

# COMPLETE CompTIA® A+ Guide to PCs

SIXTH EDITION

## INSTRUCTOR'S ANSWER KEY

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800 East 96th Street  
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# Complete CompTIA® A+ Guide to PCs, Sixth Edition

## Instructor's Answer Key

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## 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, CCNP, VoIP, QoS, and wireless technologies. 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, 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. Computer repair 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.

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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).

## We Want to Hear from You!

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

We welcome your comments. You can email or write to let us know what you did or didn't like about this book—as well as what we can do to make our books better.

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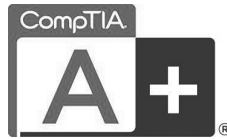
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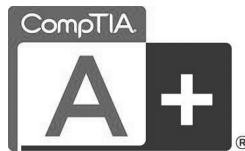
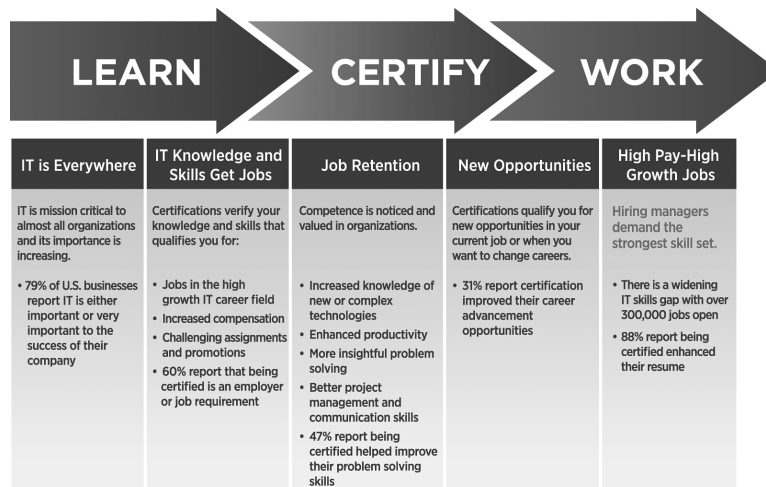




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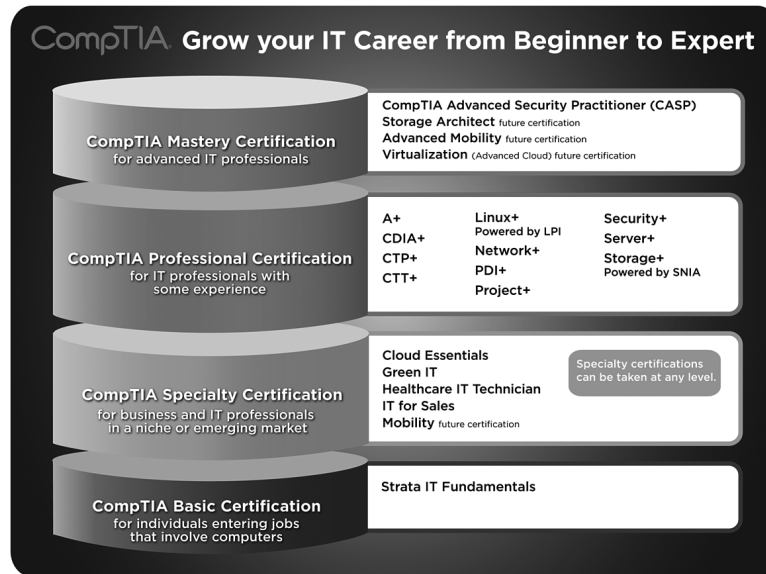
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<b>Take the Test!</b>	Select a certification exam provider and schedule a time to take your exam. You can find exam providers at the following link: <a href="http://www.comptia.org/certifications/testprep/testingcenters.aspx">http://www.comptia.org/certifications/testprep/testingcenters.aspx</a>

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# Introduction

*Complete CompTIA A+ Guide to PCs*, Sixth Edition, is intended for one or more courses geared toward CompTIA A+ Certification and Computer Repair. It covers all the material needed for the CompTIA A+ 220-801 and 220-802 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 their entire career.

## What's New in the Sixth Edition?

This update has been revised to include coverage of mobile devices such as smartphones and tablets, virtualization, and design. This edition differs from the Fifth Edition Update book in the following ways:

- Conformity with the latest CompTIA A+ Exam requirements, including the CompTIA A+ 220-801 exam, as well as the CompTIA A+ 220-802 exam.
- A new chapter on computer design was added after the hardware chapters. The chapter includes design activities with various scenarios.
- Mobile devices and virtualization technologies have been added to relevant hardware and software chapters. Labs have also been included.
- Chapters 1 through 10 focus on hardware and design. Chapters 11 and 12 are the operating system chapters. Chapter 13 and 14 cover Internet/networking concepts. Chapter 15 handles security concepts.
- The Internet Connectivity chapter was moved after the Windows chapters and before the Introduction to Networking chapter. The chapter was revamped to be a better introduction to Internet technologies, before the book dives into the details of supporting devices that connect to a wired or wireless network.
- Chapters 1 through 3 were reorganized to better flow through the basic concepts.
- 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.
- The number of questions at the end of each chapter was reduced, but 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** covers beginning terminology and computer part and port identification. 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.
- **Chapter 2** details components, features, and concepts related to motherboards, including processors, cache, expansion slots, and chipsets. Active listening skills are described in the soft skills section in this chapter.

- **Chapter 3** deals with system configuration basics. BIOS options, UEFI BIOS, and system resources are key topics. The soft skills section covers how one thing at a time should be done when replacing components.
- **Chapter 4** steps the student through how to disassemble and reassemble a computer. Laptop disassembly is also covered. 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. Written communication tips are provided for the soft skills training.
- **Chapter 5** covers troubleshooting skills and error codes. Good communication skills are stressed in the soft skills section.
- **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 the floppy drive and IDE PATA/SATA and SCSI (parallel and SAS) hard drive installation, preparation, and troubleshooting. SSDs are also covered. Phone communication skills is the target area for soft skills in 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** deals with peripheral devices, including printers and video output devices. A discussion of work ethics finishes the chapter.
- **Chapter 10** is the new computer design chapter. Not only are the specialized computers and components needed within those types of systems covered, but computer subsystem design is also included. The soft skills section targets recommendations for dealing with irate customers.
- **Chapter 11** introduces operating systems, including Windows, Android, and iOS. The chapter also includes common desktop or home icons, how to manage files and folders, the registry, and how to function from a command prompt. The soft skills section includes tips on how to stay current in this fast-paced field.
- **Chapter 12** covers Windows XP, Vista, and 7. Details include how to install, configure, and troubleshoot the environment. Avoiding burnout is the soft skill discussed in this chapter.
- **Chapter 13** handles Internet connectivity. Analog and digital modems, cable modems, DSL modems, and mobile connectivity including wireless, WiMax, and broadband cellular are all discussed. Internet browser configuration is covered along with the soft skill of mentoring.
- **Chapter 14** introduces networking. Basic concepts, terminology, and exercises make this chapter a favorite. An introduction to subnetting has been added. The focus of the soft skills section is being proactive instead of reactive.
- **Chapter 15** describes computer, mobile device, and network security. The exercises include file and folder security, event monitoring, and local policy creation. The soft skills section is on building customer trust.

## Features of This Book

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

### Chapter Objectives:

In this chapter you will learn:

- To recognize and identify important motherboard parts
- To explain the basics of how a processor works
- What issues to consider when upgrading or replacing the motherboard or processor
- How to add cards to computers and mobile devices
- The differences between PCI, PCI-X, AGP, and PCIe adapters and slots
- About motherboard technologies such as HyperTransport, Hyper-Threading, and multi-core
- The benefits of active listening

### CompTIA Exam Objectives:

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

- ✓ 801-1.2 Differentiate between motherboard components, their purposes, and properties.
- ✓ 801-1.6 Differentiate among various CPU types and features and select the appropriate cooling method.
- ✓ 801-3.1 Install and configure laptop hardware and components.
- ✓ 801-5.3 Given a scenario, demonstrate proper communication and professionalism.
- ✓ 802-1.9 Explain the basics of client-side virtualization.
- ✓ 802-4.2 Given a scenario, troubleshoot common problems related to motherboards, RAM, CPU, and power with appropriate tools.

