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CompTIA® A+® Core 1 (220-1001) and Core 2 (220-1002)

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CHAPTER 14

Custom PCs and Common Devices

This chapter covers the following A+ 220-1001 exam objectives:

- **3.8** – Given a scenario, select and configure appropriate components for a custom PC configuration to meet customer specifications or needs.
- **3.9** – Given a scenario, install and configure common devices.

Let's customize! This chapter is all about purpose; the reasons people use computers, and how people use them. In short, custom computers. We'll also briefly discuss the basics of first time computer usage. Let's go!

3.8 – Given a scenario, select and configure appropriate components for a custom PC configuration to meet customer specifications or needs

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Objective 3.8 concentrates on the following concepts: graphics/CAD/CAM design workstation, audio/video editing workstation, virtualization workstation, gaming PC, network attached storage device, standard thick client, and thin client.

There are several custom configurations that you might encounter in the IT field. You should be able to describe what each type of computer is and the hardware that is required for these custom computers to function properly.

Graphic/CAD/CAM Design Workstation

Graphic workstations are computers that illustrators, graphic designers, artists, and photographers work at (among other professions). Often, these graphic workstations will be Mac desktops, but can be PCs as well; it depends on the preference of the user. Professionals will use software tools such as Adobe Illustrator, Photoshop, and Fireworks, as well as CorelDRAW, GIMP, and so on.

Computer-aided design (CAD) and computer-aided manufacturing (CAM) workstations are common in electrical engineering, architecture, drafting, and many other engineering arenas. They run software such as AutoCAD.

Both types of software are GPU- and CPU-intensive and the images require a lot of space on the screen. 3-D design and rendering of drawings and illustrations can be very taxing on a computer. So, hardware-wise, these workstations need a high-end video card, perhaps a workstation-class video card—which is much more expensive. They also require as much RAM as possible. If a program has a recommended RAM requirement of 4 GB of RAM, you should consider quadrupling that amount; plus, the faster the RAM, the better—just make sure your motherboard (and CPU) can support it. Next, a solid-state drive can be very helpful when opening large files, saving them, and especially, rendering them into final deliverable files. That means a minimum SATA Rev. 3.0 solid-state hard drive is good, but something NVMe would be better—either M.2 or PCI Express-slot based, or possibly something more advanced than that. Finally, going beyond the computer itself, a large display is often required; one that has the correct input based on the video card. For example, a 27-inch LED-LCD with excellent contrast ratio and black levels, and the ability to connect with DisplayPort, DVI, or HDMI—whichever the professional favors.

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Don't forget, graphic/CAD/CAM design workstations need powerful high-end video cards, solid-state drives (SATA and/or M.2), and as much RAM as possible.

Audio/Video Editing Workstation

Multimedia editing, processing, and rendering require a fast computer with high-capacity storage and big displays (usually more than one). Examples of audio/video workstations include

- **Video recording/editing PCs:** These run software such as Adobe Premiere Pro or Apple Final Cut Pro X.

- **Music recording PCs:** These run software such as Apple Logic Pro X or Avid Pro Tools.

> **Note**
>
> Identify the software programs listed above and understand exactly what they are used for.
>
> **Adobe Premiere Pro:** https://www.adobe.com/products/premiere.html
>
> **Apple Final Cut Pro X:** https://www.apple.com/final-cut-pro/
>
> **Apple Logic Pro X:** https://www.apple.com/logic-pro/
>
> **Avid Pro Tools:** https://www.avid.com/en/pro-tools

This just scratches the surface, but you get the idea. These computers need to be designed to easily manipulate video files and music files. So, from a hardware standpoint, they need a specialized video or audio card, the fastest hard drive available with a lot of storage space (definitely SSD and perhaps NVMe-based, or SATA Express), and multiple monitors (to view all of the editing windows). Keep in mind that the video cards and specialized storage drives are going to be expensive devices; be sure to employ all antistatic measures before working with those cards.

Some video editing workstations might require a secondary video card or external device for the capturing of video or for other video usage. Likewise, many audio editing workstations will require a secondary audio device, and will often rely on external audio processors and other audio equipment to "shape" the sound before it enters the computer via USB or otherwise.

> **ExamAlert**
>
> Remember that audio/video workstations need specialized A/V cards; large, fast hard drives; and multiple monitors.

> **Note**
>
> Most specialized, custom computers should have powerful multicore CPUs.

