674-675
  - Remote Desktop utility, 793
  - security, 1015
  - users, 982
- Remote Disc (macOS), 926
- remote networks
  - accessing devices, 801
  - attaching devices, 794-796
  - connectivity testing, 796-797
  - Remote Assistance, 905
  - Remote Desktop (mstsc command), 905
  - Remote Settings link, 905
  - Windows installations, 833
- remote servers, BranchCache, 733
- remote wipes, 500
- removable drives, 285
- removable media files, deleting, 737
- removable/rotating screens (laptops), 493
- removing
  - adapters, 167, 173, 180
  - cables, 168-172
  - cases, 168
  - connectors, 169-172
  - credentials from Windows, 869
  - DIMM, 227-228
  - directories, 777, 797
  - files from directories, 778
  - flash memory, 236
  - hard drives, 173, 484
  - laptop batteries, 473
  - laptop displays, 494-496
  - malware, 1004-1005
  - memory, 227-228, 482
  - motherboards, 174-175
  - PCIe adapters, 98-99
  - plastic parts, 475
  - SSD, 173
  - storage devices, 173
  - touchscreens, 496
  - USB devices, 46
- ren command, 798
- renaming
  - directories, 798
  - files, 798
  - system files, troubleshooting, 1004
- Repair Your Computer (Advanced Boot Options menu), 888
- repairing
  - displays (laptops), 494-499
  - hard drives, 483-485, 783-784, 933
  - installations, 833, 845-846
  - inverters (laptop displays), 499
  - laptops
    - Bluetooth cards, 487
    - DC jacks, 489
    - displays, 494-499
    - hard drives, 483-485
    - inverters, 499
    - keyboards, 478
    - memory removal/installation, 482
    - microphones, 498
    - motherboards, 476
    - optical drives, 486
    - processors, 477
    - smart card readers, 487
    - sound, 490
    - touchpads, 479
    - touchscreens, 496
    - video cards, 491
    - webcams, 498
    - WiFi cards, 487



- microphones, 498
- touchscreens (laptops), 496
- webcams, 498
- repeaters (wireless extenders), 656
- repetition (Windows scripting), 808
- repetition structures. *See* loops
- replacing
  - Bluetooth laptop cards, 487
  - DC jacks, 489
  - fuses, 184
  - hard drives (laptops), 484
  - ink cartridges, 384
  - inverters (laptop displays), 499
  - motherboards, 102-103
  - optical drives, 486
  - power supplies, 193-194
  - print heads, 363
  - processors (laptops), 477
  - smart card readers, 487
  - touchscreens, 496
  - video cards (laptops), 491
  - WiFi laptop cards, 487
- replay attacks, 980
- reservations, DHCP servers, 667
- Reset This PC tool (Windows), 882
- resets (factory), mobile devices, 500-501
- resetting
  - Android devices, 460
  - Apple iOS devices, 461
  - passwords, AD accounts, 986
- resistance, 182-184
- resistive touchscreens, 495-496
- resizing partitions (hard disks), 282
- resolution
  - digital cameras, 342
  - displays, 855
  - Enable Low-Resolution Video (640-480), Advanced Boot Options menu, 888
  - laptop displays, 495
  - projectors, 341
  - scanners, 337-338
- Resource Monitor, troubleshooting performance, 903-904
- resources
  - network resources, 685
  - pooling (cloud computing), 597
  - system, 128-130
  - workgroup resource management, 624
- restarting
  - computers, 800
  - services, 895
- restore points, 849
  - controlling, 998
  - Windows repair installations, 846
- restores
  - Time Machine (macOS), 925
  - wbadmin command, 802
  - xcopy command, 802
- restoring
  - Apple iOS devices, 461
  - data from backup, 998-1000
  - System Restore, 886-887
  - Windows installations, 833
  - Windows OS
    - recovery discs, 760
    - reloadOS, 760
    - Safe Mode, 761
    - system images, 760-761
    - System Restore, 886-887
    - WinRE, 761, 832, 884-886
- restrict user permissions, 988
- Resume by Alarm power setting (ACPI), 193
- retaining clips, 175
- retinal scanners (biometrics), 967
- reusing passwords, 972
- reviewing error messages/log entries (troubleshooting), 543
- RFI (Radio Frequency Interference), 165
- RFID (Radio Frequency Identification) tags, 449, 962
- RG-6 coax cable, 41
- RG-59 coax cable, 41
- ribbon cables, 170
- ribbons (printer), 361
- riser cards, 94
- RJ-11 connectors, 629
- RJ-11 ports, 51
- RJ-45 connectors, 629-633
- RJ-45 ports, 51
- RJ-45 wall jacks, 634
- rm command (macOS), 934-936
- robocopy command, 778, 798
- rogue antivirus applications, 1003
- roll back device drivers, 855-856
- roll back Windows updates, 847
- rollers (inkjet printers), 365
- ROM (Read-Only Memory), 212, 315
- root directories, 771-773
- root users (UNIX/Linux), 936
- rooting mobile devices, 503
- rootkits, 608, 976, 1095
- rotating/removable screens (laptops), 493

- routers
    - ADSL routers, 653
    - Network layer (OSI model), 644
    - router/switch functionality, 654
    - wireless, 652-654
    - wireless routers, 652-654, 675-676
  - RPC (Remote Procedure Call) services, print spoolers, 392
  - RPM (Revolutions Per Minute), hard drives, 255
  - RS-232 ports. *See* serial devices, serial ports
  - RS232C, 576
  - RTF (Rich Text Format) extension, 747
  - rubber printer rollers, troubleshooting, 404
  - Ryzen 3 processors, 84
  - Ryzen 5 processors, 84
  - Ryzen 7 processors, 84
  - Ryzen PRO processors, 84
  - Ryzen Threadripper processors, 84
- S**
- 
- S/MIME (Secure/Multipurpose Internet Mail Extensions)
    - email configuration on mobile devices, 454
  - S/PDIF (Sony/Phillips Digital interface), 50, 59, 324
  - S-Video ports, 36, 59
  - SaaS (Software as a Service), 594
  - Safe Boot (System Configuration utility), 890-891
  - Safe mode
    - Advanced Boot Options menu, 888
    - macOS, 929
    - Windows installations, 844
  - Safe Mode with Command Prompt (Advanced Boot Options menu), 888
  - Safe Mode with Networking (Advanced Boot Options menu), 888
  - safety
    - clean rooms, 1058
    - electricity, 182-183
    - EMI, 165
    - environmental enclosures, 1057
    - ESD, 162-165
    - fire safety, 1041
    - goggles/glasses, 178, 1043
    - laser printers, 367
    - LCD, 492
    - lifting, 25
    - memory, 227
    - personal safety, 1044
    - power, 25, 183
    - refilling ink cartridges, 380
    - RFI, 165
    - static electricity, 271
    - technical field kits, 1043-1044
    - workplace procedures
      - cable management, 1040
      - environmental impact guidelines, 1045
      - fire safety, 1041
      - incident reports, 1040-1041
      - OSHA, 1041-1045
      - personal safety, 1044
      - toxic waste handling, 1044
  - sags (electricity), 1051
  - sampling
    - 8-bit sound cards, 326
    - 16-bit sound cards, 327
    - 24-bit sound cards, 327
  - sandboxes, mobile device security, 499
  - SAS (Serial Attached SCSI), 259
    - cables, 264
    - connectors, 262
  - SATA (Serial ATA), 51, 59, 259
    - cables, 260, 263
    - configuring, 121
    - connectors, 171, 262
    - eSATA cards, 268
    - hard drives, power consumption, 195
    - installing devices, 267-270
    - Molex-to-SATA power converters, 186
    - ports, enabling in BIOS/UEFI, 268
    - SATA 1, 262
    - SATA 2, 262
    - SATA 3, 262
    - SATA drives, power supplies, 538
    - SATA IDE, motherboard connectors, 261
  - satellite modems, 586-587
  - satellite network connections, 706
  - Save Configuration (Zigbee devices), 679
  - saving
    - data, 760-761
    - files, 748
  - scanner units (laser printers), 370
  - scanners
    - ADF, 18, 335
    - barcode scanners, 18, 335-336, 346
    - biometric scanners, 967
    - bit depth, 337
    - cleaning, 338
    - defined, 335
    - file formats, 337
    - film, 335
    - fingerprint scanners, 967
    - flatbed scanners, 18, 335-337

- glass, 338
- handheld scanners, 335, 967
- interpolation, 337
- OCR, 337
- preventive maintenance, 338
- Printers & Scanners setting (macOS, System Preferences), 928
- QR scanners, 18, 335
- resolution, 337-338
- retinal scanners, 967
- TWAIN, 337
- vulnerability scanners, 980
- scope of change (change management cycle), 1065
- screens
  - locks, 500, 983
  - mobile devices
    - calibration, 440
    - protective covers, 428-430
  - rotating/removable screens (laptops), 493
  - screen savers, 972
    - Desktop & Screen Saver setting (macOS, System Preferences), 928
    - sleep mode conflicts, 200
  - sharing (iCloud), 923-924
- screwdrivers, 166
- scribes, 475
- scripting (Windows)
  - attrib command, 782
  - automating tasks, 803
  - batch files, 804
  - bcdedit command, 782-783
  - bootrec command, 783-784
  - cd command, 784
  - chkdsk command, 784
  - chkntfs command, 785
  - cipher command, 785
  - cls command, 786
  - [command name] /? command, 782
  - command command, 786
  - command prompt
    - accessing, 770-771
    - administrative privileges, 771
    - attrib command, 779, 782
    - bcdedit command, 782-783
    - bootrec command, 783-784
    - cd command, 774, 784
    - chkdsk command, 784
    - chkntfs command, 785
    - cipher command, 785
    - closing, 771
    - cls command, 786
    - [command name] /? command, 782
    - command command, 786
    - common commands list, 781
    - copy command, 778-779, 786
    - defrag command, 786
    - del command, 778, 787
    - dir command, 774-776, 787
    - directories, 771-773, 777-779
    - disable command, 787
    - diskpart command, 788
    - dism command, 788
    - dxdiag command, 788
    - enable command, 789
    - exit command, 789
    - expand command, 789
    - explorer command, 789
    - finding help, 781
    - format command, 790
    - gpreresult command, 790
    - gpupdate command, 790-791
    - help command, 791
    - ipconfig command, 791
    - md command, 777, 792
    - mmc command, 792
    - more command, 792
    - msconfig command, 793
    - msinfo32 command, 793
    - mstsc command, 793
    - navigating, 774-776
    - nbtstat command, 793
    - net command, 794
    - net use command, 794
    - net user command, 794-795
    - netdom command, 795
    - netstat command, 795-796
    - notepad command, 796
    - nslookup command, 796
    - operation requires elevation messages, 803
    - overview of, 771
    - ping command, 796-797
    - rd command, 777, 797
    - regedit command, 797
    - regsvr32 command, 797
    - ren command, 798
    - robocopy command, 778, 798
    - root directories, 771-773
    - running Device Manager, 780
    - services.mmc command, 798
    - set command, 799