**OBJECTIVES** Each chapter begins with BOTH chapter objectives and the CompTIA A+ exam objectives



**GRAPHICS AND PHOTOGRAPHS** Many more have been added to better illustrate the concepts

ter and remove the computer pen expansion slot. Some adapters ptions include 16- and 32-bit PCI



### Enable SATA port

Many manufacturers require that you enable the motherboard port through the system BIOS before any device connected to the port is recognized.

**TECH TIPS** The chapters are filled with Tech Tips that highlight technical issues and certification exam topics

RAM is divided into two major types: **DRAM** (dynamic RAM) and **SRAM** (static RAM). DRAM is less expensive but slower than SRAM. With DRAM, the 1s and 0s inside the chip must be refreshed. Over time, the charge, which represents information inside a DRAM chip, leaks out. The information, stored in 1s and 0s, is periodically rewritten to the memory chip through the **refreshing** process. The refreshing is accomplished inside the DRAM while other

**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

access time.....	216	fully buffered memory..	208	SIMM.....	203
cache memory .....	203	microSD .....	226	single-sided memory ....	208
CL rating.....	216	miniSD.....	226	SO-DIMM.....	207
CompactFlash.....	226	non-parity .....	208	SPD .....	208
DDR.....	205	PAE.....	223	SRAM.....	203
DDR2.....	205	pages .....	221	swap file .....	221
DDR3.....	205	parity .....	208	triple-channel .....	215
DDR3L.....	205	Performance utility .....	223	unbuffered memory.....	208
DIMM .....	203	RAM.....	202	USB flash drive .....	227
double-sided memory...	208	RDRAM.....	205	virtual machine .....	224
DRAM.....	203	refresh (process) .....	203	virtual memory.....	221
dual-channel.....	212	registered memory .....	207	Windows Memory	
dual-voltage memory ...	217	quadruple-channel .....	215	Diagnostics Tool.....	225
ECC .....	209	SD.....	226	xD .....	226
flash memory.....	226	SDRAM.....	205		

**KEY TERMS LIST** At the end of the chapter, all key terms are listed with page references to which to refer for context



## Soft Skills—Active Listening

**Active listening** is participating in a conversation where you focus on what the customer is saying—in other words, listening more than talking. For a technician, active listening has the following benefits:

- Allows you to gather data and symptoms quickly
- Allows you to build customer rapport
- Improves your understanding of the problem
- Allows you to solve the problem more quickly because you understand the problem better
- Provides mutual understanding between you and the customer
- Provides a means of having a positive, engaged conversation rather than having a negative, confrontational encounter
- Focuses on the customer rather than the technician
- Provides an environment where the customer might be more forthcoming with information related to the problem

Frequently, when a technician arrives onsite or contacts a customer who has a technical problem, the technician is (1) rushed; (2) thinking of other things, including the problems that need to be solved; (3) assuming that he or she knows exactly what the problem is, even though the user has not finished explaining the problem; or (4) more interested in the technical problem than in the customer and the issues. Active listening changes the focus from the technician's problems to the customer's problems.

A common but ineffective service call involves a technician doing most of the talking and questioning, using technical jargon and acronyms and a flat or condescending tone. The customer, who feels vulnerable, experiences a heightened anxiety level. Active listening changes this scenario by helping you build a professional relationship with your customers. The following list outlines some measures that help you implement active listening.

Have a positive, engaged professional attitude when talking and listening to customers:

- Leave your prejudices behind; be polite and aware of other cultures and customs; be open-minded and nonjudgmental.
- Have a warm and caring attitude.
- Do not fold your arms in front of your chest because doing so distances you from the problem and the customer.

**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

- Memory on a motherboard is SDRAM, a type of RAM that is cheaper and slower than SRAM, the type of memory inside the CPU and processor housing.
- A DDR module fits in a DDR slot. A DDR2 module requires a DDR2 slot; a DDR3 module requires a DDR3 slot.
- RIMMs use RDRAM and were developed by Rambus, Inc. C-RIMMs are inserted into empty memory slots.
- Unbuffered memory is the memory normally installed in computers.
- ECC is used for error checking and is commonly found in high-end computers and servers. An older method of error checking was called parity.
- The CL rating or the timing sequence first number shows how fast the processor can access data in sequential memory locations. The lower the first number, the faster the access.
- SPD is a technology used so the memory module can communicate specifications to the BIOS.

**CHAPTER SUMMARY** Recap the key concepts of the chapter, and use this for review to ensure you've mastered the chapter's learning objectives



## Review Questions

- Which expansion slot would most likely be used to add an internal adapter to a new laptop?  
[ ExpressCard/34 | ExpressCard/54 | mini PCIe | PC Card | USB port | PCI-X | mini PCI ]
- Which expansion slot would be *best* for a video card in a desktop computer?  
[ PCI-X | PCIe | PCI | ExpressCard/54 | AGP ]
- A motherboard has a PCIe x16 expansion slot. Which PCIe adapter(s) will fit in this slot?  
(Select any that apply.) [ x1 | x2 | x4 | x8 | x16 | x32 ]
- Match the capacity to the description.
 

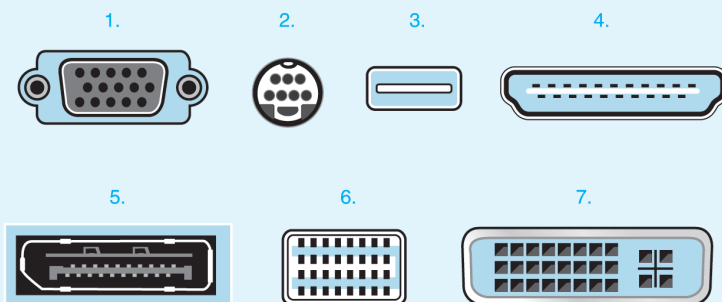
___ bit	a. 8 bits
___ kilobyte	b. a 1 or a 0
___ megabyte	c. approximately 1,000 bytes
___ byte	d. approximately 1 million bytes
___ gigabyte	e. approximately 1 trillion bytes
___ terabyte	f. approximately 1 billion bytes
- What is the front side bus?
  - the internal data bus that connects the processor core to the L1 cache
  - the internal data bus that connects the processor core to the L2 cache
  - the external data bus that connects the processor to the motherboard components
  - the external data bus that connects the processor to the L2 cache
- A customer wants to upgrade the L2 cache. What will this definitely require?
  - a motherboard purchase

**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 learning

### Lab 1.3 Identification of Video Ports

**Objective:** To identify various video ports correctly

**Procedure:** Identify each video port in Figure 1.55.



**Figure 1.55** Video ports

- 
- 
- 
- 

**LAB EXERCISES** More than 125 labs enable you to link theory to practical experience

## Activities

### Internet Discovery

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

**Parts:** Computer with Internet access

**Procedure:** Obtain technical information about a computer. Answer the following questions based on the information. More documents may need to be obtained in order to answer the questions.

**Questions:**

1. What ports are available on the front of the computer?
2. What ports are available on the back of the computer?
3. How many drive bays are available to install devices such as hard drives, optical drives, tape drives, and so on?
4. Were the photos in the documentation clear enough to differentiate between the different ports? If not, explain what is wrong.
5. List three safety precautions or procedures the documentation offers.

### 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 which components you know in one column and the components you do not know in the other column. Select one component you do not know and research that component. Write the new information and share with at least one other person.

