

Working with Customers

You can be the best technician in the world, but if you aren't able to work with customers, you might end up with more opportunities to update your résumé than you'll care to have. The most successful technicians have a good mix of technical knowledge, communication skills, and troubleshooting ability. This chapter covers some core skills related to communicating with customers and troubleshooting problems effectively. Additionally, it ties some of the concepts from previous chapters together so that you can help customers identify the right components to meet their needs.

Exam 220-801 objectives in this chapter:

- 1.9 Evaluate and select appropriate components for a custom configuration, to meet customer specifications or needs.
 - Graphic / CAD / CAM design workstation
 - Powerful processor
 - High-end video
 - Maximum RAM
 - Audio/Video editing workstation
 - Specialized audio and video card
 - Large fast hard drive
 - Dual monitors
 - Virtualization workstation
 - Maximum RAM and CPU cores
 - Gaming PC
 - Powerful processor
 - High-end video/specialized GPU
 - Better sound card
 - High-end cooling
 - Home Theater PC
 - Surround sound audio
 - HDMI output

- HTPC compact form factor
 - TV tuner
- Standard thick client
 - Desktop applications
 - Meets recommended requirements for running Windows
- Thin client
 - Basic applications
 - Meets minimum requirements for running Windows
- Home Server PC
 - Media streaming
 - File sharing
 - Print sharing
 - Gigabit NIC
 - RAID array
- 5.2 Explain environmental impacts and the purpose of environmental controls.
 - Temperature, humidity level awareness and proper ventilation
 - Protection from airborne particles
 - Enclosures
 - Air filters
- 5.3 Given a scenario, demonstrate proper communication and professionalism.
 - Use proper language – avoid jargon, acronyms, slang when applicable
 - Maintain a positive attitude
 - Listen and do not interrupt the customer
 - Be culturally sensitive
 - Be on time (if late contact the customer)
 - Avoid distractions
 - Personal calls
 - Talking to co-workers while interacting with customers
 - Personal interruptions
 - Dealing with difficult customer or situation
 - Avoid arguing with customers and/or being defensive
 - Do not minimize customer’s problems
 - Avoid being judgmental
 - Clarify customer statements (ask open ended questions to narrow the scope of the problem, restate the issue or question to verify understanding)

- Set and meet expectations/timeline and communicate status with the customer
 - Offer different repair/replacement options if applicable
 - Provide proper documentation on the services provided
 - Follow up with customer/user at a later date to verify satisfaction
- Deal appropriately with customers confidential materials
 - Located on a computer, desktop, printer, etc
- 5.4 Explain the fundamentals of dealing with prohibited content/activity.
 - First response
 - Identify
 - Report through proper channels
 - Data/device preservation
 - Use of documentation/documentation changes
 - Chain of custody
 - Tracking of evidence/documenting process

220-802 Exam objectives in this chapter:

- 1.9 Explain the basics of client-side virtualization.
 - Purpose of virtual machines
 - Resource requirements
 - Emulator requirements
 - Security requirements
 - Network requirements
 - Hypervisor
- 4.1 Given a scenario, explain the troubleshooting theory.
 - Identify the problem
 - Question the user and identify user changes to computer and perform backups before making changes
 - Establish a theory of probable cause (question the obvious)
 - Test the theory to determine cause
 - Once theory is confirmed determine next steps to resolve problem
 - If theory is not confirmed re-establish new theory or escalate
 - Establish a plan of action to resolve the problem and implement the solution
 - Verify full system functionality and if applicable implement preventive measures
 - Document findings, actions and outcomes

Interacting with Customers

Being a good personal computer (PC) technician requires more than just knowing about the hardware and software and how to fix the systems. An extremely important element is the ability to interact with customers. You might be the best technician in the world, but if you can't maintain a professional attitude when working with customers, you'll either be unemployed or find yourself working alone in an isolated room, with no room for advancement.

An important principle to remember is that you and the customer need to have a collaborative relationship. If you think about a customer as an adversary, you'll end up with an adversarial relationship. If you think about customers as collaborators, you're much more likely to have rewarding experiences. Remember, they need you to fix the problem. You need them for a job.

Communication and Professionalism

Effective communication skills combined with a professional attitude are easily the most important skills you'll need when interacting with customers. They'll help you collect information about the problem, diffuse difficult situations, and get the customer working with you instead of against you.



EXAM TIP

CompTIA took out customer service objectives in an earlier version of their A+ exams. However, they received a lot of feedback from companies about the importance of communication skills when working with customers and have since added these objectives back in. You can often answer the questions if you simply apply the golden rule—treat customers as you want to be treated when you are a customer.

Use Proper Language

Whenever possible, you should avoid jargon, acronyms, and slang. I sometimes watch "Through the Wormhole," hosted by Morgan Freeman, which covers some pretty complex topics. I have great respect for the scientists on the show who can explain complex scientific theories in easy terms. They use terms and analogies that just about anyone can understand, and it's clear that they are really trying to help viewers understand.

If you want to ensure that customers understand what you're talking about, you need to use language they can understand. Imagine that a system was having problems due to dust buildup within the case and around the CPU fan. After cleaning it out, you could tell the customer, "The BIOS was reporting a thermal problem from the CPU causing intermittent reboots. The internal cooling devices weren't able to regulate the temperature due to foreign debris, so I used an ESD-safe device to remove the excess particles."

Or, you could say, "It had a lot of dust built up, so I cleaned it out."

If you give the first explanation, the customer might not understand and might think that you're just full of yourself. Hearing the second explanation, the customer will understand and might even ask what to do to prevent it from getting so dirty.



EXAM TIP

Avoid jargon and acronyms when talking with customers. Jargon is often used when talking with other technicians, but when talking to customers, you should use language that anyone can understand.

Maintain a Positive Attitude

Maintaining a positive attitude is an important part of troubleshooting and working with others. You will run into problems—that's unavoidable. However, how you respond when you run into these problems is entirely your choice.

From the customer's point of view, they are coming to you because they have a problem they can't solve. They might be frustrated and even angry. However, they are not angry at you; they are angry at the situation. As long as you remain positive, you have a much better chance at getting them to remember that you're there to help.