- sfc command, 799
- shutdown command, 800
- subdirectories, 772
- syntax, 771
- systeminfo command, 800
- taskkill command, 800
- tasklist command, 801
- telnet command, 801
- tracert command, 801
- type command, 778, 802
- wbadmin command, 802
- wscript command, 802
- xcopy command, 778, 802
- commands, common list of, 781
- comments, 812
- compiled programs, 803-804
- compound conditions, 817
- constructs, 813
- copy command, 786
- decision structures
  - dual-alternative decision structures, 814-815
  - examples of, 816-817
  - multiple alternative decision structures, 815-816
  - relational operators, 813
  - single-alternative decision structures, 814
- defined, 780, 803
- defrag command, 786
- del command, 787
- dir command, 787
- disable command, 787
- diskpart command, 788
- dism command, 788
- dxdiag command, 788
- enable command, 789
- exit command, 789
- expand command, 789
- explorer command, 789
- file types, 804
- format command, 790
- gpreresult command, 790
- gpupdate command, 790-791
- help command, 791
- input, 808
- interpreted programs, defined, 803
- ipconfig command, 791
- languages, 804
  - compiled languages, 808
  - keywords, 809
  - syntax, 807
- listsvc command, 789
- logical operators, 817
- logon scripts, AD user accounts, 985
- loops, 813, 817
  - for loops, 819-820
  - while loops, 818-819
- machine code, 808
- md command, 792
- mmc command, 792
- more command, 792
- msconfig command, 793
- msinfo command, 793
- mstsc command, 793
- nbtstat command, 793
- net command, 794
- net use command, 794
- net user command, 794-795
- netdom command, 795
- netstat command, 795-796
- notepad command, 796
- nslookup command, 796
- output, 808
- overview of, 770-771
- ping command, 796-797
- PowerShell, 804, 820-821
- processing scripts, 808
- Python, 804
- rd command, 797
- regedit command, 797
- regsvr32 command, 797
- ren command, 798
- repetition, 808
- robocopy command, 798
- script property sheets, viewing, 802
- selections, 808
- sequences, 808
- services.mmc command, 798
- set command, 799
- sfc command, 799
- shell scripts, 804
- shutdown command, 800
- syntax, 770
- systeminfo command, 800
- taskkill command, 800
- tasklist command, 801
- tasks, automating, 803
- telnet command, 801
- text files, 803-805
- tracert command, 801
- type command, 802

- variables, 812
  - alphanumeric characters, 810
  - data types, 810
  - declaring, 809
  - defined, 808
  - editing, 809
  - environment variables, 805-807
  - examples of, 810-811
  - floating-point numbers, 810
  - initializing, 810
  - integers, 810
  - naming, 809
  - path variables, 805
  - strings, 810
  - viewing, 809
- VBScript, 804, 820
- wbadmin command, 802
- wscript command, 802
- xcopy command, 802
- scroll gestures, 435
- SCSI (Small Computer System Interface), 259
  - cables, 264
  - connectors, 262
- SD (Secure Digital) memory cards, 424
- SDelete utility, overwriting hard drives, 1001
- SDK (Software Development Kits), 442
- SDRAM (Synchronous DRAM), 215
- SDS (Safety Data Sheets), 179, 1041
- SDSL (Symmetric DSL), 585
- search function
  - Windows 8 desktop, 740
  - Windows 8.1 desktop, 740
  - Windows 10 desktop, 742
- searching
  - files/folders, 751
  - skills, 7-8
- seccedit command, 988
- sectors (hard drives), 256
- secure boot, configuring, 121
- Secure Digital storage, 343
- security, 1027
  - access attacks, 979
  - ACL, 969
  - AD, 732, 983
    - adding users to groups, 984
    - creating accounts, 984
    - data storage, 986
    - deleting accounts, 986
    - disabling accounts, 986
    - group policies, 987-988
    - local security policies, 987
    - logon scripts an user accounts, 985
    - resetting account passwords, 986
    - shared folder passwords, 988
    - unlocking accounts, 986
- Administrator accounts, 982
- AES, 651
- Android, 500-503
- antimalware
  - Disable Early Launch Anti-Malware Protection (Advanced Boot Options menu), 888
  - logical security, 968
  - mobile devices, 464
- antivirus software, 840, 978
  - logical security, 968
  - policies, 960
  - reinitializing, 843
  - rogue antivirus applications, 1003
- AP, 676, 1017, 1022-1024
- app scanners, 464
- Apple ID, 923
- Apple iOS, 500-503
- AUP, 960, 973
- authentication, 981
  - apps, 500
  - authenticator apps, 966
  - biometrics, 966-968
  - EAP, 1018
  - multifactor, 966-968
  - open, 1018
  - physical security, 961
  - RADIUS, 966
  - shared key, 1018
  - single-factor, 966
  - software tokens, 966
  - SSO, 980
  - TACACS, 966
  - TPM, 963, 971
  - two-factor, 966
- authorization, 981
- backdoor attacks, 979
- badge readers, 962
- biometrics, 966
  - facial recognition devices, 967-968
  - fingerprint readers/locks, 967
  - hand scanners, 967
  - locks, 963
  - retinal scanners, 967
  - voice recognition devices, 967
- BIOS, 126, 970-971

- BitLocker encryption, 732
- blacklists, 1010
- bootups, 971
- botnets, 976-979
- brute force attacks, 979
- BYOD, 960
- cable locks, 963
- cameras, installing, 682
- cell tower analyzers, 465
- certificates of destruction, 965
- content filtering, 1016
- corporate OS
  - BitLocker encryption, 732
  - EFS, 733
- credentials, 867
- DDoS attacks, 979
- DEP, 728, 1002-1003
- dictionary attacks, 972, 979
- digital security certificates, 1008
- directory permissions, 969
- Disable Execute Bit, 121
- DLP, 969
- DMZ, 1010
- DNS, 1005-1007
- documents, 965
- domains, 980
- DoS attacks, 979
- dumpster diving, 965
- educating users about security, 979
  - AUP, 973
  - domains, 980
  - licensing software/apps, 973
  - phishing, 978
  - regulated data, 974-975
  - social engineering attacks, 972, 978
  - threats to security, 975-978
  - workgroups, 980
- EFS, 733
- email, 961, 969, 1007
- emergency procedures, 961
- encryption
  - AES, 651
  - BitLocker, 732
  - defined, 963
  - EFS, 733
  - TKIP, 670
  - WEP, 670, 1019-1020
  - wireless NIC, 670
  - WPA, 670
    - WPA2, 670
    - WPA2 with AES, 671
- failed attempts lockout, 983
- files, 991
  - attributes, 996
  - quarantined files, 1005
- fingerprint readers, 346-347
- firewalls, 644, 968
  - antimalware software and, 1009
  - antivirus software and, 1009
  - Windows Firewall, 1010-1013
  - wireless networks, 1017
- flash memory, 236
- folders, 991
- GPS tracking, 500
- grayware, incident reports, 1026
- group policies (AD), 987-988
- guest accounts, disabling, 982
- hard drives, backups, 998-999
- hardware tokens, 962-964
- HomeGroups, passwords, 972
- IDS, 1016
- incident reports, 1025-1026
- Internet, 1003
  - blacklists, 1010
  - digital security certificates, 1008
  - DMZ, 1010
  - DNS configuration, 1005-1007
  - email, 1007
  - end-point management servers, 1016
  - firewalls, 1009
  - IDS, 1016
  - IPS, 1016
  - MBSA, 1004
  - proxy servers, 1008-1009
  - removing malware, 1004-1005
  - UPnP, 1010
  - UTM systems, 1016
  - whitelists, 1009
  - Windows Defender, 1004
- IPS, 1016
- Kerberos protocol, 971
- key fobs, 962
- Keychain Access (macOS), 932
- keyloggers, 976
- laptops, 499-503
- libraries, 993
- Linux, logical security, 970

- local resources
  - AD, 732, 983-986
  - authentication, 981
  - authorization, 981
  - user management, 981-983
- local security policies (AD), 987
- Lock Computer option, 983
- logical security
  - ACL, 969
  - antimalware, 968
  - antivirus, 968
  - authentication, 968
  - BIOS/UEFI passwords, 970-971
  - complexity, 971
  - directory permissions, 969
  - disabling unused ports, 969
  - DLP, 969
  - email filtering, 969
  - firewalls, 968
  - Linux, 970
  - passwords, 968, 971-972
  - ports, 969
  - screen savers/locks, 972
  - trusted/untrusted sources, 970
  - user ID, 972
  - VPN, 969
- logon time restrictions, 982
- logs (Event Viewer), 865
- MAC address filtering, 1022
- malware, 975-978, 1004-1005
- MITM attacks, 979
- mobile devices
  - antimalware, 464, 499
  - antivirus software, 499
  - app scanners, 464
  - Authenticator apps, 500
  - cable locks, 499
  - cameras, 502
  - cell tower analyzers, 465
  - data transmission limits, 503
  - facial recognition locks, 500
  - factory resets, 500-501
  - failed logins, 501
  - fingerprint locks, 500
  - firmware, 500
  - GPS tracking, 500
  - jailbreaking, 503
  - leaked data, 501-502
  - lost mode, 500
  - microphones, 502
  - passcode locks, 500
  - physical laptop locks, 499
  - PIN, 500
  - remote wipes, 500
  - rooting, 503
  - sandboxes, 499
  - screen locks, 500
  - security patterns, 500
  - swipe locks, 500
  - system lockouts, 501, 894
  - unauthorized access, 501
  - unauthorized tracking, 501
  - updates, 500
  - upgrades, 500
  - USS, 499
  - Wifi analyzers, 464
  - wireless connectivity, 499
- multifactor authentication
  - logical security, 968
  - physical security, 966
- NAT, 1014
- networks
  - access attacks, 979
  - AD, 732, 983-986
  - authentication, 981
  - authorization, 981
  - backdoor attacks, 979
  - botnets, 979
  - brute force attacks, 979
  - DDoS attacks, 979
  - dictionary attacks, 979
  - domains, 980
  - DoS attacks, 979
  - MITM attacks, 979
  - permissions, 988-996
  - rainbow table attacks, 979
  - reconnaissance attacks, 980
  - replay attacks, 980
  - Smurf attacks, 980
  - spoofing attacks, 980
  - SSO, 980
  - TCP/IP hijacking, 980
  - trapdoor attacks, 979
  - user management, 981-983
  - vulnerability scanners, 980
  - workgroups, 980
  - zero day attacks, 980
  - zombie attacks, 980
- noncompliant systems, 960

- OS
  - account recovery, 1000
  - backups, 998-1000
  - BitLocker encryption, 1000
  - corporate OS, 732-733
  - DEP, 1002-1003
  - destroying hard drives, 1002
  - disabling AutoPlay/AutoRun functions, 1001
  - EFS, 1001
  - full device encryption, 1000-1001
  - overwriting hard drives, 1001
  - patch management, 997-998
  - restores, 998-1000
  - update management, 997-998
  - vulnerabilities, 730
  - wiping hard drives, 1001
- overview, 960
- parental controls, 929, 1013
- passwords
  - Administrator accounts, 982
  - AP, 676, 1022
  - BIOS, 970-971
  - cached passwords, 456
  - complexity, 971
  - expiration dates, 972
  - failed attempts, 972
  - formatting, 972
  - HomeGroups, 972
  - Kerberos protocol, 971
  - logical security, 968
  - passwd command (Linux), 944-945
  - policies, 960, 1064
  - power-on, 971
  - rainbow table attacks, 979
  - reminders, 971
  - reusing, 972
  - synchronization, 456
  - UEFI, 970-971
  - wireless AP, 676
  - wireless routers, 676
  - workgroups, 623
- PAT, 1014
- permissions
  - administrative shares, 991
  - command prompt and, 996
  - effective permissions, 995-996
  - file attributes, 996
  - file permissions, 989
  - hidden shares, 991-992
  - inherited permissions, 995
  - libraries, 993
  - local shares, 991
  - NTFS permissions, 989, 994-996
  - Public folders, 992
  - restrict user permissions, 988
  - share permissions, 988-991
- phishing, 978, 1026
- physical security
  - authentication, 961, 966-968
  - badge readers, 962
  - biometrics, 963, 966-968
  - cable locks, 963
  - document security, 965
  - door locks, 962
  - electronic key cards, 961
  - entry control rosters, 963
  - guards, 962
  - hardware tokens, 962-964
  - key fobs, 962
  - mantraps, 963-964
  - policies, 960
  - privacy screens, 963
  - RFID, 962
  - server locks, 963
  - smart cards, 962-963
  - TPM, 963, 971
  - tracking modules, 963
  - USB locks, 963
- policies, 960-961, 973, 1064
- ports, 962, 969
- principle of least privilege, 991
- printer data privacy, 401
- privacy filters, 963
- proof of incineration, 965
- proxy servers, 1008-1009
- Public folders, 992
- RADIUS, 966
- rainbow table attacks, 979
- ransomware, 976-977
- reconnaissance attacks, 980
- remote access policies, 961
- remote desktops, 1015
- replay attacks, 980
- RFID, 962
- rootkits, 608, 976
- screen locks, 983
- screen savers/locks, 972
- Security & Privacy setting (macOS, System Preferences), 928
- security patterns, mobile devices, 500