**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



### A+ Certification Exam Tips

- ✓ Review Table 6.2 right before the exam(s) in case you are asked to identify the memory type or DDRx name.
- ✓ Review Table 6.6, especially the Windows 7 and 32-bit Windows memory limitations.
- ✓ Know how to calculate what memory is needed for an upgrade or a new install.
- ✓ Be able to identify memory slots on a motherboard.
- ✓ Know how to populate memory when dual- or triple-channeling is being implemented.
- ✓ Be able to describe the difference between unbuffered and ECC memory.
- ✓ Know that memory chips are especially susceptible to ESD and how to prevent ESD damage when installing or removing memory.
- ✓ Review the troubleshooting symptoms and tips for the 220-802 exam.
- ✓ Keep in mind that the following professionalism skills are part of the 220-801 exam: (1) maintain a positive attitude and (2) be on time (or, if late, contact the customer). You should not forget to review the professionalism skills.

**EXAM TIPS** Read through these tips on the CompTIA A+ exams so you aren't caught off guard when you sit for the exam

## CompTIA A+ Exam Objectives

Tables I-1 and I-2 summarize where you can find all the CompTIA A+ exam objectives covered in the book.

**Table I-1** CompTIA A+ 220-801 exam objectives

Objective	Chapters
220-801	
1.0 PC Hardware	
1.1 Configure and apply BIOS settings.	3, 7, 8, 15
1.2 Differentiate between motherboard components, their purposes, and properties.	1, 2, 3, 4, 6, 14
1.3 Compare and contrast RAM types and features.	6
1.4 Install and configure expansion cards.	3, 8, 9, 13
1.5 Install and configure storage devices and use appropriate media.	1, 6, 7, 8
1.6 Differentiate among various CPU types and features and select the appropriate cooling method.	2
1.7 Compare and contrast various connection interfaces and explain their purpose.	1, 13, 14
1.8 Install an appropriate power supply based on a given scenario	4
1.9 Evaluate and select appropriate components for a custom configuration, to meet customer specifications or needs.	10
1.10 Given a scenario, evaluate types and features of display devices.	1, 9
1.11 Identify connector types and associated cables.	1, 7, 9, 13
1.12 Install and configure various peripheral devices.	1, 8, 9

Objective	Chapters
<b>220-801</b>	
<b>2.0 Networking</b>	
2.1 Identify types of network cables and connectors.	14
2.2 Categorize characteristics of connectors and cabling.	14
2.3 Explain properties and characteristics of TCP/IP.	14
2.4 Explain common TCP and UDP ports, protocols, and their purpose.	14
2.5 Compare and contrast wireless networking standards and encryption types.	14, 15
2.6 Install, configure, and deploy a SOHO wireless/wired router using appropriate settings.	14, 15
2.7 Compare and contrast Internet connection types and features.	13, 14
2.8 Identify various types of networks.	14
2.9 Compare and contrast network devices their functions and features.	13, 14, 15
2.10 Given a scenario, use appropriate networking tools.	14
<b>3.0 Laptops</b>	
3.1 Install and configure laptop hardware and components.	1, 2, 4, 6, 7, 8, 9, 14
3.2 Compare and contrast the components within the display of a laptop.	9, 14
3.3 Compare and contrast laptop features.	1, 8, 14, 15
<b>4.0 Printers</b>	
4.1 Explain the differences between the various printer types and summarize the associated imaging process.	9
4.2 Given a scenario, install, and configure printers.	3, 9, 14
4.3 Given a scenario, perform printer maintenance.	9
<b>5.0 Operational Procedures</b>	
5.1 Given a scenario, use appropriate safety procedures.	4, 14
5.2 Explain environmental impacts and the purpose of environmental controls.	4, 10
5.3 Given a scenario, demonstrate proper communication and professionalism.	1, 2, 4, 5, 7, 10, 15
5.4 Explain the fundamentals of dealing with prohibited content/activity.	15

**Table I-2** CompTIA A+ 220-802 Exam Objectives

Objective	Chapters
<b>220-802</b>	
<b>1.0 Operating Systems</b>	
1.1 Compare and contrast the features and requirements of various Microsoft operating systems.	6, 11, 12, 15
1.2 Given a scenario, install and configure the operating system using the most appropriate method.	7, 11, 12, 14
1.3 Given a scenario, use appropriate command line tools.	11, 12, 14
1.4 Given a scenario, use appropriate operating system features and tools.	4, 6, 7, 8, 11, 12, 14, 15
1.5 Given a scenario, use Control Panel utilities (the items are organized by “classic view/large icons” in Windows).	4, 6, 8, 11, 12, 14, 15
1.6 Setup and configure Windows networking on a client/desktop.	13, 14, 15
1.7 Perform preventive maintenance procedures using appropriate tools.	7, 11, 12
1.8 Explain the differences among basic OS security settings.	14, 15
1.9 Explain the basics of client-side virtualization.	2, 11, 12, 14, 15
<b>2.0 Security</b>	
2.1 Apply and use common prevention methods.	12, 15
2.2 Compare and contrast common security threats.	12, 15
2.3 Implement security best practices to secure a workstation.	15
2.4 Given a scenario, use the appropriate data destruction/disposal method.	7, 15
2.5 Given a scenario, secure a SOHO wireless network.	15
2.6 Given a scenario, secure a SOHO wired network.	15
<b>3.0 Mobile Devices</b>	
3.1 Explain the basic features of mobile operating systems.	6, 11
3.2 Establish basic network connectivity and configure email.	1, 14
3.3 Compare and contrast methods for securing mobile devices.	15
3.4 Compare and contrast hardware differences in regards to tablets and laptops.	1
3.5 Execute and configure mobile device synchronization.	14
<b>4.0 Troubleshooting</b>	
4.1 Given a scenario, explain the troubleshooting theory.	5
4.2 Given a scenario, troubleshoot common problems related to motherboards, RAM, CPU, and power with appropriate tools.	2, 4, 5, 6, 14

Objective	Chapters
<b>220-802</b>	
4.3 Given a scenario, troubleshoot hard drives and RAID arrays with appropriate tools.	7
4.4 Given a scenario, troubleshoot common video and display issues.	9
4.5 Given a scenario, troubleshoot wired and wireless networks with appropriate tools.	13, 14
4.6 Given a scenario, troubleshoot operating system problems with appropriate tools.	6, 7, 11, 12
4.7 Given a scenario, troubleshoot common security issues with appropriate tools and best practices.	12, 15
4.8 Given a scenario, troubleshoot, and repair common laptop issues while adhering to the appropriate procedures.	1, 4, 9, 14
4.9 Given a scenario, troubleshoot printers with appropriate tools	9

## Summary of Exam Domains by Chapter

Schmidt Table of Contents	220-801 Domains	220-802 Domains
Chapter 1: Introduction to Computer Repair	1, 5	3, 4
Chapter 2: On the Motherboard	1, 3, 5	1, 4
Chapter 3: System Configuration	1, 4	
Chapter 4: Disassembly and Power	1, 3, 5	1, 4
Chapter 5: Logical Troubleshooting	5	4
Chapter 6: Memory	1, 3	1, 3, 4
Chapter 7: Storage Devices	1, 3, 5	1, 2, 4
Chapter 8: Multimedia Devices	1, 3	1
Chapter 9: Other Peripherals	1, 3, 4	4
Chapter 10: Computing Design	1, 5	
Chapter 11: Basic Windows Operating Systems		1, 3, 4
Chapter 12: Windows XP, Vista, and 7		1, 2, 4
Chapter 13: Internet Connectivity	1, 2	1
Chapter 14: Introduction to Networking	1, 2, 3, 4, 5	1, 3, 4
Chapter 15: Computer and Network Security	1, 2, 3, 5	1, 2, 3, 4

# Introduction to Computer Repair

## Chapter Objectives:

In this chapter you will learn:

- Good qualities a technician should have
- What connects to different ports of a computer
- Important computer parts
- Basic computer terms



## CompTIA Exam Objectives:

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

- ✓ 801-1.2 Differentiate between motherboard components, their purposes and properties.
- ✓ 801-1.5 Install and configure storage devices and use appropriate media.
- ✓ 801-1.7 Compare and contrast various connection interfaces and explain their purpose.
- ✓ 801-1.10 Given a scenario, evaluate types and features of display devices.
- ✓ 801-1.11 Identify connector types and associated cables.
- ✓ 801-1.12 Install and configure various peripheral devices.
- ✓ 801-3.1 Install and configure laptop hardware and components.
- ✓ 801-3.3 Compare and contrast laptop features.
- ✓ 801-5.3 Given a scenario, demonstrate proper communication and professionalism.
- ✓ 802-3.2 Establish basic network connectivity and configure email.
- ✓ 802-3.4 Compare and contrast hardware differences in regards to tablets and laptops.
- ✓ 802-4.8 Given a scenario, troubleshoot and repair common laptop issues while adhering to the appropriate procedures.