Listen and Don't Interrupt Customers

When you're working with customers, it's important to take the time to listen to what they're saying and not interrupt them. Give them time to explain the problem. The customer might not know what is important and what isn't important. However, giving the customer time to talk and listening to what they have to say will help you get a better idea of the problem.

After listening, it's useful to restate the issue or symptoms. This lets the customer know that you have been listening and that you understand the problem. Sometimes, you might need to restate the issue a little differently to clarify it, or you might need to ask questions to get more information.

When asking questions, it's often useful to ask open-ended questions. An open-ended question is any question that can't be answered with a one-word response such as yes or no. For example, "Can you explain the problem?" or "What type of symptoms are you seeing?" are open-ended questions.

Communicate Status

After you have an understanding of a problem, you'll have a good idea of how long it'll take to resolve it. Some problems are relatively easy to fix and can be resolved in minutes. Other problems can take much longer. For example, if you need to order new hardware and wait for it to arrive, it could take days or weeks to complete the repair.

Most people are reasonable, and by communicating the status, you can help set their expectations. If you tell them it will take a week or longer because a part needs to be ordered, most people will understand. They might not be happy with the situation, but they'll

understand. However, if you don't tell them anything, they might expect it to be fixed within minutes and will get more and more frustrated as the days drag by.

In addition to communicating the status, consider providing additional information, including the following:

- **Options.** Based on the problem, there might be different repair or replacement options available. If there are options, let the customer know so that the customer can decide based on his or her needs.
- **Documentation on services.** If your company has specific documentation for services, ensure that you provide it to the customer.
- **Follow-up.** A simple call to the customer at a later date can help you verify that the customer is satisfied. If they aren't, you'll have an opportunity to fix the problem. If they are satisfied, this follow-up helps build rapport, showing that you care.

REAL WORLD DEFUSE SITUATIONS WITH A SOFT VOICE

I remember dealing with a customer once who was extremely frustrated and angry. Another technician was successful only at getting the customer angrier, and the customer was passed to me. I was able to ask a couple of open-ended questions to get the customer to explain the situation, and during this time, I was well aware how loud the customer was. However, I didn't respond with the same volume. Instead, I used a normal voice and when the customer became louder, I became quieter. At some point, the customer recognized the huge disparity in our volumes and recognized that I wasn't angry but truly trying to help. He became embarrassed and apologetic.

At that point, we began making much better progress at solving his problem. I could just as easily have matched this customer's volume and anger, but it's unlikely that we would have solved his problem. Instead, I recognized the customer wasn't angry with me, and I did my best to calmly focus on the problem. You'll likely come across an angry customer at some point, and it's best to have different methods you can use to defuse the situation and help the customer.

Dealing with Difficult Customers or Situations

Not all customers calm down; this is sad but true. How you respond to these customers can make the difference between the customer becoming angrier and an adversary, or calmer and a collaborator.

There are a few things you can do in these situations, including the following:

- **Avoid arguing or being defensive.** Under no circumstances should you argue with a customer. That will only make the situation worse.
- **Do not minimize a customer's problems.** Customers don't come for help for problems that they know how to solve. It might be a simple problem for you because

you're knowledgeable and experienced, but it's best not to minimize the impact on the customer. A little empathy goes a long way.

- **Avoid being judgmental.** If you take a judgmental attitude toward customers in general, this is likely to come across in your dealings with customers. You'll often end up with an adversarial relationship with customers without understanding why. For example, some technicians use cutesy phrases camouflaging their dislike of customers. I've heard technicians refer to a problem as an ST1 problem (pronounced as *S T one*), or an ID 10 T problem (pronounced as *I D ten T*). What they mean is that the customer is as dumb as a stone (*S T one*) or is an idiot (*I D 10 T*). You can feel when someone is talking down to you or acting in a condescending manner. Other people can feel it when you're doing it to them.

It's valuable to remember that customers do not start out being angry with you. They might be frustrated or angry with the situation, but not with you as a person. However, if you respond to the customer's emotions instead of to the problem, the customer can end up becoming angry with you.



EXAM TIP

It's never acceptable to yell or argue with a customer. If a situation is escalating and you find yourself getting angry or losing your control, find a way to defuse the situation. If that's not possible, seek assistance based on your company policies.

It's possible that you are doing all the right things but the customer is not calming down and is not giving you the information you need to solve the problem. In that case, most organizations have a method of passing the customer off to someone else. In some cases, this is done by referring the customer to a manager or, sometimes, passing the customer to another technician who might be able to get the customer to calm down. Managers will often have training for how to deal with these customers and will use forceful, assertive language to get unreasonable customers to calm down.

Be Culturally Sensitive

A culture has a set of attitudes, values, and practices that are shared among people within that culture. Some language and communication techniques can be completely acceptable in one culture but quite offensive in another culture.

For example, if you flick your hand from under your chin outward, it means very little to many people living in the United States. However, do this to someone from Italy and you might have a fight on your hands. Being culturally sensitive means that you recognize that there are differences among cultures and that you respect those differences.

Respect Customer Materials

When you assist customers at their work area, they'll often have work materials open and accessible. This could include open files or emails, and papers on their desk or printer. You should respect the privacy of the individual and not read through the material.

If material is in your way, you might want to hand it to the customer. For example, if you're called to work on a printer and it has printouts marked as confidential, hand these to the customer as you begin your work.

Rebooting systems often solves many problems, so you might choose that course of action. Let customers know that you plan on rebooting a system so that they have a chance to save and close any files they're working on. Rebooting without saving files could result in the loss of the customer's data or recent work.

Be Professional

Successful technicians regularly demonstrate common professional behaviors. These are many of the same behaviors that you would want professionals to demonstrate when you are the customer. Some of these include the following:

- **Be on time.** If you tell customers that you'll be there at a certain time, they'll be waiting. If something is holding you up, contact the customer and let them know.
- **Avoid distractions and interruptions.** This includes not taking personal phone calls. If a coworker contacts you for help or assistance, offer to help them when you're done with the customer.

Responding to Prohibited Content/Activity

In the course of your job, you might occasionally run across content or activity that is prohibited. Prohibited content and activity is anything that is against the law and anything that is counter to an organization's policy.