- Security tab (Internet Explorer 11, Internet Options window), 598, 601
- sensitive printed material and printers, 360
- server locks, 963
- shoulder surfing, 963-965, 972, 978
- single-factor authentication, physical security, 966
- smart cards, 962-963
- smartphones, 500-503
- Smurf attacks, 980
- social engineering attacks, 972, 978
- software tokens, 966
- spear phishing, 978
- spoofing attacks, 980
- spyware, 975, 1026
- SSO, 980
- tablets, 500-503
- TACACS, 966
- tailgating, 978
- TCP/IP hijacking, 980
- timeouts, 983
- TKIP, 670
- tokens, 962-964
- TPM, 963, 971
- tracking modules, 963
- trapdoor attacks, 979
- Trojans, 976
- trusted/untrusted sources, 970
- two-factor authentication, physical security, 966
- UEFI, 970-971
- UPnP, 1010
- USB locks, 963
- users, 981-983
  - educating about security, 972-980
  - ID, 972
- UTM systems, 1016
- virtualization, 592-593
- viruses, 975-978, 1026
- VPN
  - configuring, 1014-1015
  - logical security, 969
- vulnerability scanners, 980
- WEP, 670, 946, 1019
- whitelists, 1009
- WiFi analyzers, 464
- Windows Firewall, 1010-1013
- Windows installations, 840
- wireless AP, 1017
- wireless networks, 1017-1025
- workgroups, 980-982
- worms, 976
  - WPA, 670, 1020
  - WPA2, 670, 1020
  - WPA2 with AES, 671
  - WPS, 1021-1022
  - zero day attacks, 980
  - zombie attacks, 980
- selection structures. *See* decision structures
- selections (Windows scripting), 808
- self-grounding, 164, 1049
- self-powered hubs, 46
- sensitive printed material and printers, 360
- separation pads (laser printers), 370
- sequences (Windows scripting), 808
- serial AT attachment. *See* SATA
- serial devices
  - asynchronous transmissions, 576
  - configuring, 576,-577
  - serial cables, 53
  - serial hard drive interfaces, 259
  - serial ports, 53, 59, 575-577
  - USB-to-serial converters, 575
- servers
  - AD, 732, 983-988
  - authentication servers, 693, 972
  - cloud computing, 593-597, 733
  - DHCP servers, 666-667, 693
  - DMZ, 1010
  - DNS servers, 669, 687, 693
  - end-point management servers, 693, 1016
  - file servers, 693
  - locks, 963
  - logging servers, 693
  - mail servers, 693
  - networks, 621-622, 692-693
  - NOS, 621
  - print servers, 693
  - proxy servers, 693, 1008-1009
  - remote servers, BranchCache, 733
  - syslog servers, 693
  - web servers, 693
- service packs, 551, 758, 846
- service releases (software), 551
- services
  - disabling, 787, 895
  - enabling, 789
  - fails to start errors, troubleshooting, 895
  - listsvc command, 789
  - managing, 878
  - network services, troubleshooting, 688
  - process IDs, 801

- restarting, 895
- troubleshooting, 688, 895
- viewing, 789
- Services tab
  - System Configuration utility, 891
  - Task Manager, 894
- Services window, 798
- services.mmc command, 798
- Session layer (OSI model), 644
- set command, 799
- setup logs
  - Event Viewer, 865
  - Windows installations, 845
- Setup program, 117
  - boot options, 120
  - Boot Sequence, changing, 122
  - Disable Execute Bit, 121
  - drive encryption, 121
  - fan control, 120
  - general optimization, 120
  - hard drives, 271
  - Hardware Monitor, 121
  - Hyper-Threading, 120
  - iGPU, 121
  - interface configuration, 121
  - intrusion detection/notification, 121
  - LoJack, 121
  - number lock key, 120
  - onboard devices, 120
  - passwords, 120
  - peripherals, 120
  - power configuration, 121
  - processors, 120
  - secure boot, 121
  - system information, 120
  - system resources
    - defined, 126
    - I/O addresses, 127, 130-131
    - IRQ, 127, 130
    - memory addresses, 127, 131
    - PCI interrupts, 127-128
    - PCIe interrupts, 127-128
  - TPM, 121, 1144
  - USB, 120
  - video, 120
  - virtualization, 121
  - virus protection, 120
- sfc command, 799
- sfc / scannow command, 296
- SFC (System File Checker), 296, 845-846
- SFTP (Secure File Transfer Protocol), 697
- .sh files, 804
- Shadow Copy technology, 887
- shared key authentication, 1018
- shares, 866
  - administrative shares, 991
  - hidden shares, 991-992
  - local shares, 991
  - mapping to, 703-704
  - permissions, 988-991
  - Sharing tab, 702-703
- shareware, 973
- sharing
  - files, 995
  - folders, 866, 995-996
    - access denied messages, 992
    - AD password protection, 988
    - hidden shared folders, 998
  - printers, 407, 691
    - accessing shared networks, 399
    - Bluetooth, 397-398
    - print servers, 398-399
    - Windows environments, 395
    - wireless networks, 397-398
  - resources, cloud computing, 597
  - screen-sharing (iCloud), 923-924
  - Sharing setting (macOS, System Preferences), 928
  - subfolders, 996
  - system memory, 142
- shell scripts, 804
- shells (macOS), 919
- shielding (speakers), 331
- shoes (smart), 426
- shortcuts, Windows desktop icons, 736
- shoulder surfing, 963-965, 972, 978
- shredding documents, 965
- shrink partitions, 282, 875
- shutdown command, 800, 944
- shutting down
  - computers, 800
  - troubleshooting, 103, 898, 899
  - unexpected shutdowns, 103, 898-899
  - Windows 7, 739
- side loading apps, 442
- side-by-side apps (Windows), 832
- signal strength (antennas), wireless networks, 662
- signature pads, 19
- SIIA (Software and Information Industry Association), 1026

- SIM (System Image Manager), corporate Windows deployments, 842
- SIM cards, 436
- SIMM (Single In-line Memory Modules), 213
- simple volumes (Windows Disk Management), 281
- single IDE setting, 265
- single link DVI connectors, 36
- single-alternative decision structures, 814
- single-core processors, 80
- single-factor authentication, physical security, 966
- single-mode fiber cables, 56-57
- single-sided memory, 217
- site surveys, wireless networks, 662
- slave devices, 265
- SLC (Single-Level Memory Cells), 257
- sleep mode
  - going into, 193
  - mobile devices, 435
  - troubleshooting, 193, 199
  - Zigbee devices, 679
- sleep-and-charge USB ports, 46
- sleep/suspend mode (ACPI), 192
- slots
  - expansion slots, 14-15, 93
    - AGP, 95
    - bus bandwidth comparisons, 97
    - covers and EMI/RFI, 165
    - laptops, 469-470
    - M.2 expansion cards, 470
    - NVMe cards, 470
    - PCI, 94
    - PCIe, 96-99
    - types, 94
  - M.2 slots, 121
  - PCI slots, 94-97
  - PCIe slots, 94-99
  - Slots Used field (Task Manager Performance tab), 233
  - USS, laptop security, 499
- slow performance, troubleshooting, 297
  - boots, 896
  - profile loads, 896-897
  - systems, 894
  - transfer speeds (networks), 687
  - web browsers, 610
- SLP (Service Location Protocol), 697
- S.M.A.R.T. (Self-Monitoring, Analysis and Reporting Technology) errors, 296
- smart cameras, 421-423. *See also* webcams
- smart card readers, 19, 348-349, 424, 487
- smart cards, security, 962-963
- smart devices, 677
  - digital assistants, 683
  - door locks, 683
  - earrings, 426
  - light switches, 681
  - shoes, 426
  - thermostats, 680-681
  - voice-enabled smart speakers, 683
  - watches, 426
  - Z-wave, 678-680
  - Zigbee, 678-679
- SmartMedia, 343
- smartphones, 420, 438. *See also* phablets
  - apps, 439-442
  - baseband updates, 437
  - disposal of/recycling, 1046
  - headsets, 652
  - IMEI numbers, 435-436
  - IMSI, 436
  - notification areas, 432
  - PRI, 437
  - PRL, 437
  - radio firmware updates, 437
  - security, 500-503
  - SIM cards, 436
  - troubleshooting, 505-515
- SMB (Server Message Blocks), 697
- SMC (System Management Controller) resets, 505
- smoke, troubleshooting, 147, 198, 550
- SMS (Short Message Service), 451
- SMTP (Simple Mail Transfer Protocol), 453, 697
- Smurf attacks, 980
- snapshots, virtualization, 590
- SNMP (Simple Network Management Protocol), 697
- social engineering attacks, 972, 978
- sockets, 85-86
- SODIMM (Small-Outline DIMM), 213, 481-482
- soft resets, mobile devices, 504
- Soft-off power setting (ACPI), 193
- software
  - antimalware, 968
    - firewalls and, 1009
    - mobile devices, 499
  - antivirus software, 840, 968, 978
    - firewalls and, 1009
    - mobile devices, 499
    - reinitializing, 843
  - automatically loading programs from startup, stopping, 883
  - AutoPlay function, disabling, 1001