## Chapter Summary

- Computer technicians should actively listen, have a positive attitude, refrain from using technical acronyms and terminology when speaking with nontechnical people, and be culturally sensitive.
- Easily identify important computer parts installed in a computer and as standalone parts: case, keyboard, mouse, motherboard, monitor, power supply, hard drive, optical drive, adapter, riser board, and memory.
- Easily identify various ports to determine what device attaches to them: VGA, DVI, HDMI, DisplayPort, USB, IEEE 1394, 3.5mm sound jack, PS/2, RJ-45, eSATA, parallel, serial, and RJ-11.
- The most popular method for adding functionality to desktops, laptops, and tablets is to use a USB port.
- USB 3.0 ports will accept 3.0 and older devices and provide more power. You can add additional ports by connecting a USB module to motherboard pins. This module takes an expansion space (but not a slot). A PCI/PCIe adapter can also be installed to provide additional ports. Cabling from the power supply to the adapter might be required to provide power to the new USB ports.
- Up to five USB hubs can be daisy-chained to one port. Upstream ports connect to the computer or another USB port. Devices connect to downstream ports.
- USB hubs can be self-powered or bus powered.
- IEEE 1394 devices do not have to have a computer port and can be cabled to each other; otherwise, an IEEE 1394 device can be cabled to a port or a hub.
- USB and IEEE 1394 troubleshooting issues commonly relate to power, drivers, or system resources.

## Key Terms

adapter .....	8	HDMI.....	20	port.....	11
BIOS.....	6	IEEE 1394 port.....	30	port replicator.....	36
Bluetooth .....	16	infrared .....	16	power supply.....	7
bus-powered hub .....	24	input device .....	6	RAM.....	10
Certified W-USB .....	26	integrated motherboard ..	11	riser board.....	8
charging USB port.....	24	Internet appliance .....	6	RJ-11 .....	33
device driver .....	5	keyboard port.....	12	RJ-45 .....	33
DisplayPort .....	22	keyed .....	12	ROM .....	10
docking station.....	35	KVM switch.....	7	SD.....	11
downstream port .....	23	mechanical mouse.....	13	self-powered hub .....	24
D-shell connector .....	12	memory.....	10	serial port.....	29
dual link.....	20	mini-DIN connector .....	12	single link .....	20
DVI port .....	19	modem .....	34	sleep-and-charge USB	
DVI-A.....	20	motherboard .....	7	port.....	24
DVI-D .....	20	mouse port.....	12	software.....	5
DVI-I.....	20	MSDS .....	3	sound card .....	29
eSATA port.....	33	multitouch.....	14	S/PDIF.....	29
eSATAp port.....	33	Network port.....	33	S-Video port.....	19
Ethernet port.....	33	NIC .....	33	Thunderbolt port.....	22
expansion slot .....	8	operating system .....	5	TouchFlo.....	14
firmware.....	6	optical drive .....	7	upstream port.....	23
flash memory.....	11	optical mouse .....	13	USB OTG.....	26
floppy drive .....	7	output device .....	7	USB port .....	22
hard drive.....	7	parallel port .....	28	VGA port .....	19
hardware .....	5	PC.....	6	xD .....	11



## Review Questions

1. Match the part to the description.

- |                        |   |
|------------------------|---|
| <u>c</u> motherboard   | a. converts AC to DC                    |
| <u>e</u> RAM           | b. holds the most data                  |
| <u>f</u> optical drive | c. has the most electronics             |
| <u>b</u> hard drive    | d. fits in an expansion slot            |
| <u>d</u> adapter       | e. contents disappear when power is off |
| <u>a</u> power supply  | f. holds a disc                         |

2. Match the port to the description.

- |                 |                       |
|-----------------|-----------------------|
| <u>f</u> DVI    | a. Ethernet           |
| <u>e</u> VGA    | b. TOSLINK            |
| <u>d</u> PS/2   | c. up to 127 devices  |
| <u>c</u> USB    | d. mouse/keyboard     |
| <u>a</u> NIC    | e. CRT                |
| <u>b</u> S/PDIF | f. flat panel monitor |

3. What is a visual indication that a cable is USB version 2.0? **The USB symbol includes a plus sign (+).**
4. What is another name for IEEE 1394? **FireWire, iLink, or Lynx**
5. How is an eSATAp port different from an eSATA port? **An eSATAp port accepts both USB and eSATA connections and is powered.**
6. When considering VGA, HDMI, RGB/component, DVI, and DisplayPort, which video port can output both digital audio and video signals and is the most technologically advanced? **HDMI**
7. What is the most common DVI port? **DVI-I**
8. Which has the faster transfer time when connected externally to a computer, USB 3.0, or FireWire 800? **USB 3.0 (USB 3.0 has speeds up to 5Gbps, whereas FireWire 800 is 800Mbps.)**
9. What are the two ports most commonly used to attach a keyboard? **PS/2 and USB**
10. What type of memory is commonly found on a motherboard? **RAM**
11. [ **T** | F ] When lifting a heavy computer, you should squat, bend at the knees, and use your legs to lift.
12. What should you remove before working inside a computer? [ tie | necklace | shoes | **ring** ]
13. Is the following question open ended or closed? You say your computer has been running slow since Monday. What applications have you installed this week?  
[ open ended | **closed ended** ]
14. List one example of having a positive attitude. **Answers will vary, but a few sample answers follow. A technician sees every issue as an opportunity to help or be positive. A technician is sensitive to other cultures. A technician takes the time to listen to the entire problem. A technician with a positive attitude does not normally blame others. A technician with a positive attitude has a can-do attitude.**
15. Which of the following devices are commonly output devices? Select all that apply.  
[ digital piano | **speakers** | **display** | stylus | track stick | barcode reader | **printer** ]

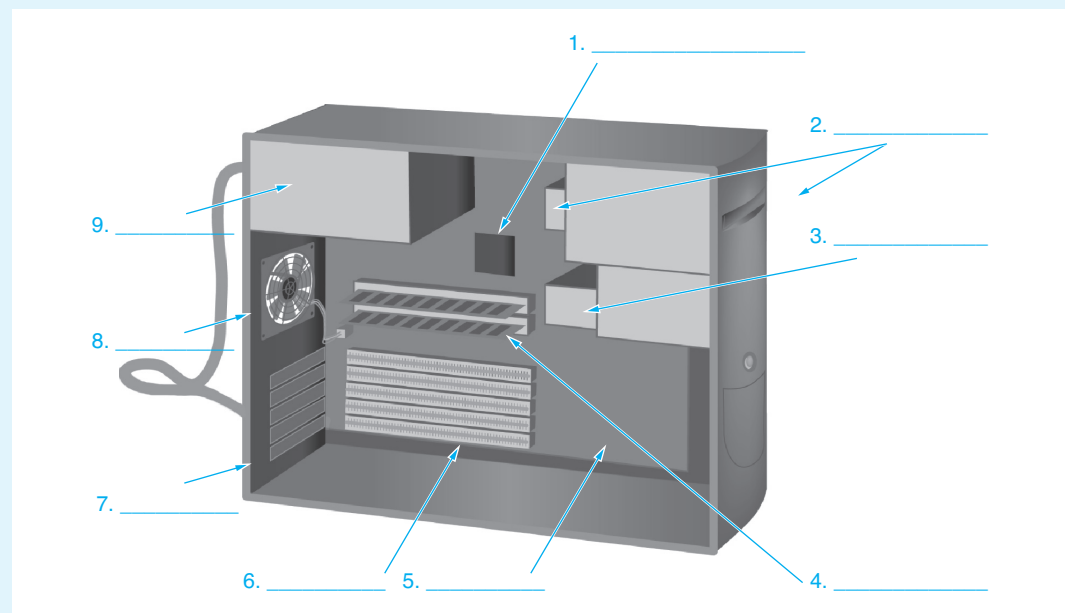
16. How can you control a laptop keyboard backlight? **By using a special  $\boxed{\text{Fn}}$  or function key**
17. How is a multitouch display different from a normal mobile display? **A multitouch display allows two or more touches to be used to control the screen such as enlarging text or a photo.**
18. In which of the following situations would Bluetooth most likely be used?
  - a. to connect to a corporate wireless network
  - b. to attach a keyboard to a PC**
  - c. to connect a PC to a phone line
  - d. to connect a flash drive to a camera
19. List one advantage of having an adapter rather than an integrated motherboard port.  
**Answers will vary, but several examples follow. A video adapter can offer more RAM that is not shared by the motherboard, a separate processor, or multiple ports for more than one monitor. A network adapter could offer a port with higher speeds or connects using a different media. A sound card could offer more sound ports and higher quality sound output.**
20. 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? **Answers will vary, but a sample answer follows. Good morning. I have a service log that states you are getting an error message whenever you access a PDF file. Can you access a file and show me the error message?**