It could be an action on the part of an external attacker or by an employee. Within the realm of information technology (IT), this is often referred to as a security incident. Some examples include the following:

- **Unauthorized applications.** Many organizations prohibit users from installing applications on their systems, but you might find an unauthorized application running on a user's system.
- **Unauthorized drives.** Some organizations restrict the use of USB flash drives as a security precaution. Other times, any types of external drives are prohibited.
- **Unauthorized access.** This includes unauthorized individuals in secured areas of a building or the unauthorized access of sensitive data.
- **Any types of attacks.** Attacks commonly come from external sources but can also come from a malicious insider.

- **Online activities.** Some online activities might be illegal and/or counter to the organization's policy. For example, gambling during company time is very likely prohibited.
- **Illegal pictures or video.** Offensive pictures and video might be more than just inappropriate in a workplace; they could be illegal, depending on the content.

NOTE NSFW

NSFW is an acronym for *not safe for work*, or *not suitable for work*. There might be activities that people are comfortable with at home but should not engage in at work. It includes going to some forums and blogs, viewing pictures of people in various stages of undress, and forwarding pictures or jokes that can offend others. Many employees have been reprimanded and even fired for engaging in NSFW activities because they fall into the category of prohibited content and activity.

First Response

Within IT security, the first IT professionals on the scene of an incident are referred to first responders and they provide the *first response* to an incident. You can compare them to first responders in the medical community.

Medical first responders are dedicated, trained individuals, such as emergency medical treatment (EMT) personnel, who respond to auto accidents. Their goal is to treat and stabilize injured people and get them to a medical facility if needed. They aren't doctors, and they aren't expected to do surgery. However, they can identify life-threatening injuries, know when to call for help, and know what to do to preserve life until help arrives or until they get a patient to a hospital.

Similarly, you might be the first responder for a security incident. You aren't expected to know how to perform in-depth computer forensics. However, you'll be expected to identify an incident, know how to report it, and know how to preserve evidence.

If you do come across any prohibited content or activity, you'll need to take the following three basic actions:

- **Identify.** This is where you recognize that the content or activity is either not authorized or illegal. Understanding your organization's security policies will help you identify incidents. If it's prohibited by a company security policy, it's an incident.
- **Report through proper channels.** If you run across content or activity that is clearly illegal, you're obligated to report it. If you don't report it, you might inadvertently become an accessory to the crime. Organizations commonly have procedures to follow in these situations, and your first step is often to report it to your supervisor.
- **Preserve data or devices.** Any data or devices involved in the incident need to be protected as evidence. Often, the best thing you can do is not touch it and not allow anyone else to touch it until help arrives. Turning a system off or manipulating the keyboard or mouse can destroy or modify evidence.

Many organizations include specific procedures to isolate or contain an incident in certain situations. For example, if a system is infected with a virus or worm, procedures often state that the network cable should be disconnected from the system. This isolates the system and prevents the infection from spreading to other systems.

Protecting Evidence and Chain of Custody

If there is any possibility that evidence needs to be collected and analyzed for an incident, the first step is to protect it.

For example, if a computer is running, don't turn it off or reboot it. Data within the system's random access memory (RAM) can be retrieved with forensic tools, but if you turn it off, it is lost. Similarly, you should not access any files. Files have attributes that identify when they were last accessed or modified. If you access or modify the files, these attributes will be changed and the original evidence is lost.



EXAM TIP

Data in a computer's RAM is lost when the power is removed. This RAM is commonly referred to as *volatile RAM*. Computer forensics tools are available to retrieve data from volatile RAM, but they cannot retrieve the data after the system has been turned off.

Occasionally, you might be required to collect evidence. If so, you should ensure that it is controlled at all times. This means that someone has it in their physical possession or that it is secured, such as in a locked cabinet. You shouldn't just leave it on a desk where anyone can access and manipulate it.



Additionally, you should establish a *chain of custody* log to verify that the evidence has been controlled. A chain of custody log verifies that evidence presented in court is the same evidence that was collected. For example, if you must collect an external hard drive or USB flash drive, you should establish a chain of custody log to document how the drive was protected after it was collected.



Quick Check

1. You are due to arrive at a customer's location in 10 minutes, but you'll be late. What should you do?
2. You have come across a security incident. What three things should you do?

Quick Check Answers

1. Inform the customer that you'll be late.
2. Identify, report, and preserve data or devices.

Troubleshooting Theory

An important part of working as a PC technician is troubleshooting. Troubleshooting is more than just fixing a system. Successful technicians employ several steps in the troubleshooting process to ensure that they can identify and resolve problems as efficiently as possible and not cause additional problems.

CompTIA has specifically stated six steps in troubleshooting theory, and you'll need to know each of these and in the following order:

1. Identify the problem.
2. Establish a theory of probable cause.
3. Test the theory to determine cause.
4. Establish a plan of action to resolve the problem, and implement the solution.
5. Verify full system functionality, and if applicable, implement preventive measures.
6. Document findings, actions, and outcomes.



EXAM TIP

The preceding steps are not the only troubleshooting steps that you're likely to see in your career. However, know them exactly when preparing for the A+ exam. CompTIA is known to ask questions specifically related to the troubleshooting theory, which they include with the A+ objectives.

Identify the Problem

In this step, you'll gather information about the problem. Many problems occur because of a recent action, so it's important to ask the user whether anything has recently changed. Users often make changes to their system and don't recognize the impact that the change can have.

When questioning users, it's very easy for them to get defensive and stop giving you helpful answers, especially if a technician asks questions in a threatening manner. For example, ask someone, "What did you do?" and the answer is very often, "Nothing."

However, if you think of the user as a partner in your quest to resolve the problem, you can start a conversation and get them to help you. For example, asking something like, "When did it last work?" and "Do you know whether anything has changed since then?" doesn't attack the user and is likely to get you more information.

Also, if a user is working in an environment with other users, it's worthwhile to ask them whether they're having the same problem. This is especially true when troubleshooting network problems. If it's affecting one user, the problem is likely with that user's system. If it's affecting all users, the problem is likely a network problem.