- AutoRun function, disabling, 1001
- buying, licensing software, 973
- compatibility, troubleshooting, 731
- compliance, 730
- defined, 9
- DLP, 969
- drivers, troubleshooting, 144
- end-of-life concerns, 730
- errors, troubleshooting, 551
- extensible software, 731
- file recovery, 290
- firewalls, 968
- freeware, 973
- image management, 674
- incompatibility, 730
- interfering software, disabling in Windows OS installations, 841
- licensing, 973
- Linux, obtaining software with CLI, 947-948
- logical security, 968-969
- open source software, 918, 973
- operating costs, 730
- patches, 551
- performance, 730
- piracy, 973, 1026
- printers, troubleshooting, 405
- RAID, configuring, 283
- reliability, 730
- SDK, 442
- service packs, 551
- service releases, 551
- shareware, 973
- Software Updater tool (Ubuntu), 942
- synchronizing, 859
- system requirements, 858
- tokens (authentication), 966
- Ubuntu
  - obtaining software with CLI, 947-948
  - Ubuntu Software Center, 942
- updates, end-of-life concerns, 730
- versions, end-of-life concerns, 730
- Windows installations, 857-860
- solid ink printers, 366
- solid state drives. *See* SSD
- Sony/Phillips Digital interface. *See* S/PDIF
- sound
  - 2.0 audio subsystems, computer design, 540
  - 2.1 audio subsystems, computer design, 540
  - Android settings, 490
  - Apple Digital AV adapters, 444
  - Apple iOS settings, 490
  - audio beeps (POST codes), 546-547
  - computer design, 540
  - digitized sound, 327
  - headphones, 334
  - headsets, 19, 330
  - laptops, 490, 493, 498
  - microphones, 19, 329, 493, 498, 502, 540
  - mobile devices, troubleshooting, 513
  - motherboard speakers, 324
  - muting, 329
  - ODD, 325, 334
  - ports, 324-326
  - resolution, 327
  - sound cards, 50, 326-329, 333-334, 540
  - Sound setting (macOS, System Preferences), 928
  - sound waves, 326
  - speakers, 330-334, 540, 683
  - troubleshooting, 329, 333-334, 513, 854
  - VoIP, 329
- spam, 1007
- spanned volume (Windows Disk Management), 281
- sparks, troubleshooting, 147
- SPD (Serial Presence Detect), 217, 235
- speakers, 330, 334, 428-429
  - amplification, 331-332
  - choosing, 332
  - computer design, 540
  - connectivity, 332
  - external speakers, 331
  - extras, 332
  - frequency response range, 331
  - internal speakers, 331
  - laptops, troubleshooting, 490
  - mobile devices, troubleshooting, 490, 513
  - motherboards, 324
  - power ratings, 331
  - shielding, 331
  - Sound setting (macOS, System Preferences), 928
  - troubleshooting, 332-333, 490, 513
  - USB speakers, 331
  - voice-enabled smart speakers, 683
- spear phishing, 978
- special characters, file/folder names, 746
- special function keys (keyboards), laptops, 480-481
- special thermal paper, 371
- speech recognition devices (biometrics), 967
- Speed field (Task Manager Performance tab), 233

## speeds

- NIC, 672, 1140
- processors, 76
- SPGA (Staggered Pin Array) sockets, 85
- spikes (electricity), 1050
- spilled toner, 371, 1048
- spinning pinwheels, 297, 548, 930
- splitting
  - partitions (hard disks), 282, 875
- spoofing attacks, 980
- Spotlight (macOS), 920, 928
- spread gestures, 435
- SPS (Standby Power Supplies), 1055-1059
- spyware, 975, 1026
- SRAM (Static RAM), 213, 228-229
- SSD (Solid-State Drives), 483
  - Advanced Boot Options menu, 889
  - defined, 256-258
  - defragmenting, 293
  - externally, 271
  - hard drives, compared, 257
  - hybrid SSD, 258
  - industries supported, 257
  - installing, 270-271, 299
  - M.2 SSD, 260
  - MLC, 257
  - NVMe, 260
  - removing, 173
  - SLC, 257
  - SSHD, 258
  - static electricity, 271
  - troubleshooting, 299
  - upgrading to, 485
  - wear leveling, 257
  - write amplification, 257
- SSH (Secure Shell), 697, 1015
- SSHD (Solid-State Hybrid Drives). *See* hybrid drives
- SSID (Service Set Identifiers)
  - AP, 655, 677, 1023
  - wireless AP, 677
  - wireless NIC, 670
- SSL (Secure Sockets Layer), 453, 695
- SSO (Single Sign-On) authentication, network security, 980
- stabilizer bars, inkjet printers, 365
- standard thick client workstations, 533, 538
- standard user accounts, 871, 981
- standby power, 181
- standoffs, 174
- start bits, 576

- Start button (Windows 7 desktop), 738-739
- Start screen (Windows desktop), 734, 740-742
- Start Windows Normally (Advanced Boot Options menu), 888
- starting
  - Notepad, 796
  - Remote Desktop, 793
  - System Configuration utility, 793
  - System File Checker, 799
  - Windows Explorer, 789
- startup
  - automatically loading programs from startup, stopping, 883
  - Startup Disk setting (macOS, System Preferences), 929
  - Startup tab
    - System Configuration utility, 891
    - Task Manager, 894
- static electricity, SSD, 271
- statically configuring IP addresses, 666
- stepper motors, inkjet printers, 365
- sticking keys (keyboards), troubleshooting, 508
- stop bits
  - asynchronous transmissions, 576
  - serial ports, 577
- stopping
  - apps, 442
  - tasks, 893
- storage
  - AP, 676
  - cloud storage, 252, 594, 993, 998-999
  - component handling/storage procedures, 1049-1050
  - computer design, 539-540
  - configuring, 265-267
  - credentials, security, 867
  - data storage, 986, 1000
  - design components, 539-540
  - digital cameras, 343-344
  - disk maintenance, 876-877
  - DVD drives, 11
  - eSATA, 264, 269-270
  - external storage drives, 19
  - files, cloud computing, 594
  - flash drives, Linux bootups, 939
  - hard drives, 11, 253-264, 271-293
  - IDE, 261-262
  - installing, 293-298
  - laptops
    - during travel, 504
    - hard drives, 483-485

- optical drives, 486
  - smart card readers, 487
- local storage, backups, 998
- managing. *See* disk management
- mobile devices, 424
  - optical drives, 486
  - smart card readers, 487
- NAS devices, 531-532
- OneDrive, 832
- optical drives, 11
- PATA, 265-266
- PATA IDE, 261-262
- processor storage capacities, 24
- RAID, 298
- removable storage, 285
- removing, 173
- SATA, 267, 270
- SATA IDE, 262-263, 269
- SSD, 256-260, 270-271, 293
- storage cards, 424
- storage pools, 286
- storage spaces, 286, 876
- troubleshooting, 290-298
- Windows, 908
  - disk maintenance, 876-877
  - disk management, 874-876
  - drive status, 874
  - Storage Spaces Control Panel, 876
  - Windows Storage Spaces, 286
- STP (Shielded Twisted-Pair) cables, 55, 627
- straight-through cables, 629
- streaks (printing issues), troubleshooting, 409
- strings (Windows scripting, variables), 810
- striped volumes (Windows Disk Management), 281
- striping (disk), 283
- su command (Linux), 944
- subfolders, 746, 772
  - encryption, 1001
  - shared subfolders, 996
- subnet masks
  - broadcast address, 1087
  - CIDR, 650
  - IPv4 addresses, 649-650
  - network number, 1086-1087
  - prefix notation, 1086
  - purpose, 1085
  - stopping point, showing, 1087
  - viewing, 1085
- subtrees, Windows registry, 758-759
- sudo command (macOS), 935-936
- supervisors, BIOS/UEFI security, 970
- surface wave touchscreens, 496
- surge protectors, 197, 1051
  - buying, 1053
  - clamping speed, 1052
  - clamping voltage, 1052-1053
  - energy absorption/dissipation, 1052
  - modems, 587
  - tripping hazards, 1052
  - troubleshooting, 199
  - TVS ratings, 1052
  - UL ratings, 1052
- surges (power), 1050
- SUSE website, 939
- suspend/sleep mode (ACPI), 192
- swabs (urethane), cleaning keyboards, 178
- swap files, 229, 289
- swap partitions, 838
- swipe gestures, 435
- swipe locks, mobile devices, 500
- Swiss army knives, 166
- switches
  - command switches, 775
  - defined, 626
  - Ethernet, 626
  - hubs versus, 626
  - KVM switches, 19, 339
  - light switches (smart), 681
  - managed switches, 626
  - PoE switches, 657
  - router/switch functionality, 654
  - unmanaged switches, 626
  - VLAN, 649
- swollen batteries, troubleshooting, 511
- Sync Center (Windows 7), 859
- synchronization
  - Android devices, 457
  - Apple iOS devices, 458-459
  - apps
    - cloud computing, 594
    - fitness apps, 455
    - software apps, 859
  - cached passwords, 456
  - contacts, 457
  - mobile devices, 455
    - Android devices, 457
    - Apple iOS devices, 458-459
  - cars, 456
  - clouds, 456

- connection types, 457
- desktops, 456
- wired network connectivity, 457
- wired USB connectivity, 457
- wireless connectivity, 457
- syntax, scripting languages, 770, 807
- syslog servers, 693
- Sysprep, corporate Windows deployments, 842
- system configuration. *See* Setup program
- system bars, mobile device OS, 432
- system boards. *See* motherboards
- System Configuration utility (msconfig command), 793, 889-892
- system environment variables (Windows scripting), 805
- system files, 880-881
  - renamed files, troubleshooting, 1004
  - System File Checker, 799
- system images, 760-761
- System Information (macOS), 931
- System Information window, opening, 793, 1122
- system lockouts, 501, 894
- system lockups, 103, 234
- system logs
  - Event Viewer, 864-865
  - reviewing (troubleshooting), 543
- system partitions
  - macOS, 927-929
  - NTFS, 278
- System Protection, 886
- system requirements, software/apps, 858
- system resources
  - defined, 126
  - I/O addresses, 127, 130-131
  - IRQ, 127, 130
  - memory addresses, 127, 131
  - MSI/MSI-X interrupts, 128
  - PCI interrupts, 127-128
  - PCIe interrupts, 127-128
- System Restore, 849, 886-887, 925
- system updates, macOS, 924
- system volumes, 281, 880
- systeminfo command, 800, 846

## T

---

- T1 network connections, 706
- T3 network connections, 706
- T568A cabling standard, 56, 629
- T568B cabling standard, 56, 629
- tables
  - FAT, 279
  - partition, 278
- tablets. *See also* phablets
  - apps, 439-442
  - ASUS tablets, 431
  - disposal of/recycling, 1046
  - security, 500-503
  - troubleshooting, 505-515
- tabs, Windows dialog boxes, 744
- TACACS (Terminal Access Control Access Control System), 966
- tailgating (social engineering attacks), 978
- tap gestures, 435
- tap-to-pay devices, 19
- tape drives, 285
- Task Manager, 892
  - App History tab, 893
  - Details tab, 894
  - missing tabs, troubleshooting, 893
  - Performance tab, 231-233, 893, 901-902
  - performance, troubleshooting, 901-903
  - Processes tab, 893
  - Services tab, 894
  - Startup tab, 894
  - troubleshooting, 893
  - Users tab, 894
- Task Scheduler, 862
- Task View (Windows 10 desktop), 743
- taskbars
  - multi-monitor taskbars (Windows), 832
  - Windows 7 desktop, 737-739
- taskkill command, 800
- tasklist command, 801
- tasks
  - automating via scripts, 803
  - killing (stopping), 800, 893
- TB (Terabytes), 22-24
- TCP (Transmission Control Protocol), 695
- TCP/IP (Transmission Control Protocol/Internet Protocol), 644, 1123
  - AFP, 696
  - Application layer, 697
  - CIFS, 697
  - components of, 645
  - DHCP, 696
  - DNS, 696
  - FTP, 696
  - hijacking, 980
  - HTTP, 696