## Exercises

### Lab 1.1 Identifying Tower Computer Parts

*Objective:* To identify various computer parts correctly

*Procedure:* Identify each computer part in Figure 1.53.



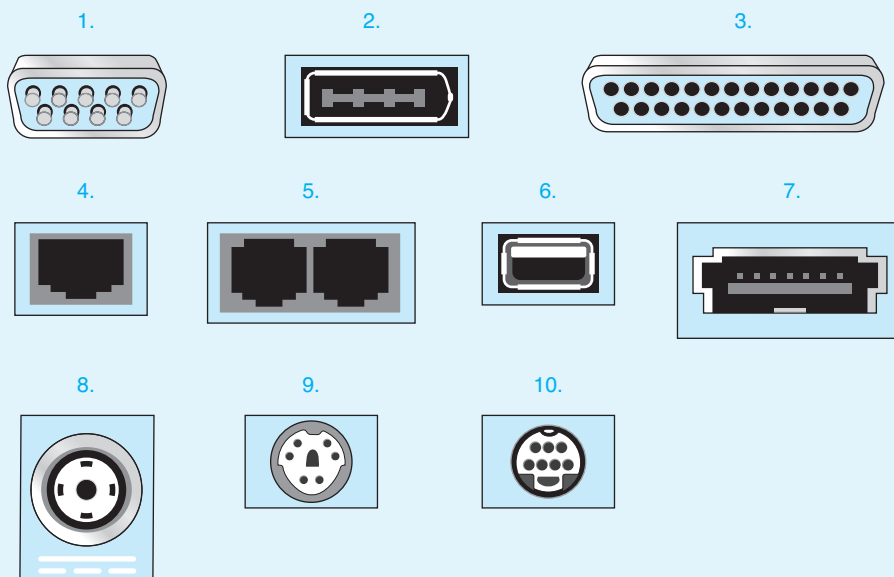
**Figure 1.53** Tower computer parts

1. CPU or processor
2. Optical drive
3. Hard drive
4. RAM or memory
5. Motherboard
6. Expansion slot
7. Case
8. Case fan
9. Power supply

## Lab 1.2 Identification of Computer Ports

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

**Procedure:** Identify each computer port in Figure 1.54.



**Figure 1.54** Computer ports

1. 9-pin male serial port
2. IEEE 1394 port
3. 25-pin female parallel port
4. RJ-45 NIC or network port
5. 2 RJ-11 connectors: internal modem
6. USB
7. eSATAp or eSATA/USB combo port
8. Laptop power connector
9. PS/2 or 6-pin DIN
10. S-Video

Lab 1.3 Identification of Video Ports

Objective: To identify various video ports correctly  
Procedure: Identify each video port in Figure 1.55.

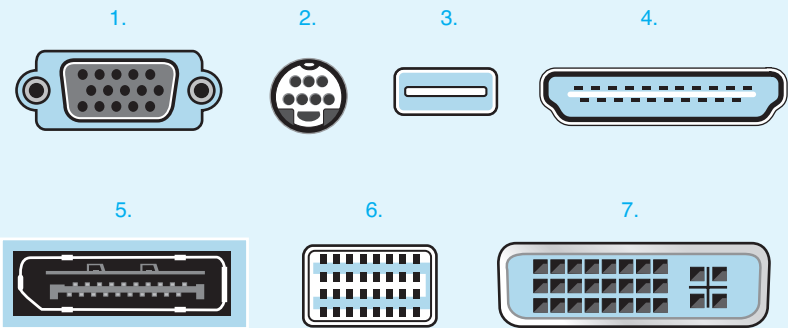


Figure 1.55 Video ports

- 1. VGA
- 2. S-Video
- 3. Micro-DVI
- 4. HDMI
- 5. DisplayPort
- 6. Mini-DVI
- 7. Dual-link DVI-I

Lab 1.4 Port Identification

Objective: To identify various computer ports correctly  
Parts: Computer ports, either built into a specific computer or as separate adapters  
Procedure:

- 1. Contact your instructor for a computer on which to work or to obtain adapters.
- 2. Identify the computer port(s) given to you by the instructor. In Table 1.6, fill in the connector type, number of pins, and port type.

Table 1.6 Connector identification

Connector type (D-shell, DIN, etc.)	Number of pins	Port purpose (video, USB, NIC, etc.)
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____
6. _____	_____	_____
7. _____	_____	_____
8. _____	_____	_____
9. _____	_____	_____
10. _____	_____	_____

The answers depend on the ports chosen by an instructor or lab assistant.

## Activities

### Internet Discovery

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

**Parts:** Computer with Internet access

**Procedure:** Obtain technical information about a computer. Answer the following questions based on the information. More documents may need to be obtained in order to answer the questions.

**Questions:**

1. What ports are available on the front of the computer? **Machine dependent**
2. What ports are available on the back of the computer? **Machine dependent**
3. How many drive bays are available to install devices such as hard drives, optical drives, tape drives, and so on? **Machine dependent**
4. Were the photos in the documentation clear enough to differentiate between the different ports? If not, explain what is wrong. **Student dependent**
5. List three safety precautions or procedures the documentation offers. **Documentation dependent**

### 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. **Team dependent, but some qualities of a good technician include logical, good communicator, proactive, keeps skills current, patient with computer users, and puts in a full day's work.**
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. **Team dependent, but some unprofessional practices include pirating software, being lazy, not telling the truth, blaming others, talking about other technicians behind their backs, being late to work and early to leave work, and being a poor communicator.**

### 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 which components you know in one column and the components you do not know in the other column. Select one component you do not know and research that component. Write the new information and share with at least one other person. **Student dependent**

2. Why do you think that 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. **Group dependent, but one possible answer is that many parts, such as motherboards, keyboards, and inkjet printers, are considered throw-away technology because it would cost a company more money to hire a technician to repair these parts than it would to just purchase a new component.**
3. Provide five tips that might help someone identify the different computer ports. If possible, each person in the class should state a tip without duplicating someone else’s tip. **Student dependent, but some examples include the following: Serial killers are normally male, and serial ports are male. Network ports and modem ports look just alike except that modem ports only have four conductors, like the phone jacks in a house, and network ports have eight conductors. The only port that has three rows of connections is for video. Look at the symbol above the port to help with identification. USB ports are probably on the front and back of the computer.**



### A+ Certification Exam Tips

- ✓ Get a good night’s rest the night before the exam.
- ✓ Ensure that you are knowledgeable and proficient with the terms and technologies listed in the official CompTIA A+ exam objectives.
- ✓ Ensure that you can identify the basic parts of the computer and explain the purpose of each one. Ensure that you know the following parts: hard drive, optical drive, power supply, motherboard, RAM, laptop AC adapter, and laptop video controller.
- ✓ Know what port(s) a specific device can use. Particular ports to know include HDMI, VGA, DVI, DisplayPort, USB, IEEE 1394, eSATA, eSATAp, PS/2, RJ-45, RJ-11, and Ethernet. (On 3×5 cards, write the names of ports you have a hard time remembering. Put a picture of the port on one side and the term on the other. Take the cards with you wherever you go the week before the exam and practice with them.)
- ✓ The following communication and professionalism skills are part of the 220-801 exam: (1) use proper language; (2) maintain a positive attitude; (3) listen and do not interrupt the customer; and (4) be culturally sensitive.