NOTE CONSIDER REBOOTING AS FIRST STEP

Rebooting solves many ills. It's common for technicians to reboot the system after they've identified the symptoms of a problem and then see whether the symptoms have disappeared. This doesn't always explain why a problem occurred, but it gets the user back to a working state quickly. Many help desk procedures include this as one of their first steps.

Establish a Theory of Probable Cause

In the next step, you'll make an educated guess to identify the source of the problem. During this step, it's important to question the obvious. A useful troubleshooting practice is to check the easy things first. If a computer display is dark, an obvious theory is that the monitor isn't plugged in and turned on or that the computer isn't plugged in and turned on.

Test the Theory to Determine Cause

Next, you'll test your theory by looking at the system. If it's a simple problem, such as a blank display, it can be as easy as checking all the plugs and power connections. Some problems aren't so simple and obvious, so you might need to take a few steps to test the theory. You'll probably be using different hardware or operating system tools described throughout this book to help identify the problem.

It's very possible that your educated guess about the cause wasn't correct. If so, look for a new theory of the probable cause.

Establishing and testing are listed as separate steps, but experienced technicians go through the steps very quickly. For example, if you have a blank display, you might go through the following steps.

- **Theory:** Computer not on.
 - **Test theory:** Check to see whether it's on.
- **Theory:** Monitor not plugged in or turned on.
 - **Test theory:** Check for power indicator on monitor.
- **Theory:** Monitor not plugged into correct graphics port.
 - **Test theory:** Verify cable plugged into extension card port instead of into motherboard onboard connector.

If you run out of ideas, you might need to escalate the problem by calling in some help. Many organizations have several levels of technicians. If a technician on one level can't solve the problem, the technician escalates it to the next level, and a technician from that level will try to resolve it.

Establish a Plan of Action and Implement It

After you've confirmed your theory, you'll need to establish a plan of action to resolve the problem and implement the solution. Ideally, this will solve the problem. If not, you'll need to go back to step 2 to establish a different theory.

It's important to take your time with this. Experienced technicians sometimes use the term *shotgunning*, referring to a process of just trying everything without taking the time to think things through or analyze the problem.

Consider the following problem. You turn a computer on, and the fans are spinning but nothing else is working. This could be a faulty power supply, faulty CPU, faulty motherboard, faulty RAM, or faulty expansion card. You could just start replacing everything one by one. You might get lucky and fix the problem, but if you take the time to test your theories and implement fixes individually, you'll end up with better results.

- **Theory:** Faulty power supply.
 - **Test theory:** Measure voltages supplied via the primary motherboard connector and CPU power connector with the system turned on.
 - **Plan of action:** If these are out of tolerance, replace the power supply. If you replace the power supply without checking the voltages, you might be replacing a good component and inadvertently cause another problem in the process.
- **Theory:** Faulty expansion card. In some cases, a faulty expansion card can load down a system and prevent anything from working.
 - **Test theory:** About the only way to test this theory is to remove all the cards to see whether the problem disappears. You can then reinstall the cards one by one to see if the problem comes back when you install a card.
 - **Plan of action:** This will be time-consuming and very risky. It's very possible for a card to be damaged while a technician is removing it. Additionally, it's very possible cables and connectors might not get returned to their original locations when the cards are reinstalled. This theory should not be tested before doing simpler checks, such as checking the power supply voltages.

When you're faced with a challenging problem, it's important to document your steps. Each time you test a theory, take some notes so that you can easily recall what you did, and list the results of your actions. If you end up working for several hours on a problem, you might find that your actions from a couple hours ago aren't crystal clear.

One more thing: if you implement a change and it doesn't resolve the problem, you should undo your change. This is especially important when making configuration changes. I've witnessed several problems that started as a simple configuration issue that could be resolved by making one change. However, technicians made multiple changes in an attempt to resolve the problem but never undid them. Eventually, the original problem is resolved, but unfortunately these other changes have caused a host of other problems.

Verify Full System Functionality

After implementing a solution, it's important to check out the entire system to ensure that it is operating as expected. For example, imagine that you're troubleshooting a printer with two paper trays. You could fix a problem with one paper tray, test it, and verify that it works. However, you should also check the second paper tray to ensure that you can print using this tray, too.

In some situations, preventive measures are needed when you implement a fix. For example, if you're troubleshooting a system and notice that the fans and the inside of the system are clogged with an excessive amount of dust, you should use the proper tools and vacuum it out.

Document Findings, Actions, and Outcomes

In the last step, you document what you did to resolve the problem. Many organizations have dedicated applications used to track all troubleshooting activity in trouble tickets. These trouble tickets track the progress until it's resolved. This information is searchable to allow technicians to easily share their knowledge or to research the solution to a previously solved problem.

For example, Microsoft uses a Knowledge Base (KB) system. Problems that have been troubleshot and resolved are documented as KB articles. If you're troubleshooting a software problem that is giving you a specific error, you can type the error in as a search phrase on Bing. This will often take you directly to a KB article that describes the problem and the solution.

Trouble ticket databases are also useful in other situations, such as tracking trends. Some systems fail more than others, and when the trend is identified, it's possible to take proactive steps to reduce the problems. Also, management often uses information in the database as justification for hiring additional workers and sometimes to identify the most productive workers.



Quick Check

1. What's the first step in the CompTIA troubleshooting model?
2. What should you do after establishing a plan of action and implementing it?

Quick Check Answers

1. Identify the problem.
2. Verify full system functionality.

Identifying Customer Needs

Customers are often confused by the dizzying array of options available when buying a computer and simply don't know which options are best for them. They often look to experts like you to help them buy the computer that will meet their needs.

One of the core questions you'll need to ask is, "What do you plan on doing with the computer?" If you have an idea of what they'll use it for, you'll be better prepared to help them.

While there are many different options available for computers, most can be summarized in five specific components. If you understand these components, you can then match their importance to different workstation roles. The following sections describe these components and the common workstation roles.

- **CPU/Processor.** Some systems require powerful processors to meet the demands of the applications that they'll run. These include processors with multiple cores and faster speeds.