- HTTPS, 697
- IMAP, 697
- Internet layer, 697
- layers of, 645
- LDAP, 697
- message formatting, 645
- NetBT, 697
- Network access layer, 697
- NTP, 697
- POP3, 697
- printing, 692
- RDP, 697
- SFTP, 697
- SLP, 697
- SMB, 697
- SMTP, 697
- SNMP, 697
- SSH, 697
- statistics, viewing, 793
- Telnet, 697
- Transport layer, 697
- teamwork, 237
- technical field kits (safety equipment), 1043-1044
- technicians
  - active listening skills, 105-106
  - qualities, 2-4, 150
  - skills, 201-202, 237, 300, 350-351, 410, 516-517, 559-560, 611, 707, 762, 822, 907-908, 953, 1028, 1066-1076
- Telnet, 697, 1015
- telnet command, 801
- temperature changes and laptops, 472
- temperature control, UPS/SPS battery backups, 1059
- Terminal (macOS), 926, 934
- Terminal Services. *See* remote desktops, Remote Desktop Services
- terminating cables, 629-633
- test pages (printers), 390
- testing
  - backups, 998
  - installations, 321
  - ports, 550
  - remote network device connectivity, 796-797
  - theory of probable cause (troubleshooting), 551-553
  - wall outlets, 199
- tethering, 449, 588
- text files, 8
  - scripts as, 803-805
  - viewing, 792, 802
- text messages, SMS, 451
- textboxes (Windows dialog boxes), 744
- TFT (Thin Film Transistor), laptop displays, 492
- theories
  - theory of probable cause (troubleshooting), establishing
    - boot process, 544-545
    - diagnostics, 548-549
    - error messages, 545-548
    - hardware errors, 550
    - intermittent device failures, 550-551
    - POST codes, 545-550
    - software errors, 551
    - testing, 551-553
  - troubleshooting, 1071
- thermal paste, 86-88
- thermal printers, 361, 371-372, 386
- thermal sensors, 217
- thermal wax transfer printers, 366
- thermostats (smart), 680-681
- thick clients, 533, 538, 673-675
- thin clients, 533, 538, 673-675
- threading, 79
- Threads field (Task Manager Performance tab), 231
- throttling processors, 90
- thumb drives, 236
- Thunderbolt cables, 49
- Thunderbolt ports, 49-50, 59
- TIFF (Tag Image File Format) files, 337, 344, 747
- tiles (Windows desktop), 734-736, 741
- Time Machine (macOS), 924-925, 929
- time management, 1072
- time restrictions (logon), workgroups, 982
- time/date settings
  - Date & Time setting (macOS, System Preferences), 929
  - Windows, 841
- timeliness, 237
- timeouts (security), 983
- TKIP (Temporal Key Integrity Protocol), 670, 1020
- tokens (security), 962-966
- tone generators, 639
- toner, 387
  - defined, 370
  - disposal of/recycling, 1048-1049
  - laser printers, 370-371
  - refilling, 380
  - spilled toner, 1048
  - spills, 371
  - troubleshooting, 409, 1048
- toner probes, 639



- toner vacuums, 178
- tools
  - AC circuit testers, 199
  - disassembly, 165-167
  - loopback plugs, 550
  - power converters, 187
  - power supply testers, 198
  - preventive maintenance kits, 178
  - scribes, 475
  - Y connectors, 187
- Tools tab (System Configuration utility), 892
- topologies
  - defined, 625
  - Ethernet star topologies, 626-627
  - Z-Wave topologies, 680
- topology diagrams (networks), 1060
- TOSLINK cable connections, 50
- Total Physical Memory field (Task Manager Performance tab), 231
- touch and hold gestures, 435
- touch command (macOS), 934-935
- touch gestures, 435
- touchpads, 19
  - cleaning, 178
  - laptops, repairing, 479
- touchscreens
  - calibrating, 498
  - capacitive touchscreens, 496
  - IR touchscreens, 496
  - performance, 511
  - replacing, 496
  - resistive touchscreens, 495-496
  - surface wave touchscreens, 496
  - troubleshooting, 510
- toxic waste handling, 1044
- TPM (Trusted Platform Modules), 963
  - BIOS/UEFI security, 971
  - configuring, 121, 1144
- TR4 (sTR4) sockets, 86
- tracert command, 687, 801
- tracking modules (physical security), 963
- trackpads, 509, 928
- tracks (hard drives), 255
- transfer belts (laser printers), 368
- transfer coronas (laser printers), 368-370, 385
- transfer pads (laser printers), 368
- transfer rollers (laser printers), 368
- transferring data, 835
- transmission limits (data), mobile devices, 503
- Transport layer
  - OSI model, 644
  - TCP/IP, 697
  - TCP/IP model, 645
- Transport Mode (Zigbee devices), 679
- trapdoor attacks, network security, 979
- traveling with mobile devices/laptops, 504
- triggering ports, 1011
- triple-channel memory, 223
- triple-rail power supplies, 194
- Trojans, 976
- troubleshooting. *See also* preventive maintenance
  - apps, 505-507, 859, 864, 893
  - artifacts, 148
  - audio, 322, 329, 333-334, 854
  - batteries, 511
  - BIOS, 149
  - black/blank screens, 884
  - blue screens, 864
  - Bluetooth, mobile devices, 514-515
  - bootups, 197, 295, 544-545
  - BSOD, 548
  - burning smells, 198
  - cables, 638-639
  - color, incorrect color patterns, 144
  - compatibility, software, 731
  - device installations, 855-857
  - Device Manager, 149
  - digital cameras, 344
  - dim images, 145
  - DirectX, 322, 334
  - disappearing files, 1004
  - displays, 144-148, 509-510
  - distorted geometry, 146
  - distorted images, 144
  - DNS, 687, 796
  - Dock (macOS GUI), 920
  - electricity
    - overvoltage, 1050
    - undervoltage, 1050-1051
  - email, 507
  - EMI, 165
  - error messages, 545-548
  - ESD, 162-165, 1049
  - Ethernet star topologies, 627
  - Event Viewer, 866
  - failed print jobs, 407
  - failures to boot, 882
  - fans, 197-199
  - files, 1004

- firewalls, 1012-1013
- flash memory, 236
- flickering images, 145
- flowcharts, 555-558
- follow ups, 554
- frozen mobile devices, 512
- General tab (Properties dialog), troubleshooting with, 149
- ghost images (printing issues), 409
- GPS, mobile devices, 514
- grounding problems, 162-165
- hard drives, 235, 255, 290-298, 486
- headphones, 334, 513
- humidity and component handling/storage, 1049
- incorrect color patterns, 144
- information gathering process/resources, 542
- ink cartridges, 409
- intermittent device failures, 550-551
- kernel panic (macOS), 931
- keyboards, 17-18, 507-508
- laptops
  - Bluetooth cards, 487
  - DC jacks, 489
  - displays, 494-499
  - hard drives, 483-485
  - inverters, 499
  - keyboards, 478
  - memory, 482
  - microphones, 498
  - motherboards, 476
  - optical drives, 486
  - processors, 477
  - smart card readers, 487
  - sound, 490
  - touchpads, 479
  - touchscreens, 496
  - video cards, 491
  - webcams, 498
  - WiFi cards, 487
- laser printers, 385
- LCD, 145
- logical steps
  - documentation, 554
  - establishing theory of probable cause, 544-551
  - identifying problems, 543
  - implementing preventive measures, 554
  - plans of action, 554
  - testing theories to determine cause, 551-553
  - verifying full system functionality, 554
- macOS
  - Force Quit, 926
  - kernel panic, 931
  - Safe mode, 929
  - spinning pinwheels, 930
  - System Preferences, 927-929
  - Terminal, 926
- mechanical drives, 486
- memory, 228, 234-235, 901-902
- mice, 17-18
- mobile devices
  - app installations, 506
  - app log errors, 506
  - email, 507
  - hard resets, 504-505
  - high resource utilization, 505
  - loading apps, 507
  - soft resets, 504
- modems, 691
- monitors, 198, 509
- motherboards, 103-104, 549
- networks
  - cable modems, 691
  - cables, 638-639
  - connectivity, 684-685, 689-690
  - DNS servers, 687
  - DSL modems, 691
  - ifconfig command, 686
  - ipconfig command, 686
  - mobile devices, 513
  - net command, 688
  - net computer command, 688
  - net config command, 688
  - net help command, 688
  - net share command, 688
  - net start command, 688
  - net stop command, 688
  - net use command, 688
  - net user command, 688
  - net view command, 688
  - netdom add command, 688
  - netdom command, 688
  - netdom join command, 688
  - netdom remove command, 688
  - netdom renamecomputer command, 688
  - netdom reset command, 688
  - netdom resetpwd command, 688
  - netdom verify command, 688
  - NIC, 686, 689-690
  - ping command, 684-686

- printers, 692
- services, 688
- slow transfer speeds, 687
- tracert command, 687
- unavailable resources, 685
- updates, 897
- NIC, 686, 689-690
- no OS found errors, 845
- NTLDR is Missing errors, 844
- ODD, 321-322, 334
- operation requires elevation messages (command prompt), 803
- OS
  - software compatibility, 731
  - updates, 730
- overheating, 148, 198, 512-513
- oversized images/icons, 145
- overview, 542
- overvoltage, 1050
- paper (printers), 383
- passwords, Keychain Access (macOS), 932
- performance, 900-904
- PnP, 132
- ports, 550
- POST codes, 545-547, 550-551
- POST errors, 123, 552
- power supplies, 197-199, 511-513, 1050-1051
- print logs, 407
- printers, 383-388, 402-409, 692, 880
- processors, 92
- proprietary crash screens, 297, 548
- RAID, 298
- read/write failures, 297
- reboots, 197
- renamed system files, 1004
- RFI, 165
- S.M.A.R.T. errors, 296
- services, 895
- shutdowns, 898-899
- sleep mode, 193, 199
- slow boots, 896
- slow profile loads, 896-897
- smartphones, 505-515
- smoke, 147, 198, 550
- software
  - compatibility, 731
  - drivers, 144
  - errors, 551
- sound, 329, 333-334
- sparks, 147
- speakers, 332-333, 513
- spinning pinwheels, 297, 548, 930
- SSD, 299
- storage devices, 290-298
- streaks (printing issues), 409
- surge protectors, 199, 1052
- system files, renamed files, 1004
- system performance, 894
- tablets, 505-515
- Task Manager, 893
- techniques, 822
- theories, 1071
- toner, 409
- touchscreens, 510
- trackpads, 509
- UEFI, 149
- undervoltage, 1050-1051
- updates, OS, 730
- USB devices, 136-137
- USB drives, 297
- vertical lines (printing issues), 409
- VGA mode, 145
- video, 144-148, 322
- volume, 333
- web browsers, 608-610
- Windows, 904
  - black/blank screens, 884
  - blue screens, 864
  - boot process, 882-883, 896
  - BSOD errors, 886
  - device installations, 855-857
  - installations, 843-845
  - profiles, 896-897
  - shutdowns, 898-899
  - updates, 886
  - upgrades, 844-845
  - Windows Firewall, 1012-1013
  - Windows Troubleshooting Wizard, 857
  - wireless connectivity, mobile devices, 513-514
  - wireless networks, 1025
- trust, building, 1028
- Trusted Platform Modules. *See* TPM
- trusted/untrusted sources, logical security, 970
- TVS (transient voltage suppressing) ratings, surge protectors, 1052
- TWAIN (scanners), 337
- tweaker screwdrivers, 166
- twisted-pair cables
  - corporate environments, 634
  - PVC, 628