# On the Motherboard

## Chapter Objectives:

In this chapter you will learn:

- To recognize and identify important motherboard parts
- To explain the basics of how a processor works
- What issues to consider when upgrading or replacing the motherboard or processor
- How to add cards to computers and mobile devices
- The differences between PCI, PCI-X, AGP, and PCIe adapters and slots
- About motherboard technologies such as HyperTransport, Hyper-Threading, and multi-core
- The benefits of active listening



## CompTIA Exam Objectives:

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

- ✓ 801-1.2 Differentiate between motherboard components, their purposes, and properties.
- ✓ 801-1.6 Differentiate among various CPU types and features and select the appropriate cooling method.
- ✓ 801-3.1 Install and configure laptop hardware and components.
- ✓ 801-5.3 Given a scenario, demonstrate proper communication and professionalism.
- ✓ 802-1.9 Explain the basics of client-side virtualization.
- ✓ 802-4.2 Given a scenario, troubleshoot common problems related to motherboards, RAM, CPU, and power with appropriate tools.

## Chapter Summary

- Important motherboard parts include the following: processor, RAM slots/RAM, expansion slots (PCI, PCI-X, PCIe, and AGP), and cooling devices.
- Processors can be multi-core and contain very fast cache memory: L1 cache inside the processor and L2 cache outside the processor but inside the chip. Processors can also support L3 cache.
- Processors use HyperThreading to make efficient use of processor time.
- Processors must be kept cool with fans and/or heat sinks. A thermal paste is applied between a heat sink and a processor.
- The clock speed refers to the processor's internal clock. This is not the same as the FSB or bus speed.
- CPU throttling slows down the processor to prevent overheating.
- PCI/PCI-X is a 32- and 64-bit parallel bus. The AGP expansion slot has a dedicated path for video to the processor. PCI, PCI-X, and AGP have been replaced with the point-to-point serial PCIe bus.
- PCIe slots have a specific number of bidirectional lanes that are the maximum a card can use. A PCIe adapter can fit in a slot of the same number of lanes or a higher number of lanes.
- A chipset is one or more chips that coordinate communication between the processor and the rest of the motherboard. A chipset could have an MCH (north bridge) to coordinate between the CPU and some expansion slots as well as memory. The chipset could also have a ICH (south bridge) to coordinate between the CPU and the rest of the motherboard expansion slots and ports. The chipset dictates the maximum number and type of slots and ports on a motherboard. AMD and Intel have created technologies to address the slowness of the FSB: HyperTransport, QPI, and DMI.
- Laptops use mini PCI/PCIe slots for adapters and can use ExpressCards if the laptops have a slot in the side for these type of cards.
- When replacing a motherboard, ensure that the CPU socket and number/types of expansion slots are appropriate. When replacing a laptop motherboard, additional components may have to be removed.
- When replacing or upgrading the CPU, ensure that the motherboard supports the processor and that the heating device is attached before powering on the computer. When replacing a laptop CPU, a screw may have to be loosened before you can remove the old processor.
- When replacing a CPU, ensure that the heat sink or fan is attached before powering on the computer.
- Active listening is an important skill for a technician. Don't be distracted by people or technology, take notes, make good eye contact, and ask directed questions when appropriate.



## Key Terms

ACR .....	76	ExpressCard .....	75	megabyte .....	46
active listening .....	81	external data bus .....	47	mini PCI .....	74
AGP .....	69	form factor .....	78	mini PCIe .....	74
AMR .....	76	FSB .....	51	north bridge .....	68
APU .....	49	gigabyte .....	46	octa-core .....	55
back side bus .....	51	gigahertz .....	46	overclocking .....	65
bit .....	46	GPU .....	49	PC Card .....	75
bus .....	47	hexa-core .....	55	PCI .....	67
bus speed .....	51	hot swapping .....	75	PCIe .....	70
byte .....	46	HT .....	54	PCI-X .....	68
cache memory .....	51	HyperTransport .....	55	PCMCIA .....	75
CardBus .....	75	ICH .....	77	POST .....	80
chipset .....	76	internal data bus .....	47	processor .....	46
clock .....	51	kilobyte .....	46	quad-core .....	55
clock speed .....	51	L1 cache .....	51	south bridge .....	77
CNR .....	76	L2 cache .....	51	thread .....	54
CPU speed .....	51	L3 cache .....	51	throttle management .....	63
CPU throttling .....	51	liquid cooling system .....	62	virtualization .....	57
dual-core .....	55	MCH .....	77	ZIF socket .....	57

## Review Questions

- Which expansion slot would most likely be used to add an internal adapter to a new laptop?  
[ ExpressCard/34 | ExpressCard/54 | **mini PCIe** | PC Card | USB port | PCI-X | mini PCI ]
- Which expansion slot would be *best* for a video card in a desktop computer?  
[ PCI-X | **PCIe** | PCI | ExpressCard/54 | AGP ]
- A motherboard has a PCIe x16 expansion slot. Which PCIe adapter(s) will fit in this slot? (Select any that apply.) [ **x1** | **x2** | **x4** | **x8** | **x16** | x32 ]
- Match the capacity to the description.
 

___ <b>b</b> ___ bit	a. 8 bits
___ <b>c</b> ___ kilobyte	b. a 1 or a 0
___ <b>d</b> ___ megabyte	c. approximately 1,000 bytes
___ <b>a</b> ___ byte	d. approximately 1 million bytes
___ <b>f</b> ___ gigabyte	e. approximately 1 trillion bytes
___ <b>e</b> ___ terabyte	f. approximately 1 billion bytes
- What is the front side bus?
  - the internal data bus that connects the processor core to the L1 cache
  - the internal data bus that connects the processor core to the L2 cache
  - the external data bus that connects the processor to the motherboard components**
  - the external data bus that connects the processor to the L2 cache
- A customer wants to upgrade the L2 cache. What will this definitely require?
  - a motherboard purchase
  - a CPU purchase**
  - a ROM module purchase
  - a RAM module purchase

7. Match the expansion slot to the definition.
- |                            |                                |
|----------------------------|--------------------------------|
| __ <b>b</b> __ ExpressCard | a. 32- or 64-bit parallel bus  |
| __ <b>c</b> __ AGP         | b. used in laptops             |
| __ <b>a</b> __ PCI         | c. just for video cards        |
| __ <b>d</b> __ PCIe        | d. has varying number of lanes |
8. What is the difference between Hyper-Threading and HyperTransport? **Hyper-Threading is an Intel technology that allows intermixing of program threads to keep the CPU busy. HyperTransport is an AMD technology used to connect the processor to motherboard components.**
9. Which of the following would be a function of a chipset? (Select all that apply.)
- a. Process instructions obtained from RAM
  - b. Set the maximum number of USB 3.0 ports allowed on a motherboard**
  - c. Coordinate between the CPU and motherboard components**
  - d. Temporarily hold documents and instructions
  - e. Provide permanent storage
  - f. Prioritize threads being queued for processing by the CPU
10. Which of the following statements is true regarding PCIe?
- a. A PCIe slot will not accept a PCI card.**
  - b. PCIe is a parallel bus technology.
  - c. PCIe is a 32- or 64-bit bus technology.
  - d. PCIe is being replaced by PCI-X.
11. [ T | **F** ] An x8 PCIe adapter will always transmit using eight lanes.
12. What is the significance of a motherboard specification that states the following: 1 PCIe x16 (x8 mode) slot?
- a. The slot accepts x8 or x16 cards.
  - b. The slot can transmit traffic using 8 or 16 lanes.
  - c. The slot can transmit in bursts of 8 or 16 bytes at a time.
  - d. The slot accepts x16 cards but uses only 8 lanes.**
13. What determines whether a motherboard can use a specific model of RAM, such as DDR2 or DDR3? [ CPU | **chipset** | PCIe standard | processor speed ]
14. A technician for a college is going to repair a problem in another building. A professor stops the technician to talk about her slow computer. The technician gives a little eye roll but stops and listens to the teacher. The teacher comments, "I can't get my email or even type my tests. The computer takes at least 20 minutes just to boot." As the technician looks around a little exasperated, he says "Uh huh." "I logged this problem over a week ago," continues the professor, "and no one has dropped by." "Uh huh," replies the technician again. "Do you know when you folks might get to that issue or have an idea about what might be the problem?" the professor asks. The technician looks at the professor and says, "It is probably a virus that has been going around. Jim was supposed to get to those. We will get to you as soon as we can." The technician's phone rings, and he walks away while talking on the phone.