NOTE NEWEST CPUS ARE THE MOST EXPENSIVE

When shopping for CPUs, the newest and fastest are the most expensive. However, when new CPUs are released, older versions are almost always reduced in price. Some people want only the newest and fastest, and that might be what they need. However, you can often save a significant amount of money with an earlier CPU version. The earlier version might have a little less power, but this is rarely noticeable to the average user.

- **RAM.** The amount of memory a system has is the second most important resource behind the processor. You want to make sure that you get at least the minimum recommended amount of RAM for the operating system. Based on the role, you might want to add more.
- **Disk.** The three basic options related to disks are size, speed, and redundancy. Some roles require large drives to store more data, some require faster hard drives for better performance, and some require fault tolerance with a redundant array of inexpensive disks (RAID).
- **Graphics/Video.** Many applications require high-end graphics. This includes a high-end graphics card with onboard memory and monitors that provide the best display.
- **Audio.** Sophisticated audio systems provide realistic sound, and they are important for gamers and home theaters.
- **Network Interface.** If the computer will be used to transfer a large amount of data over a network, it might require a fast network interface card (NIC) to provide the best performance on the network.



Standard Thick Client

A standard *thick client* is a computer that has an operating system and basic applications. It isn't used for any dedicated role but instead is for day-to-day use.

NOTE THICK VS. THIN CLIENTS

The term *thick* isn't referring to size. It is commonly used in larger organizations that deploy computer images that include both the operating system and user applications. When applying it to individual user systems, it simply means that the computer has applications installed. In contrast, thin clients access applications that are installed and running on remote systems.

For example, a student might use a computer to do research on the Internet and write papers. Similarly, many people commonly have a computer for Internet access, email, and social networking, but for little else. Within an organization, employees doing day-to-day work could be using standard thick clients.

If you ask for what purpose a customer plans on using the computer but the customer really isn't sure, a standard thick client will often meet the customer's needs. When shopping for a thick client, consider the following points:

- **Minimum recommended for operating system.** Start by ensuring that the system has at least the minimum amount of processing power and RAM recommended by the vendor. You'll often see two minimums. One is the absolute minimum to run the operating system. However, the *recommended minimum* refers to what is needed for a satisfying user experience.
- **Desktop applications.** Customers might need assistance in identifying applications to do basic tasks. For example, Microsoft's Office suite includes several basic applications that can be useful to users. It includes Microsoft Word to write papers, résumés, newsletters, and more; Microsoft Excel to work with finances; Microsoft OneNote to create digital notebooks; and Microsoft Outlook to manage contacts, track appointments, and exchange email.



Thin Client

A *thin client* is one that has only minimal resources and applications running on it. The thin client computer is used to boot into the operating system and connect to a remote server, but little is actually done on the thin client.

For example, personnel at my doctor's office use netbooks as thin clients. They are running Windows 7 with very basic hardware installed, and everyone has connectivity to a server hosting a specialized application and data. Nurses and doctors walk from room to room with wireless netbooks, but they access the application and data on the server. Because the application is actually running on the server, the individual netbooks don't require much

processing power. Also, the netbooks are very small and light, which is something the nurses and doctors appreciate.

If you are helping someone identify the resources needed for a thin client, ensure that it meets minimum recommended requirements for the operating system and the application used to connect to the remote systems.

Gaming PC

The PC gaming industry is big business and grosses billions of dollars annually. Gamers expect top-notch graphics and audio, and the game developers deliver. Some of the most popular games are first-person shooter and online role-playing games, and many of the games are available on separate consoles, such as the Xbox 360.

You'll often find that gamers are very knowledgeable about PCs, so you might not need to educate them. However, if you need to provide some assistance to a gamer, ensure that the system includes the following items:

- **Powerful processor.** Games often consume a significant amount of processing power, so a fast processor with multiple cores is a must.
- **High-end video.** A top-notch video card with onboard memory and a specialized Graphics Processing Unit (GPU) is needed for many of the games. It ensures that the graphics are quickly displayed without any lag or latency.
- **High-end audio.** Games often have three dimensional (3D) sound, and a 5.1 surround sound system provides a realistic experience. It includes right and left front speakers, right and left rear speakers, a central speaker (often used for dialog), and a subwoofer for deep bass sounds, including realistic explosions. A 7.1 system adds speakers to the right and left of the user in addition to the right and left front speakers and the right and left rear speakers.
- **High-end cooling.** Gamers often run their systems close to full capacity, and some even overclock their processors to get the highest performance possible. High-end cooling systems protect these systems from overheating. These can include high-quality variable speed fans that spin faster when the system is hotter. They can also include liquid-cooled systems that circulate water to keep it cool without the noise generated by fans.



EXAM TIP

Gaming PCs are the primary type of end-user PC where you'll see liquid-cooling systems. Other PCs can use high-quality variable speed fans without liquid cooling.

Virtualization Workstation

Virtualization has become quite popular in recent years. Don't be surprised if someone asks you for help picking out a computer that they plan to use as a virtualization workstation. This section will give you some details on virtualization and the basic hardware requirements.

Understanding Virtualization



A *virtualization* workstation is used to run one or more virtual computers within a single workstation. The workstation is commonly called the host, and virtual systems are commonly called *virtual machines (VMs)* or guests.

Figure 10-1 shows an example of how a Windows 7 system can be used to host a virtual network with four VMs. The network includes Windows 7–based, Linux-based, and Windows 8–based systems running as desktop VMs, and one Server 2008 VM.

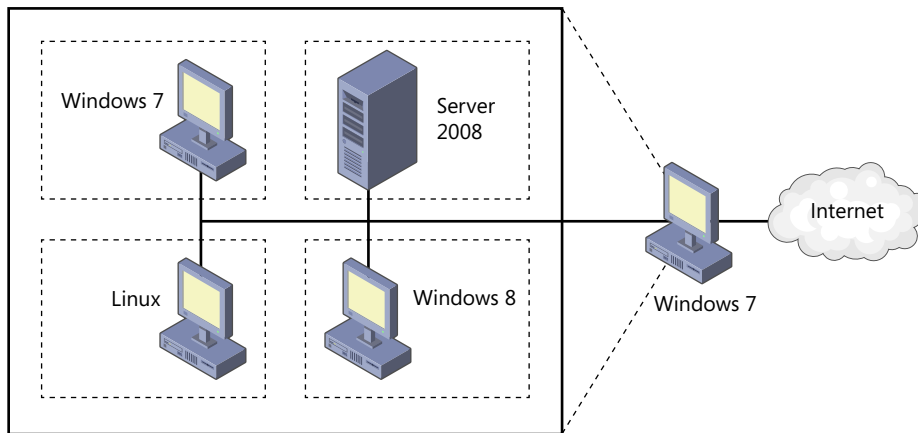


FIGURE 10-1 One physical host running four VMs.