- RJ-11 connectors, 629
  - RJ-45 connectors, 629-633
  - STP, 627
  - terminating, 629-633
  - UTP, 627-630, 634
  - two-factor authentication, physical security, 966
  - TXT (Text File Format) extension, 747
  - Type 1 hypervisors, 590
  - Type 2 hypervisors, 591
  - Type A-B-C fire extinguishers, 1041
  - Type C fire extinguishers, 1041
  - type command, 778, 802
- ## U
- 
- UAC (User Account Control), 832, 872
  - UART (Universal Asynchronous Receiver/Transmitter), 576
  - Ubuntu
    - backups, 943
    - best practices, 952
    - bootloaders, 952
    - CLI
      - copy data, 948-950
      - finding files, 951
      - missing GRUB/LILO, 952
      - network configuration, 945-946
      - obtaining software, 947-948
      - shutting down systems, 944-945
      - viewing processes, 947
    - commands, 944-951
    - Dash, 940-941
    - GParted disk management tool, 941, 949-950
    - GRUB, 952
    - hard drives, partitioning, 948-950
    - Launcher, 940
    - LILO, 952
    - Nautilus, 940
    - Panel, 940
    - Software Updater tool, 942
    - Ubuntu Software Center, 942
    - Unity GUI, 940-941
    - user forums, 951
    - website, 939, 951
  - UDP (User Datagram Protocol), 695
  - UDSL (Uni-DSL), 585
  - UEFI (Unified Extensible Firmware Interface), 116-118
    - ACPI settings, 192-193
    - AMI BIOS/UEFI chips, audio beeps (POST codes), 546
    - boot process, 545
    - Boot Sequence, changing, 122
    - configuring, 119-121, 271
    - diagnostics, 548-549
    - error messages (POST codes), 547-548
    - exit options, 122
    - flashing the UEFI, 124-125
    - hard drive configuration, 271
    - hardware configuration, 132
    - on-board NIC, 671
    - passwords, 970-971
    - Phoenix BIOS/UEFI chips, audio beeps (POST codes), 547
    - RAID configuration, 284
    - recovery methods, 125
    - SATA ports, enabling, 268
    - security, 970-971
    - troubleshooting, 149
    - updating, 126
    - upgrading, 124-125
    - virtualization, 590
  - UL (Underwriters Laboratories) ratings
    - surge protectors, 1052
    - UL 1449 VPR (Voltage Protection Rating), 1052
  - unallocated status state (disk management), 298
  - unattended Windows installations, 833
  - unauthorized access, mobile devices, 501
  - unavailable resources (networks), troubleshooting, 685
  - unbuffered memory, 217
  - uncompressing files, 789, 1106
  - undervoltage, troubleshooting, 1050-1051
  - unexpected shutdowns, 103
  - UNII (Unlicensed National Information Infrastructure), AP channel ID, 659
  - uninstalling apps, 442
  - Unity (Ubuntu GUI), 940-941
  - UNIX root users, 936
  - unknown status state (disk management), 298
  - unlocking
    - AD accounts, 986
    - mobile devices, 435
  - unmanaged switches, 626
  - unmounting eSATA drives, 270
  - unplugging USB devices, 46
  - unreadable status state (disk management), 298
  - untrusted/trusted sources, logical security, 970
  - unused ports, disabling, 962, 969
  - Up Time field (Task Manager Performance tab), 232
  - up to date (technician skills), staying, 762
  - updatedb command (Linux), 951

## updates

- baseband updates, smartphones, 437
- BIOS, 126
- boot orders, Windows installations, 843
- firmware, 124-125
- group policies, 790-791
- hotfixes, 846
- Linux, 942-943
- macOS system updates, 924
- managing, 997-998
- mobile devices, 500
- networks, troubleshooting, 897
- notifications, customizing, 848
- OS, troubleshooting, 730
- patches, 846
- preventive maintenance, 180
- PRI updates, 437
- PRL updates, 437
- radio firmware, 437
- service packs, 846
- software
  - end-of-life concerns, 730
  - Software Updater tool (Linux), 942
- UEFI, 126
- updatedb command (Linux), 944
- web browsers, 608
- Windows, 840, 843
  - Automatic Update, 846-848
  - BSOD errors, 886
  - roll back Windows updates, 847
  - Windows Update, 846-848

## upgrades

- BIOS, 124-125
- computer subsystems, 535
- hard drives, 235, 485
- in-place upgrades, Windows, 833-834, 845-846
- memory, 218, 228, 235, 481-482
- mobile devices, 500
- motherboards, 102-103
- power supplies, 193-194
- printers, 380, 404
- processors, 90
- UEFI, 124-125
- Windows
  - compatibility mode, 836
  - in-place upgrades, 833-834, 845-846
  - Microsoft Upgrade Advisor, 840
  - overview of, 841-842
  - paths, 834
  - phases of, 841

troubleshooting, 844-845

Virtual XP Mode, 836

Windows Upgrade Advisor, 835

UPnP (Universal Plug and Play), 677, 1010

upstream transmissions, cable modems, 584

UPS (Uninterruptible Power Supplies), 1054-1059

upward compatibility, 731

urethane swabs, cleaning keyboards, 178

USB (Universal Serial Buses)

cable modems and, 582

cables, 43, 46

configuring devices, 120

connectors, 44, 48

drives, troubleshooting, 297

expansion cards, 134-135

flash drives, 235-236

hubs, 46, 136

installing devices, 134-135

local printer connections, 388

locks, 963

micro-USB ports, 443

mini-USB ports, 443

mobile USB ports, 443

ports

Alternate mode, 44

charging USB ports, 46

configuring, 120

defined, 42, 59

devices supported, 42

extra USB ports, installing, 48

installing, 134-135

micro-USB ports, 45

mini-USB ports, 45

printers, troubleshooting, 405

scanners, 337

sleep-and-charge USB ports, 46

smart card readers, 349

speeds, 42

troubleshooting, 136-137

USB 2.0 ports, 42

USB 3.0 ports, 42

USB 3.2 ports, 50

USB-C ports, 49

USB-PD ports, 43

printers, 360, 386-388, 405

removing devices, 46

speakers, 331

troubleshooting, 136-137, 297

USB A-to-USB B converters, 47

USB-C cables, 42

- USB-C ports, 443
- USB-to-Bluetooth dongles, 446
- USB-to-Ethernet converters, 47
- USB-to-HDMI adapters, 491
- USB-to-RJ-45 dongles, 444
- USB-to-serial converters, 575
- USB-to-WiFi dongles, 448
- wired USB connectivity, synchronization, 457
- user environment variables (Windows scripting), 805
- user interfaces
  - macOS GUI, 919-921
  - Ubuntu, Unity, 940-941
- usernames, changing, 676
- users
  - accounts
    - administrator accounts, 871
    - Credential Manager, 867-870
    - credentials, 866-870
    - Device Manager, 873
    - Local Users and Groups tool, 870-871
    - Power Users groups, 871
    - recovery options, 871
    - standard user accounts, 871
    - UAC, 832, 872
  - Administrators, 981-982
  - authentication
    - logical security, 968
    - physical security, 961
  - BIOS/UEFI security, 970
  - educating about security
    - AUP, 973
    - domains, 980
    - licensing software/apps, 973
    - regulated data, 974-975
    - threats to security, 972, 975-980
    - workgroups, 980
  - forums (Linux), 951
  - groups, 980-984
  - guest, 981-982
  - ID, security, 972
  - managing, 981-983. *See also* AD
  - OS interaction, 724
  - power users, 982
  - privacy, 974-975
  - privileges
    - commands, 803
    - principle of least privilege, 991
  - profiles, defined, 758
  - remote desktop users, 982
  - restrict user permissions, 988

- security, 981-983
- standard, 981

- Users & Groups setting (macOS, System Preferences), 929
- Users tab (Task Manager), 894
- USMT (User State Migration Tool), 835
- USS (Universal Security Slots), laptop security, 499
- UTM (Unified Threat Management) systems, 1016
- UTP (Unshielded Twisted-Pair) cables, 54-55, 627-630, 634

## V

---

- vacuum bags, cleaning printers, 178
- vacuum cleaners, 178-179
- vacuums (safety equipment), 1044
- vapor cooling, 86
- variables (Windows scripting), 812
  - alphanumeric characters, 810
  - data types, 810
  - declaring, 809
  - defined, 808
  - editing, 809
  - environment variables, 805-807
  - examples of, 810-811
  - floating-point numbers, 810
  - initializing, 810
  - integers, 810
  - naming, 809
  - path variables, 805
  - strings, 810
  - viewing, 799, 809
- .vbs files, 804
- VBScript, 804, 820
- vCards, 457
- VDSL (Very High Speed DSL), 585
- vendor-specific logs (Event Viewer), 865
- vendor-specific OS (Operating Systems), 423
- ventilation, 190, 1059
- verifying
  - full system functionality (troubleshooting), 554
  - hardware with Device Manager, 148
  - paths, 801
  - Windows installations, 843
  - Windows versions, 757
- versions of Windows, 757, 908
- vertical lines (printing issues), troubleshooting, 409
- VESA (Video Electronics Standards Association), 38
- VGA (Video Graphics Arrays)
  - cables, 37
  - DVI-to-VGA adapters, 41
  - ports, 36-39, 58