List three active listening techniques and good customer support procedures that could improve this situation. **Answers will vary, but the following is provided as sample answers. Do not roll your eyes at anyone. When in a hurry to complete a task, politely tell the person you are on your way to a repair but that you could either call them as soon as you are done or drop by to give them your full attention. Maintain eye contact when you are talking to the customer. Ignore electronic devices until you have completed your conversation. Don't blame others. Don't jump to conclusions about the cause of an issue.**

15. Explain how a technician might be culturally insensitive. **Answers will vary, but a sample answer follows. Jack the technician arrives at an office where a Pakistani woman works. The woman explains that her wireless printer doesn't work. Jack the technician tells her that it might be interference from all the bracelets she wears.**
16. What is overclocking? **Overclocking is increasing the speed of the processor beyond the preconfigured settings.**
17. [ T | F ] When installing a CPU, orient pin 1 to pin 1 on the socket and align the other pins. Lower the ZIF socket lever and lock. Power on the computer to ensure that the CPU works. Power down the computer and install the heat sink and/or fan. **Never power on the computer without a cooling device attached to the processor.**
18. What is applied between a processor and a heat sink to increase heat dissipation? **Thermal paste/compound**
19. What component would be affected by the LGA 2011 specification? [ RAM | chipset | **processor** | expansion slot ]
20. Where are mini PCIe cards normally installed?
  - a. in tablet computers
  - b. in smartphones
  - c. on the bottom of a laptop**
  - d. in a slot adjacent to the processor

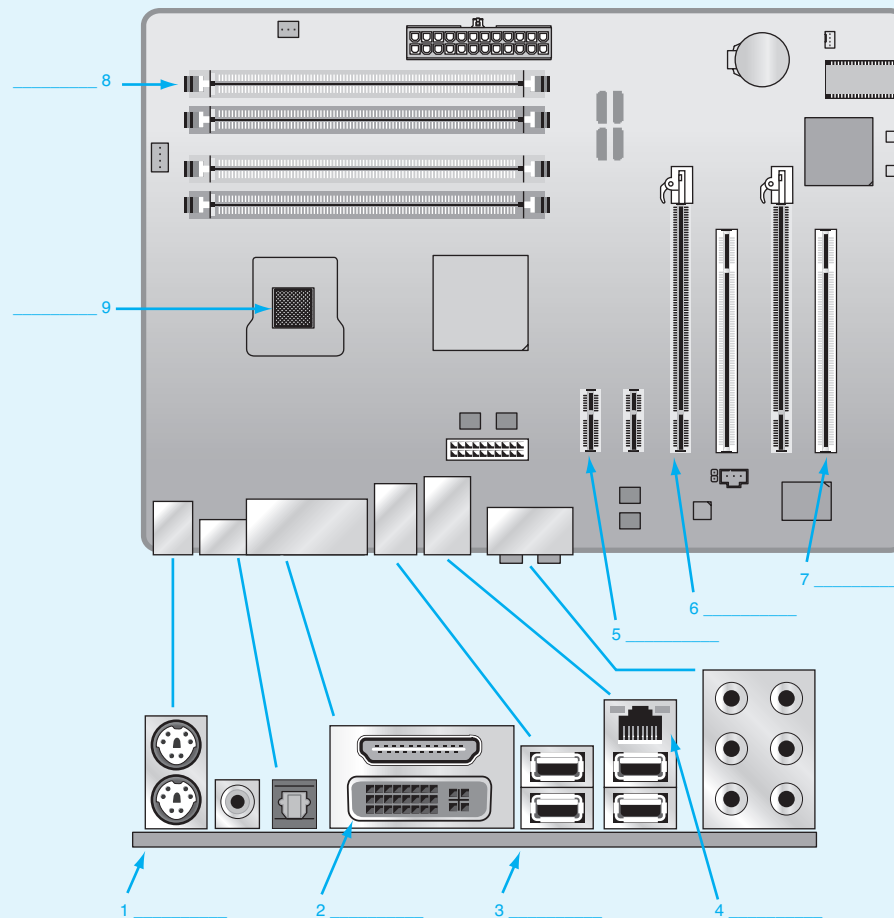
## Exercises

### Lab 2.1 ATX Motherboard Parts Identification Exercise

*Objective:* To identify various motherboard parts

*Parts:* None

*Procedure:* Using Figure 2.42, label each of the ATX motherboard parts.



**Figure 2.42** Motherboard parts

1. PS/2 or mini-DIN
2. DVI or DVI-I
3. USB
4. NIC, network port, RJ-45, or Ethernet port
5. PCIe x1
6. PCIe x16
7. PCI
8. Memory expansion slot
9. CPU or processor socket

## Lab 2.2 Motherboard Analysis

*Objective:* To identify various motherboard parts

*Parts:* None

*Procedure:* Using the information you learned in this chapter and related to the specifications found in Figure 2.43, answer the questions that follow.

XYZ Motherboard Specifications			
Form factor		ATX	
Power connector		24-pin	
<b>CPU</b>			
CPU socket type		LGA1155	
CPUs supported		Celeron, Pentium, Core i3, i5, i7	
Chipset		Intel Z77	
<b>Graphics</b>			
Integrated GPU		Multi-VGA output support: HDMI/DVI/ RGB/DisplayPort ports	
<b>Memory</b>			
Memory		4x240-pin	
Memory standard		DDR3 2600(O.C.), 2400(O.C.), 2200(O.C.), 2133(O.C.), 1866(O.C.), 1800(O.C.), 1600, 1333	
Maximum memory		32GB	
Memory channel		Dual channel	
<b>Expansion slots</b>			
PCIe 3.0/2.0 x16		2 (single x16 or dual x8)	
PCIe 2.0 x16		1 (x4 mode)	
PCIe 2.0 x1		2	
PCI		2	
<b>Onboard LAN</b>			
Max LAN speed		10/100/1000Mbps	
Wireless LAN		WiFi 802.11 b/g/n	
<b>Rear ports</b>			
PS/2		1 x PS/2 keyboard/mouse port	
Video		D-sub + DVI	
HDMI		1 x HDMI	
DisplayPort		1 x DisplayPort	
USB 1.1/2.0		2 x USB 2.0	
USB 3.0		4 x USB 3.0	
S/PDIF out		1 x optical	
Audio		6 ports	