Each VM runs as if it is a separate physical PC. You can run separate applications within them, shut them down, and reboot them, all without affecting the other VMs.

It's possible to configure each VM to be completely isolated from any other, but in Figure 10-1, they are connected via a virtual network. Additionally, each VM can access the Internet through the host NIC.

Hypervisor



The software running on the physical host is called the *hypervisor* and acts as the virtual machine manager. It provides access to the host hardware and ensures that the VM runs in its own space without affecting other VMs or the host system.

The following are some popular VM software products used on workstations for virtualization:

- **Windows Virtual PC.** This is available as a free download from Microsoft at <http://www.microsoft.com/windows/virtual-pc>. You can also access Windows XP Mode from

here. Windows XP Mode is a fully functioning version of Windows XP that can run as a virtual system on Windows 7. You can run 32-bit guest operating systems but not 64-bit operating systems in Windows Virtual PC.

- **VMware Player.** VMware has several products, but the VMware Player is free. You can get it from <http://www.vmware.com/products/player/overview.html>. It supports running both 32-bit and 64-bit guest operating systems.
- **VirtualBox.** Oracle has published VirtualBox as an open source virtualization tool. It is available as a free download at <https://www.virtualbox.org/wiki/Downloads>. It allows you to run both 32-bit and 64-bit guest operating systems.

NOTE VIRTUALIZATION ON YOUR OWN

Installing and using each of these products is beyond the scope of this A+ book, but they are worth your time. If you want to dig a little deeper, the following blog article includes detailed steps to install Windows 8 and Windows Server 2012 using Virtual Box on a Windows 7–based system: <http://blogs.getcertifiedgetahead.com/windows-server-8-virtual/>.

These hypervisor applications allow you to adjust the resources dedicated to each VM. You can adjust how much RAM is assigned to the VM and control access to other resources such as the network.

Figure 10-2 shows the settings page for a Windows Virtual PC VM that I'm using to run Windows 7. In the figure, I've selected the memory, and you can see that I've dedicated 2,048 MB of RAM for this system. I've also attached several virtual hard disks and configured one network adapter for the VM.

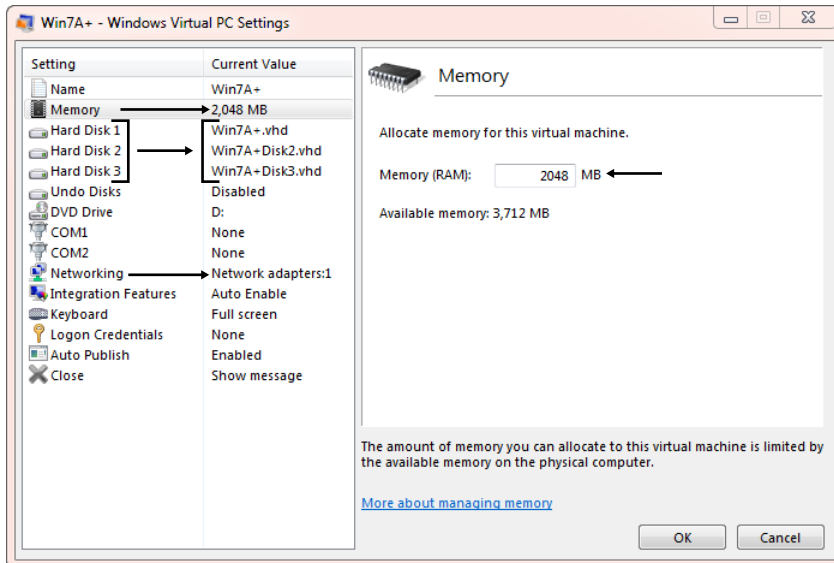


FIGURE 10-2 Virtual PC settings showing RAM.

Purpose

There are several reasons why people use virtualization on workstations, including the following:

- **Learning.** When learning new operating systems and applications, you can install them as VMs. You're free to experiment without fear of causing any real damage. The worst that can happen is that the VM no longer works and you get to install it again.
- **Testing.** New operating systems and new applications can be installed on a virtual system, even when they're in the beta stage. If the software is buggy, causing random problems, only the VM is affected. The host machine remains unaffected.
- **Legacy applications.** If an application won't run in a newer operating system, you can install it on a VM within an older operating system. For example, Windows XP Mode lets you run legacy applications that aren't compatible with Windows 7.
- **Security.** Many security professionals use VMs for security testing. For example, when a new virus is discovered, it can be released in an isolated VM without fear of it infecting the host system.



EXAM TIP

It's always important to keep operating systems up to date with current patches and updates. This is true for the host system and for each VM. However, updating the host does not update any VMs. You need to update each VM separately.

Hardware Requirements

Each VM will consume some of the host system's resources, but the most important resources are the processor and RAM. You should ensure that the system has the following:



- **Powerful processor.** A fast processor with multiple cores is a must. Additionally, the processor should support *hardware assisted virtualization (HAV)*. This is commonly available in current processors but might need to be enabled in the BIOS, as mentioned in Chapter 2, "Understanding Motherboards and BIOS."
- **Maximum RAM.** The amount of RAM you need depends on how many VMs you'll run and their requirements. For example, if you want to run four VMs with 2 GB each, you'll need at least 8 GB beyond what you'll use in the host. A system with 12–16 GB will meet most needs.
- **Network requirements.** If you want the VMs to have access to a physical network, you'll need to have a network interface card (NIC) in the host system. Also, all VMs and the host will share the bandwidth of this NIC, so heavy network usage by one VM will affect the others and the host.
- **Disk.** The VMs are stored as one or more files on the disk. As you install applications on the VM or add data to it, these files grow. Depending on how you're using the VMs, these files can become quite large, so you need to ensure that the disk drive is big enough to hold them.