VGA mode, troubleshooting, 145

vi command (macOS), 935

video

adapters, 140-143, 541

add-on video cards, 140

AGP adapters, power consumption, 195

analog signals, 35

Apple Digital AV adapters, 444

backups, Android devices, 460

BIOS settings, 120

camcorders, 344

cameras/webcams, 19

cards, 195

conference calls, 580

connectors, 37

digital cameras, 342-344

digital signals, 35

displays, computer design, 541-542

Enable Low-Resolution Video (640-480), Advanced  
  Boot Options menu, 888

game controllers, 347

GPU, 82, 140

HDMI connectors, 444

joysticks, 347

KVM switches, 19, 339

laptop video cards, replacing, 491

LCD, 145-147

memory, 141-142

MMS, 451

motion sensors, 348

multiple displays, 339

onboard video cards, 140

performance, 148

plasma displays, 147

ports, 35, 41, 58

  DisplayPort, 38, 467

  DVI ports, 36-37

  HDCP ports, 40

  HDMI ports, 38-39, 58

  mini DisplayPort, 467

  S-Video ports, 36

  VGA ports, 36-37

projectors, 19, 340-342

quality, 140

subsystem, 140

troubleshooting, 144-148, 322

video cards, 140

webcams, 344, 493, 498

video/audio editing workstations, 530, 538

video controllers, 19

video games/game pads, 428-429

video graphics arrays. *See* VGA

viewing

  computers through networks, 981

  directory files, 778

  drivers, 789

  environment variables, 807

  file/directory attributes, 779

  flash internal memory, 424

  group policies, 790, 1110

  Linux processes, 947

  print histories in macOS environments, 394

  script property sheets, 802

  services, 789

  subnet masks, 1085

  system configuration information, 800

  TCP/IP statistics, 793

  text files, 792, 802

  Ubuntu processes, 947

  variables, 799, 809

virtual machine monitors. *See* hypervisors

Virtual XP Mode (Windows 7), 836

virtualization, 82-83. *See also* connectivity

  applications, cloud computing, 594

  assistants (mobile device OS), 441

  BIOS, 590

  checkpoints, 590

  desktops, 594

  emulators, 591

  host machines, 590

  Hyper-V client requirements, 592

  hypervisors, 590-591

  memory

    configuring, 288

    hard drives, 288

    pages, 229

    paging files, 229

    size, 229

    troubleshooting, 901-902

    VMM, 288-289

    Windows, 229-230

  NIC, 594, 672-673

  OS, 591-592

  printing, 377-378

  security, 592-593

  snapshots, 590

  support for, 121

  UEFI, 590

  Virtualization Detection Tool, 592

  virtual machines, 590

- Virtual PC requirements, 591-592
  - viruses, 593
  - VM, 234, 590-591
  - workstations, 532, 538
  - viruses, 975-977
    - antivirus software, 840, 978
      - Disable Execute Bit, 121
      - firewalls and, 1009
      - logical security, 968
      - mobile devices, 499
      - reinitializing, 843
      - rogue antivirus applications, 1003
      - security policies, 960
    - BIOS settings, 120
    - Disable Execute Bit, 121
    - incident reports, 1026
    - virtualization, 593
  - VLAN (Virtual Local Area Networks), 649
  - VM (Virtual Machines), 234, 590-591
  - VMM (Virtual Memory Manager), 288-289
  - voice
    - headsets, 19
    - microphones, 19
    - virtual assistants (mobile device OS), 441
    - voice-enabled smart speakers, 683
    - voice recognition devices (biometrics), 967
  - voice-grade cables. *See* Cat 3 UTP cables
  - VoIP (Voice over Internet Protocol), 329, 579-581, 695
  - volt-ampere, 184
  - voltage
    - 115 V vs 220 V input voltage, 184
    - checking, 198
    - clamping, surge protectors, 1052
    - DC, distributing via power supplies, 189
    - defined, 181
    - dual-voltage, 184, 188, 217
    - meter rules, 181
    - monitors, 182
    - multimeters, 639
    - polarity, 181
    - power supplies, 182, 198
    - readings, 181
    - UL 1449 VPR, 1052
  - volume
    - muting, 329
    - Sound setting (macOS, System Preferences), 928
    - troubleshooting, 333
  - volumes (drive partitions), 276
    - basic disk partitions, 838
    - boot volume (Windows Disk Management), 281
    - dynamic disk partitions, 838
    - extended partitions, 838
    - GPT, 838
    - logical partitions, 838
    - primary partitions, 838
    - RAW volume (Windows Disk Management), 281
    - simple volumes (Windows Disk Management), 281
    - spanned volume (Windows Disk Management), 281
    - striped volume (Windows Disk Management), 281
    - swap partitions, 838
    - system volumes (Windows Disk Management), 281
    - Windows installations, planning drive space, 837
  - VPN (Virtual Private Networks)
    - configuring, 1014-1015
    - logical security, 969
    - mobile devices, 452
    - tunnel matching, 1014
  - VR (Virtual Reality) headsets, 18, 428
  - vulnerability scanners, 980
  - VXD (Virtual Device Driver) extension, 747
- ## W
- 
- Wake on LAN feature, 192-193, 672
  - Wake on Ring feature, 192
  - waking sleeping mobile devices, 435
  - wall jacks, 634
  - wallets (mobile), 441
  - wallpaper, Windows desktop, 736
  - WAN (Wide Area Networks), 589, 620
  - WAPD (Web Proxy AutoDiscovery) protocol, 1009
  - warm boots, 117, 551
  - watches (smart), 426
  - waterproofing mobile devices, 428
  - wattage, 182-184, 193-194
  - WAV files, 344
  - wbadmin command, 802
  - WDS (Windows Deployment Services), corporate
    - Windows deployments, 842
  - WEA (Wireless Emergency Alerts), 441
  - wear leveling, 257
  - wearable devices, 420, 426-427
  - web browsers
    - browsing history, 599
    - browsing tabs, 599
    - encryption, 608
    - hijacked browsers, 608-610
    - Internet Explorer 11, 597-608
    - performance, 610
    - pop-ups, 609



- redirecting web browsers, 608
- rootkits, 608
- slow browsers, 610
- troubleshooting, 608-610
- updating, 608
- web credentials, 867
- web servers, 693
- webcams, 19, 344. *See also* smart cameras
  - laptop displays, 493, 498
  - unauthorized activation, 502
- websites
  - battery recycling programs, 124
  - Crucial, 224
  - DSL Reports, 585
  - Kingston Technology, 224
  - Linux
    - distro websites, 939
    - user forums, 951
- weight
  - limitations (personal safety), 1044
  - paper, 375
- WEP (Wired Equivalent Privacy), 670, 946, 1019-1020
- while loops (Windows scripting), 818-819
- whitelists/blacklists, 676, 1009
- WiBro (wireless broadband), 589
- WiFi
  - analyzers, 464, 663
  - antennas, laptop displays, 493
  - calling (mobile device OS), 441
  - laptop cards, replacing, 487
  - USB-to-WiFi dongles, 448
- wildcards, 778
- WiMAX (Worldwide Interoperability for Microwave Access), 588-589, 706
- Windows
  - AD, 732, 983-988
  - adapters, installing, 132-133
  - Aero, 832
  - API, 329
  - apps
    - disabling, 891
    - installing, 857-860
    - launching, 858
    - managing, 878
    - Microsoft Store, 442
  - audio devices, troubleshooting, 854
  - backups, 761
    - backing up before Windows OS installations, 840
    - backup utility, 999
    - OneDrive, 462
  - Bluetooth, installing, 446
  - boot process
    - Advanced Boot Options menu, 887-889
    - optimizing performance, 881-882
    - overview of, 880-881
    - reboots, 898
    - troubleshooting, 882-896
  - bootups
    - multiboots, 833
    - Safe mode, 844
  - CF cards, 426
  - charms, 832
  - checkboxes, 744
  - command prompt
    - accessing, 770-771
    - administrative privileges, 771
    - attrib command, 779, 782
    - bcdedit command, 782-783
    - bootrec command, 783-784
    - cd command, 774, 784
    - chkdsk command, 784
    - chkntfs command, 785
    - cipher command, 785
    - closing, 771
    - cls command, 786
    - [command name] /? command, 782
    - command command, 786
    - common commands list, 781
    - copy command, 778-779, 786
    - defrag command, 786
    - del command, 778, 787
    - dir command, 774-776, 787
    - directories, 771-773, 777-779
    - disable command, 787
    - diskpart command, 788
    - dism command, 788
    - dxdiag command, 788
    - enable command, 789
    - exit command, 789
    - expand command, 789
    - explorer command, 789
    - finding help, 781
    - format command, 790
    - gpresult command, 790
    - gpupdate command, 790-791
    - help command, 791
    - ipconfig command, 791
    - md command, 777, 792
    - mmc command, 792
    - more command, 792

- msconfig command, 793
- msinfo32 command, 793
- mstsc command, 793
- navigating, 774-776
- nbtstat command, 793
- net command, 794
- net use command, 794
- net user command, 794-795
- netdom command, 795
- netstat command, 795-796
- notepad command, 796
- nslookup command, 796
- operation requires elevation messages, 803
- overview of, 771
- ping command, 796-797
- rd command, 777, 797
- regedit command, 797
- regsvr32 command, 797
- ren command, 798
- robocopy command, 778, 798
- root directories, 771-773
- running Device Manager, 780
- running System Restore, 887
- Safe Mode with Command Prompt, 888
- services.mmc command, 798
- set command, 799
- sfc command, 799
- shutdown command, 800
- subdirectories, 772
- syntax, 771
- systeminfo command, 800
- taskkill command, 800
- tasklist command, 801
- telnet command, 801
- tracert command, 801
- type command, 778, 802
- wbadmin command, 802
- wscript command, 802
- xcopy command, 778, 802
- compatibility mode, 836
- Component Services, 862
- Computer Management Console, 861-862
- configuring
  - device drivers, 851
  - overview of, 850
  - System Configuration utility (msconfig command), 889-892
- context menus, 745
- Control Panel
  - categories, 755-757
  - configuring Windows, 850
  - Network and Sharing Center, 698-701
  - utilities, 754
- corporate deployments, 842-843
- Credential Manager, 866-870
- Data Sources (ODBC), 878-879
- date/time settings, 841
- defined, 743
- desktop, 733-737
- device drivers, 851-856
- Device Manager, 780, 852-854, 873
- Devices and Printers Control Panel, 852
- dialog boxes, 743-745
- DirectX Diagnostic tool, 322
- disk caching, 229-230
- Disk Cleanup tool, 291-292, 877
- disk management, 280-281, 838
- displays, 855
- domains, 841
  - adding computers to, 665
  - corporate OS, 732
  - domain controllers, 665
  - security, 980
- drive partitions (volumes), 837-838
- Error Checking tool, 877
- Event Viewer, 863-866
- File Explorer, 772
- files
  - attributes, 752
  - attributes, 752
  - compressing, 752
  - copying, 752-754
  - deleting, 737
  - encryption, 753
  - extensions, 746-748
  - filenames, 745-746
  - indexing, 751
  - libraries, 746
  - moving, 752-754
  - paths, 748-749
  - removable media files, deleting, 737
  - saving, 748
  - searches, 751
  - structure, 772
- file systems, 279, 838-839
- folders
  - attributes, 752
  - compressing, 752

- copying, 752-754
- default folders, 748
- encryption, 753
- indexing, 751
- moving, 752-754
- naming, 745-746
- searches, 751
- subfolders, 746
- hard drives
  - Disk Management tool, 838
  - formatting, 838
  - planning drive space, 837
  - recovery partitions, 833
- hardware
  - drivers, 839
  - installation requirements, 839
- HomeGroups, 704-706, 841
- imaging, 788
- installing. *See also* Windows, preinstalling
  - backups before Windows OS installations, 840
  - clean installations, 833-834
  - device drivers, 853
  - devices, 852-857
  - disabling interfering software, 841
  - image deployments, 833
  - no OS found errors, 845
  - overview of, 841-842
  - phases of, 841
  - planning drive space, 837
  - refresh option, 833
  - remote network installations, 833
  - repair installations, 833, 845-846
  - restore option, 833
  - security scans before Windows OS installations, 840
  - setup log files, 845
  - troubleshooting installations, 843-845
  - unattended installations, 833
  - verifying installations, 843
  - Windows installations with older OS, 881
- language settings, 841
- libraries, 746, 993
- Local Users and Groups tool, 870-871
- logons, 733
- maintenance, 906
- MBSA, 1004
- Media Center, 732
- memory
  - monitoring usage, 231-233
  - Memory Diagnostics tool, 234
- Metro UI, 832
- MMC, 861
- multi-monitor taskbars, 832
- multiboots, 833
- networks, 621, 625, 897
- OEM and Windows OS transfers, 835
- OneDrive, 462, 832
- OS, 727-730
- overview of, 832
- partitions, 833, 837-838
- paths, 748-749
- performance
  - Performance Monitor, 903
  - Performance utility, 231-233
  - troubleshooting, 900-904
- power options, 899
- PowerShell, 780
- preinstalling, 832-841. *See also* Windows, installing
- printers, 388
  - default printers, 389-390
  - installing printers, 389
  - networking printers, 395
  - print drivers, 390-391
  - Print Management console, 879-880
  - printer properties, 390
  - print spoolers, 392-393
  - sharing printers, 395
  - troubleshooting, 405-406
- profiles, troubleshooting, 896-897
- Programs and Features Control Panel, 859-860
- ReadyBoost, 882
- reboots, 898
- recovering OS
  - recovery discs, 760
  - reloadOS, 760
  - Safe Mode, 761
  - system images, 760-761
  - WinRE, 761, 832, 884-886
- recovery discs, 760
- recovery partitions, 833
- region settings, 841
- registry, 132
  - accessing registry editor, 797
  - backups, 759, 848
  - defined, 758
  - editing, 759-760
  - registering dll files, 797
  - subtrees, 758-759
- reloading, 760, 845-846
- remote networking, 905