**Figure 2.43** Motherboard advertisement

1. If someone you know were buying this motherboard, what type of case would you need to purchase? **An ATX case is required with an ATX motherboard.**
2. What does LGA1155 tell you about this motherboard? **LGA1155 refers to the number of pins in the CPU socket on the motherboard.**
3. Does this motherboard come with a CPU installed?  
[ Yes | No | **Cannot tell from the information presented** ] **Note that normally when a motherboard comes with a CPU installed, the sale is a kit. A sample advertisement would say “Motherboard/CPU combo” or “XYZ Motherboard with CPU included.”**
4. What motherboard component controls the maximum number of 3.0 USB ports this motherboard *could* have? **The chipset**
5. What processor(s) does this motherboard accept? **Celeron, Pentium, Intel Core i3, Core i5, and Core i7**
6. What do you think that the letters O.C. after some of the memory chips mean in relationship to this motherboard? **Answers may vary due to student opinion, but the meaning is as follows: Overclocked—these memory modules only work with this motherboard when the CPU is overclocked.**
7. What is the most significant difference between a version 2.0 PCIe slot and a version 3.0 PCIe expansion slot? **Speed—the version 3.0 PCIe expansion slot travels faster (8GT/s per direction per lane) than the version 2.0 expansion slot (5GT/s).**
8. What do you think the PCIe 3.0/2.0 x16 line that states “2 (single x16 or dual x8)” means?
  - a. The adapter that goes into this slot can use a single lane that goes at x16 speeds or two lanes that go at x8 speeds.
  - b. One single x16 adapter and/or one single x8 adapter can go into the expansion slots.
  - c. **One x16 adapter can go into one of the version 3.0 slots and achieve 3.0 speeds, OR two x16 adapters can be installed, but they can only transfer eight lanes at a time at 3.0 speeds.**
  - d. A single x16 adapter can be installed in one of the version 3.0 slots, or two x8 adapters can be installed in the two version 3.0 slots.
9. What can insert into the PS/2 port? (Select the best answer.)  
[ mouse | keyboard | **mouse or keyboard** | display | external storage]
10. What type of video port is described as a D-sub in this documentation? **VGA 15-pin female**
11. What is an advantage of having an integrated GPU in the CPU? **Faster graphical processing and reduced power requirements**

12. What is the most likely reason this motherboard manufacturer chose to include two PCI expansion slots? **Answers will vary, but a sample answer is so that a customer with an older PCI card can still use it if he or she purchased this motherboard as a new or replacement motherboard.**

### Lab 2.3 Processor Speed, Processor Socket, and Ports

**Objective:** To identify various computer features such as the type of processor being used, processor socket, and additional expansion ports

**Parts:** Computer with Internet access

**Procedure:** Complete the following procedure and answer the accompanying questions.

1. Boot computer and determine the processor type and speed. Write down the processor type and speed. **The processor type and speed are computer dependent.**
2. Power off the computer. Open or remove the cover. Locate the processor. What type of processor socket is on the motherboard? If you are unsure, use the Internet as a resource. Write down the processor socket type. **The processor socket type is computer dependent.**  
What model of processors can go into this type of socket? **The processor model(s) are computer dependent.**  
List the type of cooling that is used for the processor. **The type(s) of cooling used for the processor is computer dependent, but two common answers are a fan and/or a heat sink.**
3. Look at the back of the computer, where the ports are located. List every port located on the computer and one device that could connect to the port. **Answers will vary depending on the computer being used.**
4. Locate a picture of an IEEE 1394 port or connector on the Internet. Write down the URL for the site where you find this picture. **Answers will vary, but one URL that shows an IEEE 1394 connector is as follows: [http://en.wikipedia.org/wiki/IEEE\\_1394](http://en.wikipedia.org/wiki/IEEE_1394)**
5. Using the Internet, locate one vendor that makes a motherboard that supports IEEE 1394 or has an integrated IEEE 1394 port. Write down the vendor's name and the URL where you find the information. **Answers will vary, but one motherboard is the ASUS Sabertooth 990FX, found at the following URL: <http://www.newegg.com/Product/Product.aspx?Item=N82E16813131736>.**

## Activities

### Internet Discovery

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

**Parts:** Computer with Internet access

**Procedure:** Locate documentation on the Internet for a GIGABYTE GA-A75M-DS2 motherboard in order to answer Questions 1–12. Continue your Internet search in order to answer Questions 13 and 14.

**Questions:**

1. Does the motherboard support an Intel or AMD processor? **AMD**
2. What chipset is used? **AMD A75**
3. How many expansion slots are on the motherboard? **3**
4. What form factor does this motherboard use? **MicroATX**
5. What processors can be used on this motherboard? **AMD A series, E2 series, Athlon II, and Sempron**
6. Does the motherboard support having an integrated GPU in the CPU? **Yes**
7. What type of CPU socket does the motherboard have? **FM1**

8. How many and of what type of PCIe slots are there? **Three: one PCIe x16, one PCIe x1, one PCI**
9. What type of memory does this motherboard accept? **DDR3**
10. Does this motherboard have an integrated IEEE 1394 port? **No**
11. What is the maximum number and type of USB ports supported by this motherboard? **Up to eight USB 2.0/1.1 ports and up to four USB 3.0 ports**
12. Write the URL where you found the motherboard information. **Answers can vary, but one web site is [http://download.gigabyte.us/FileList/Manual/mb\\_manual\\_ga-a75m-ds2\\_e.pdf](http://download.gigabyte.us/FileList/Manual/mb_manual_ga-a75m-ds2_e.pdf).**
13. Find a vendor for a motherboard that uses the Intel X79 chipset. Document the model and vendor. **Answers will vary, but one motherboard is the GIGABYTE G1.Assassin2 from Newegg.**
14. Find an Internet site that describes the dimensions of the extended ATX motherboard form factor. List the dimensions and the website. **Web sites will vary, but the dimensions are 12 inches by 13 inches. One web site is Wikipedia.org.**

## Soft Skills

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

**Activities:**

1. On a piece of paper or an index card, list three ways you can practice active listening at school. Share this information with your group. Consolidate ideas and present five of the best ideas to the class. **Answers will vary, but some ideas include focusing on lectures, paying close attention when classmates talk to them, taking notes when someone is talking to practice this trait, try to remember what other people order or buy in the lunchroom for one day, take notes when dealing with school support staff such as an advisor, financial aid office, scholarship office, or the registrar's office.**
2. In a team environment, determine two situations in which team members have experienced a situation in which a support person (a PC support person, sales clerk, checkout clerk, person being asked directions, and so on) could have provided better service if he or she had been actively listening. Share your findings with the class. **Team dependent**
3. In teams of two, have one person tell a story and the other person practice active listening skills. The person telling the story should critique the listener. The pair should then exchange roles. **Student dependent**

## Critical Thinking Skills

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

**Activities:**

1. Find an advertisement for a computer in a local computer flyer, newspaper, magazine, or book or on the Internet. Determine all the information about the motherboard and ports that you can from the ad. Write down any information you do not understand. Research this information and share your findings with a classmate. **Student dependent**
2. Your parents want to give you a new computer as a present. The one they are considering has a GPU integrated into the CPU. List at least one argument you might use for getting a different computer model. **Answers will vary, but the one good argument for not having an integrated GPU in a CPU is when the application, such as gaming or design work, needs more graphical power than provided (and a separate video card with separate GPU and RAM is needed).**

3. Why do you think a motherboard has different buses that operate at different speeds?  
Different buses have different requirements. For example, the bus that connects either the CPU or the chipset to memory has different requirements, such as speed and bandwidth than the PCIe bus.



### A+ Certification Exam Tips

- ✓ Review the latest Intel and AMD processor slots the day of the exam. These are not ones that you might be dealing with on a daily basis.
- ✓ Review the specifications for the expansion slots, including how some of the diagrams look. Use the Internet to view motherboards to see if you can determine the type of expansion slot. The exam has graphics that are unlabeled. Do the same for other motherboard components, including the processor.
- ✓ Review the size and type of laptop PCI/PCIe adapters.
- ✓ Know that AGP was used only for a video adapter.
- ✓ Know the difference between the north bridge and the south bridge. Know the components that each bridge type connects to the CPU.



# System Configuration

## Chapter Objectives:

In this chapter you will learn:

- How to make configuration changes to a computer
- The importance of BIOS and UEFI BIOS
- How to replace a motherboard battery
- What system resources are and how to view/change them

## CompTIA Exam Objectives:

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

- ✓ 801-1.1 Configure and apply BIOS settings.
- ✓ 801-1.2 Differentiate between motherboard components, their purposes, and properties.
- ✓ 801-1.4 Install and configure expansion cards.
- ✓ 802-1.4 Given a scenario, use appropriate operating system features and tools.
- ✓ 802-4.2 Given a scenario, troubleshoot common problems related to motherboards, RAM, CPU, and power with appropriate tools.