Home Theater PC

A *home theater PC (HTPC)* is a personal computer that has been configured to work as a digital video recorder (DVR) for television, audio player for music, and video player for movies.

Using software such as Windows Media Center, which is included with Windows 7 Home Premium, you can use just about any computer as an HTPC. However, there is a special case called the HTPC compact form factor that looks a little nicer than a bulky computer when placed on a shelf by a TV. Some of the components that you'll need to ensure are included are as follows:

- **TV tuner within the computer.** You plug in the TV signal source, such as from cable TV into the tuner. If you want to be able record one station while watching another or record two at a time, you'll need two TV tuners.
- **High-Definition Multimedia Interface (HDMI) output.** High-quality TVs support HDMI, so you'll want to ensure that the theater has an HDMI output.
- **Surround sound audio.** You'll want a sound system that is at least as good as the 5.1 surround sound system described in the Gaming PC section. Movie makers do some exceptional magic with 3D positional sound. For example, you'll be able to hear a jet approach from behind, roar over your head, and disappear in the distance in front of you.
- **Disk space.** If you plan on recording TV shows, you'll need to ensure that you have plenty of disk space to hold them.

Home Server PC

Many people manage networks at home with multiple users connected on a network, and it's common to share resources among these users. A home server can be an effective way of sharing resources among multiple users. Some common uses of a home server include the following:

- **File sharing.** Users can share files via the home server. Additionally, users can back up their data to the home server.
- **Media streaming.** Audio and video files can be stored on the server and streamed to user systems.
- **Print sharing.** You can configure the server as a print server. This allows you to easily share a single printer for all users. Print jobs are sent to the print server and spooled to printers from there.

When using a home server, the two primary resources to which you'll need to pay attention are the NIC and the disk subsystem. All users will be sharing the same NIC, so you'll want the maximum bandwidth supported by your network. It's common to have at least a gigabit NIC.

The disk system needs to be both large and quick. Additionally, you'll often want to add some fault tolerance with the disks. A RAID-5 array gives you all three. For example, you can

use four 1-TB disk drives for a total of 3 TB of disk space. Reading and writing is spread across all four drives, improving performance over a single system. And with a RAID-5, a single disk can fail and you'll still be able to continue operating.



EXAM TIP

RAID-5 was described in more depth in Chapter 4, "Comparing Storage Devices." It includes at least three disks, and the equivalent of one disk is dedicated to storing parity bits. When it has a fault, such as one drive failing, RAID-5 can tolerate the fault and will continue to operate.

Graphic/CAD/CAM Design Workstation

A graphics design workstation is used for high-end graphics and video processing. It includes computer-aided design (CAD) and computer-aided manufacturing (CAM) uses.

CAD applications are used to create two-dimensional (2D) and three-dimensional (3D) drawings for tools, machinery, and buildings. These types of drawings take a lot of processing power to render and display. Resources on which you should focus for this type of workstation include the following:

- **Powerful processor.** This includes fast speeds and multiple cores.
- **Maximum RAM.** You should start with at least 8 GB of RAM, but having as much as 16 GB might be needed, depending on the drawings. Ensure that the motherboard will support more RAM if needed.
- **High-end video.** To render and display the graphics as fast as possible, a high-end graphics card with onboard memory is needed.

Audio/Video Editing Workstation

PCs can also be used to edit audio and video as the final stage of processing. For example, many companies create their own videos and post them on YouTube as advertisements. Similarly, many companies create professional videos used for courseware and other types of training.

Some of the hardware that you'll need to consider for this system includes the following:

- **Specialized audio and video card.** This will often have a dedicated processor to take some of the load off the computer's CPU.
- **Large, fast hard drive.** Audio and video files become very large. You'll want to ensure that you have enough storage space on the drives to store them.
- **Dual monitors.** Professionals editing audio and video files often need multiple views of the data that they are editing. Instead of moving the windows around a single monitor, dual monitors allow them to make a modification on one monitor and view the results on the other monitor.

Environmental Impacts

In some cases, you might need to consider the impact of the working environment on the systems. More specifically, you need to consider the temperature, humidity level, and ventilation:

- **Temperature.** Heat is an enemy of any electronic device. If a system gets too hot, it can often damage components or cause intermittent symptoms such as random reboots. If the work area is hotter than normal, you can use advanced methods of cooling, such as a liquid-cooling system.
- **Humidity level.** The ideal humidity level is about 50 percent. When the humidity level is too low, static can build up and result in electrostatic discharge (ESD) damage. When the humidity level is too high, it results in condensation and water damage. You wouldn't want to pour a glass of water into your system. Similarly, you don't want a high humidity level to build up condensation.
- **Ventilation.** Free airflow through the system helps to keep it cool. If there is an excessive amount of airborne particles, the particles can build up within the system and clog up the vents. As they build up, it becomes harder to keep the system cool.

You might run across these environmental conditions in busy work areas. However, you can also run across some of these conditions in a home. For example, if a user is putting a home server into a closet or a basement, the location might not have the same temperature or humidity controls. When advising the customer, you can point this out to help him or her prevent a problem.

Also, a user might have pets that shed, resulting in a quick buildup of pet fur on the vents. Cleaning the vents more often is one way to prevent problems. In some extreme situations, you can use air filters on the computer vents or place the computer within an enclosure to filter out airborne particles.



Quick Check

1. What are the primary hardware resources needed for a virtualization workstation?
2. What are the primary environmental factors that can affect a PC's performance?