- Resource Monitor, troubleshooting performance, 903-904
- restoring OS
  - recovery discs, 760
  - reloadOS, 760
  - Safe Mode, 761
  - system images, 760-761
  - System Restore, 886-887
  - WinRE, 761, 832, 884-886
- scripting
  - advantages of, 804
  - attrib command, 782
  - automating tasks, 803
  - batch files, 804
  - bcdedit command, 782-783
  - bootrec command, 783-784
  - cd command, 784
  - chkdsk command, 784
  - chkntfs command, 785
  - cipher command, 785
  - cls command, 786
  - [command name] /? command, 782
  - command command, 786
  - command prompt, 770-802
  - comments, 812
  - common commands list, 781
  - compiled programs, 803
  - compound conditions, 817
  - constructs, 813
  - copy command, 786
  - decision structures, 813-817
  - defined, 780, 803
  - defrag command, 786
  - del command, 787
  - dir command, 787
  - disable command, 787
  - diskpart command, 788
  - dism command, 788
  - dxdiag command, 788
  - enable command, 789
  - exit command, 789
  - expand command, 789
  - explorer command, 789
  - file types, 804
  - format command, 790
  - gpreresult command, 790
  - gpupdate command, 790-791
  - help command, 791
  - input, 808
  - interpreted programs, 803
  - ipconfig command, 791
  - languages, 804, 807-809
  - listsvc command, 789
  - logical operators, 817
  - loops, 813, 817-820
  - machine code, 808
  - md command, 792
  - mmc command, 792
  - more command, 792
  - msconfig command, 793
  - msinfo command, 793
  - mstsc command, 793
  - nbtstat command, 793
  - net command, 794
  - net use command, 794
  - net user command, 794-795
  - netdom command, 795
  - netstat command, 795-796
  - notepad command, 796
  - nslookup command, 796
  - output, 808
  - overview of, 770-771
  - path variables, 805
  - ping command, 796-797
  - PowerShell, 804, 820-821
  - processing scripts, 808
  - Python, 804
  - rd command, 797
  - regedit command, 797
  - regsvr32 command, 797
  - ren command, 798
  - repetition, 808
  - robocopy command, 798
  - selections, 808
  - sequences, 808
  - services.mmc command, 798
  - set command, 799
  - sfc command, 799
  - shell scripts, 804
  - shutdown command, 800
  - strings, 810
  - syntax, 770
  - systeminfo command, 800
  - taskkill command, 800
  - tasklist command, 801
  - telnet command, 801
  - text files, 803-805
  - tracert command, 801
  - type command, 802
  - variables, 805-812

- VBScript, 804, 820
  - wbadmin command, 802
  - wscript command, 802
  - xcopy command, 802
  - security, Windows installations, 840
  - service packs, 758
  - services
    - managing, 878
    - troubleshooting, 895
  - Shadow Copy technology, 887
  - Shared Folders, 866
  - shares, 866
  - Sharing tab, 702-703
  - shutdowns, troubleshooting, 898-899
  - side-by-side apps, 832
  - software
    - installing, 857-860
    - synchronizing, 859
  - storage, 874-877, 908
  - System Configuration utility (msconfig command), 889-892
  - system images, 760-761
  - System Information, opening, 1122
  - System Restore, 886-887
  - Task Manager, 892-894, 901-903
  - Task Scheduler, 862
  - textboxes, 744
  - time/date settings, 841
  - troubleshooting
    - blue screens, 864
    - BSOD errors, 886
    - device installations, 855-857
    - installations, 843-845
    - updates, 886
    - upgrades, 844-845
    - Windows Troubleshooting Wizard, 857
  - UAC, 832
  - updates, 840, 843
    - Automatic Update, 846-848
    - BSOD errors, 886
    - roll back Windows updates, 847
    - Windows Update, 846-848
  - upgrades
    - in-place upgrades, 833-834, 845-846
    - Microsoft Upgrade Advisor, 840
    - overview of, 841-842
    - paths, 834
    - phases of, 841
    - troubleshooting, 844-845
    - Windows Upgrade Advisor, 835
  - user account management
    - adding credentials to Windows, 868
    - administrator accounts, 871
    - Credential Manager, 867-870
    - credentials, 866
    - Device Manager, 873
    - editing, 870
    - Local Users and Groups tool, 870-871
    - Power Users groups, 871
    - recovery options, 871
    - removing credentials from Windows, 869
    - standard user accounts, 871
    - UAC, 832, 872
  - versions, determining, 757
  - virtual memory, 229-230
  - VM, 234
  - VMM, 288-289
  - Windows Store, 832
  - WinRE, 761, 776, 832, 884-886
  - workgroups, 841
  - WRP, 845
- Windows 7
- Aero, 832
  - Backup and Restore utility, 849
  - burning discs, 317
  - Check now tool, 290
  - Compatibility mode, 233
  - Control Panel, 754-757
  - Credential Manager, 867
  - desktop, 737-740
  - hardware, installation requirements, 839
  - HomeGroups, 704
  - NVMe, 260
  - older software, running, 233
  - OS, versions of, 728-729
  - sound
    - sound cards, 328-329
    - troubleshooting, 333
  - Sync Center, 859
  - Task Manager, Performance tab, 231-232
  - Virtual XP Mode, 836
  - Windows Explorer, 748-751
  - Windows Update, 847
- Windows 8
- burning discs, 317
  - charms, 734-735, 832
  - Compatibility mode, 233
  - Control Panel, 754
  - Credential Manager, 867
  - desktop, 740-741

- File Explorer, 748-751
- File History, 849
- hardware, installation requirements, 839
- Metro UI, 832
- multi-monitor taskbars, 832
- older software, running, 233
- OS, versions of, 728-729
- Performance tab (Task Manager), 232-233
- Refresh Your PC tool, 882
- Reset This PC tool, 882
- sound
  - sound cards, 328-329
  - troubleshooting, 333
- Task Manager, 232-233
- touchscreens, calibrating, 498
- Windows Update, 847
- Windows 8.1
  - charms, 734-735, 832
  - Credential Manager, 867
  - desktop, 740-741
  - File Explorer, 748-751
  - hardware, installation requirements, 839
  - Metro UI, 832
  - multi-monitor taskbars, 832
  - Refresh Your PC tool, 882
  - Reset This PC tool, 882
- Windows 10
  - burning discs, 317
  - Compatibility mode, 233
  - Credential Manager, 867
  - desktop, 742-743
  - Device Manager, 852-854
  - File Explorer, 745, 748-751
  - file extensions, 747-748
  - File History, 849
  - hardware, installation requirements, 839
  - Metro UI, 832
  - multi-monitor taskbars, 832
  - older software, running, 233
  - OS, versions of, 728-729
  - Performance tab (Task Manager), 232-233
  - Reset This PC tool, 882
  - services, 895
  - sound
    - sound cards, 328-329
    - troubleshooting, 333
  - Task Manager, 232-233
  - touchscreens, calibrating, 498
  - Windows Update, 848
- Windows 10 Mobile OS, 423
- Windows Defender, 1004
- Windows Desktop, 734-737
- Windows Device Manager, smart card readers, 349
- Windows Disk Management, 273, 280-281, 838
- Windows Explorer. *See also* File Explorer
  - files
    - display options, 997
    - indexing, 751
    - searches, 751
  - paths, 748-749
  - starting, 789
  - view options, 749-750
- Windows Firewall, 1010-1013
- Windows Memory Diagnostics, 885
- Windows Mobile OS, 423, 730
- Windows Phone OS, 423
- Windows RT OS, 423
- Windows Storage Spaces, 286
- Windows Store, 832
- Windows Troubleshooting Wizard, 857
- Windows Update, 846-848
- Windows Upgrade Advisor, 835
- Windows Vista, HomeGroup access, 704
- Windows XP, HomeGroup access, 704
- WinRE (Windows Recovery Environment), 296, 761, 832, 884-886
- wiping hard drives, 1001
- wire strippers, 631, 638
- wired connectivity (mobile devices), 443-444
- wired networks
  - connectivity, synchronizing, 457
  - Ethernet networks, projectors, 341
  - local printer connections, 388
- wireless antennas, laptops, 488
- wireless AP, 1017, 1023-1024
- wireless bridges, 652
- wireless cards, 469
- wireless connectivity
  - broadband connectivity, 588
  - mobile devices
    - Airplane Mode, 448
    - Bluetooth, 444-448
    - cellular networks, 448, 451
    - GPS, 448
    - hotspot/tethering, 449
    - IEEE 802.11 wireless standards, 447-448
    - IR, 451
    - NFC, 450
    - RFID tags, 449
    - security, 499

- synchronization, 457
- troubleshooting, 513-514
- VPN, 452
- wireless extenders (repeaters), 656
- wireless headsets, 428-429
- wireless input devices, 59-60
- wireless LANs. *See* WLAN
- wireless locators. *See* WiFi, analyzers
- wireless networks
  - 2.4 GHz radio frequency, 650
  - 5 GHz radio frequency, 650
  - ad hoc mode, 654
  - antennas, 660-664
  - AP, 652-654, 658, 1150
    - blacklists/whitelists, 676
    - changing usernames/passwords, 676
    - channel ID, 657-659, 676
    - configuring, 675
    - data speed ranges, 664
    - DHCP, 676
    - DMZ, 676
    - DNAT, 677
    - firmware, 676
    - NAT, 677
    - omnidirectional antennas, 661
    - PoE injectors, 657
    - PoE switches, 657
    - port forwarding, 677
    - port triggers, 677
    - QoS, 676
    - repeaters, 656
    - SSID, 677
    - SSIDs, 655
    - UPnP, 677
  - Bluetooth, 651-652
  - bridges, 652, 1095
  - components of, 652
  - data transfer speeds, 664
  - defined, 650
  - designing, 654-659, 676
  - desktops, 651
  - infrastructure mode, 654
  - line-of-sight wireless connections, 706
  - local printer connections, 388
  - low RF signals, 664
  - NIC, 670-671
  - projectors, 341
  - routers, 652-654, 675-676
  - security, 1017-1025
  - site surveys, 662
  - smart devices, 677
    - digital assistants, 683
    - door locks, 683
    - light switches, 681
    - security cameras, 682
    - thermostats, 680-681
    - voice-enabled smart speakers, 683
    - Z-wave, 678-680
    - Zigbee, 678-679
  - standards, 651
  - troubleshooting, 1025
  - WiFi analyzers (wireless locators), 663
  - wireless NIC, 652-653
  - WWAN, cellular configurations, 677
- wireless NIC, 652-653
  - encryption, 670
  - installing, 671
  - properties of, 671
  - speeds, 1140
  - SSID, 670
  - WEP, 1019
- wireless printers, 397-398
- wireless speakers, 428-429
- wireless WAN connectivity, laptops, 589
- wiring racks, 637
- wizards
  - Program Compatibility Wizard, 836
  - Windows Troubleshooting Wizard, 857
- WLAN (Wireless LAN), 620, 1017, 1150
- WMN (Wireless Mesh Networks), 620
- work ethics (technicians), 410
- work networks, 625
- workgroups, 621-622, 841
  - corporate OS, 732
  - passwords, 623
  - resource management, 624
  - security, 980-982
- workplace safety procedures, 1040-1045
- workstations, OS, 729
- worms, 976
- WPA (WiFi Protected Access), 670, 1020
- WPA2 (WiFi Protected Access 2), 670, 1020
- WPA2 with AES, 671
- WPS (Microsoft Works Word Processor) file extension, 747
- WPS (Wi-Fi Protected Setup), 1021-1022
- WRI (Microsoft WordPad) extension, 747
- wrist straps (ESD), 162-163
- write amplification, 257
- write NTFS permission, 995

write-black laser printers, 369  
write-white laser printers, 369  
writable media (optical), 315-317  
written communication skills, 201-202  
wrong color (printer issues), printing in, 408  
WRP (Windows Resource Protection), 845  
wscript command, 802  
WWAN (wireless WAN), 620, 677

## X

---

xcopy command, 778, 802  
xD (Extreme Digital) memory cards, 424  
xDSL modems, 584  
XLS/XLSX (Microsoft Excel) extension, 747  
XMP (Extreme Memory Profile), 217  
XPS files, print to XPS option (virtual printing), 378

## Y

---

Y connectors, 187  
Yagi antennas, wireless networks, 663  
Yahoo, mobile device email configuration, 454  
YB (Yottabyte), 24

## Z

---

Z-Wave, 678-680  
ZB (Zetabytes), 24  
zero day attacks, 980  
ZFS file system (Linux), 942  
ZIF (Zero Insertion Force) sockets, 85  
Zigbee, 678-679  
zinc-air batteries, 473  
ZIP compressed file extension, 747  
zombie attacks, 976, 980  
ZTI (Zero-Touch Installations), 833