Quick Check Answers

1. Processor, RAM, NIC, and disk.
2. Temperature, humidity, and ventilation.

Chapter Summary

- Effective communication skills include using proper language, listening, maintaining a positive attitude, avoiding distractions, and giving the customer status information.
- When dealing with difficult customers or situations, you should avoid arguing, being defensive, or being judgmental.
- Asking open-ended questions helps you get more information about a problem. You can clarify customer statements and verify that you understand the problem by restating the issue to the customer.
- When responding to prohibited content or activity, you should identify the issue, report it based on existing laws or your organization's policies, and preserve evidence. A chain of custody form is used to document how evidence has been protected after it was originally collected.
- The CompTIA troubleshooting model includes the following six steps:
 - Identify the problem.
 - Establish a theory of probable cause.
 - Test the theory to determine cause.
 - Establish a plan of action to resolve the problem, and implement the solution.
 - Verify full system functionality, and if applicable, implement preventive measures.
 - Document findings, actions, and outcomes.
- Workstations are used for different purposes, and some have differing needs. The processor and RAM are often the most important, especially for graphics workstations, virtualization workstations, and gaming PCs.
- Virtualization within a workstation is often used for testing, learning, and security purposes. A hypervisor is the application that runs the virtual machines. It requires the maximum amount of RAM and CPU power and often requires a large amount of disk space.
- Specialized graphics cards with powerful graphics processing units (GPUs) and onboard RAM are needed for some workstations, such as graphics workstations, audio and video editing workstations, and gaming PCs.
- You sometimes need hard drives that are large, fast, and that provide fault tolerance with RAID. Audio and video editing workstations need large, fast hard drives. Home servers need disks protected with a RAID array.
- Environmental controls help ensure that the temperature is not too hot and that humidity is close to 50 percent. If the humidity is too high, it can cause water damage from condensation. If it is too low, it can cause ESD damage.
- If the area has a high amount of dust or other airborne particles, you can use enclosures and/or air filters to protect PCs.

Chapter Review

Use the following questions to test your knowledge of the information in this chapter. The answers to these questions, and the explanations of why each answer choice is correct or incorrect, are located in the "Answers" section at the end of this chapter.

- 1.** You are working with a customer to resolve a problem with his laptop, and your personal cell phone rings. What should you do?
 - A.** Ignore it.
 - B.** Switch the cell phone to vibrate.
 - C.** Excuse yourself and answer the phone.
 - D.** Explain that it is an emergency and that you have to answer the phone.

- 2.** You are a technician helping an executive resolve a problem with her computer. While helping her, you see some confidential company papers on her printer. Of the following choices, what is acceptable?
 - A.** Look at the papers only if she leaves.
 - B.** Throw them away.
 - C.** Ignore them.
 - D.** Tell her she shouldn't print them.

- 3.** A network printer with multiple paper trays was no longer printing due to a network problem. A technician reconfigured the printer and verified that it was connected. Later, customers complained that the printer could print to one tray but not the other. What troubleshooting step did the technician miss?
 - A.** Identify the problem.
 - B.** Verify full system functionality.
 - C.** Establish a plan of action to resolve the problem.
 - D.** Documentation.

- 4.** Sally wants to purchase a computer that she'll use as a basic computer at home. She plans on doing research on the Internet, accessing email, and writing some documents. Which of the following choices best meets her needs?
 - A.** Thick client.
 - B.** Thin client.
 - C.** HTPC.
 - D.** Virtualization workstation.

5. Of the following types of workstations, which would most likely use a high-end liquid-cooling system?
- A. Thick client.
 - B. Gaming PC.
 - C. Home server.
 - D. Home theater PC.
6. A user is planning to add a home server PC that will be used by five users in his home for data sharing. He asks you what type of disk storage would be best. What would you recommend?
- A. Solid state disk.
 - B. Blu-ray.
 - C. RAID array.
 - D. HDMI-compatible.

Answers

This section contains the answers to the chapter review questions in this chapter.

1. Correct Answer: B

- A. Incorrect:** A ringing phone that can be heard by you and the customer is disruptive, so it should not be ignored.
- B. Correct:** The best choice is switch the phone to vibrate and return your attention to the customer.
- C. Incorrect:** Your attention should stay with the customer.
- D. Incorrect:** You have no idea whether it's an emergency or not, and lying about it will easily be recognized by the customer.

2. Correct Answer: C

- A. Incorrect:** It is not acceptable to snoop through someone's papers even if they leave the room.
- B. Incorrect:** You should not throw away someone else's property.
- C. Correct:** You should respect customers' confidential property, so the best solution of those given is to ignore them.
- D. Incorrect:** There is no indication that she should not use her printer for printing confidential papers.

3. Correct Answer: B

- A. Incorrect:** The first step is to identify the problem, and the technician did so for the original problem.
- B. Correct:** The fifth step in the CompTIA troubleshooting model is to verify full system functionality after resolving a problem. In this case, the technician likely bumped or opened the second tray, preventing it from printing.
- C. Incorrect:** The technician did establish a plan of action and did resolve the original problem.
- D. Incorrect:** Documentation is the last step, and it could be that the technician was documenting that the problem was resolved at the same time that the customers identified the second problem.

- 4. Correct Answer: A**
- A. Correct:** A standard thick client includes an operating system and application needed by typical users.
 - B. Incorrect:** A thin client has minimal software and connects to a remote system for most applications.
 - C. Incorrect:** A home theatre PC (HTPC) is used for TV, movies, and music.
 - D. Incorrect:** A virtualization workstation is used to run one or more multiple VMs within the host but isn't needed here.
- 5. Correct Answer: B**
- A. Incorrect:** A thick client is a standard PC and doesn't require any high-end components.
 - B. Correct:** Gaming PCs often use high-end cooling, such as a liquid-cooling system to keep the systems from overheating.
 - C. Incorrect:** Home servers require high-end disk subsystems and fast network interface cards but would not require high-end cooling.
 - D. Incorrect:** A home theater PC requires high-quality graphics, sound, and a TV tuner, but not high-end cooling.
- 6. Correct Answer: C**
- A. Incorrect:** A solid state disk (SSD) is quick but is often very expensive and not the best choice for a home server that will be storing a high volume of data.
 - B. Incorrect:** A Blu-ray player would be needed in a home theater PC but is not used for shared disk storage.
 - C. Correct:** A redundant array of inexpensive disks (RAID) array is a good choice for a home server. A RAID-5 can be configured to store a high volume of data, have better performance than typical drives, and provides fault tolerance.
 - D. Incorrect:** A High-Definition Multimedia Interface (HDMI) is used for graphics, not disks.