Virtualization Workstation

A virtualization workstation is a computer that runs one or more virtual operating systems (also known as virtual machines or VMs). Did you ever

wish that you had another two or three extra computers lying around so that you could test multiple versions of Windows, Linux, and possibly a Windows Server OS all at the same time? Well, with virtual software, you can do this by creating virtual machines for each OS. But if you run those at the same time on your main computer, you are probably going to bring that PC to a standstill. However, if you build a workstation specializing in virtualization, you can run whatever operating systems on it that you need. The virtualization workstation uses what is known as a hypervisor, which allows multiple virtual operating systems (guests) to run at the same time on a single computer. It is also known as a virtual machine manager (VMM). But there are two different kinds:

- **Type 1: Native:** This means that the hypervisor runs directly on the host computer's hardware. Because of this, it is also known as *bare metal*. Examples of this include VMware vSphere and Microsoft Hyper-V (for Windows Server).
- **Type 2: Hosted:** This means that the hypervisor runs within (or "on top of") the operating system. Guest operating systems run within the hypervisor. Compared to Type 1, guests are one level removed from the hardware and therefore run less efficiently. Examples of this include VirtualBox, VMware Workstation, and Hyper-V for Windows 10. Figure 14.1 shows an example of VMware Workstation running. You will note that it has a variety of virtual machines inside, such as Windows 10 Pro (running), Windows Server, and Ubuntu Linux.

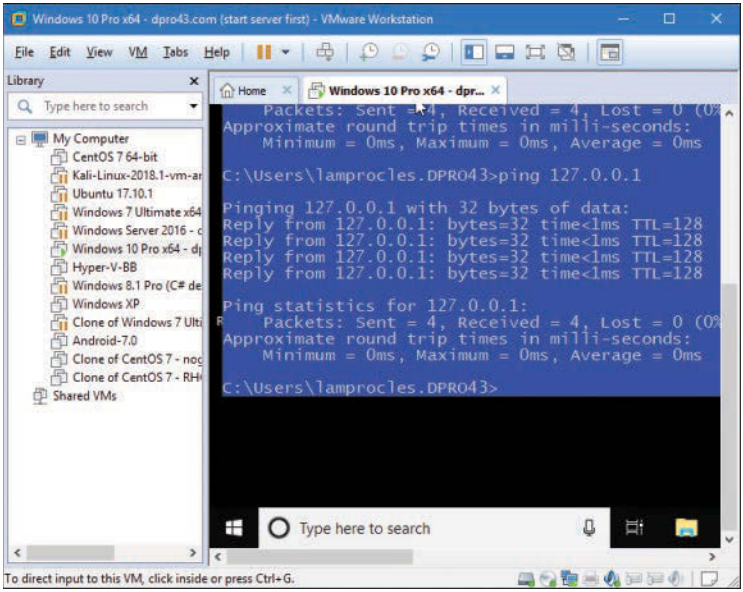

FIGURE 14.1 **VMware Workstation**

Generally, Type 1 is a much faster and efficient solution than Type 2. Because of this, Type 1 hypervisors are the kind used for virtual servers by web-hosting companies and by companies that offer cloud-computing solutions. It makes sense, too. If you have ever run a powerful operating system within a Type 2 hypervisor, you know that a ton of resources are used, and those resources are taken from the hosting operating system. It is not nearly as efficient as running the hosted OS within a Type 1 environment. However, keep in mind that the hardware/software requirements for a Type 1 hypervisor are more stringent and costlier.

For virtualization programs to function, the appropriate virtualization extensions need to be turned on in the UEFI/BIOS. Intel CPUs that support x86 virtualization use the VT-x virtualization extension. Intel chipsets use the VT-d and VT-c extensions for input-output memory management and network virtualization, respectively. AMD CPUs that support x86 virtualization use the AMD-V extension. AMD chipsets use the AMD-Vi extension. After virtualization has been enabled in the UEFI/BIOS, some programs, such as Microsoft Hyper-V, need to be turned on in Windows. This can be done in **Control Panel > All Control Panel Items > Programs and Features**, and click the **Turn Windows features on or off** link. Then checkmark **Hyper-V**. Windows will disallow it if virtualization has not been enabled in the UEFI/BIOS, or in the uncommon case that the CPU doesn't support virtualization.

Any computer designed to run a hypervisor often has a powerful CPU (or multiple CPUs) with multiple cores and as much RAM as can fit in the system. This means a powerful, compatible motherboard as well. So in essence, the guts—the core of the system—need to be robust. Keep in mind that the motherboard UEFI/BIOS and the CPU should have virtualization support.

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Remember that virtualization systems depend on the CPU and RAM heavily. These systems require maximum RAM and CPU cores.

Gaming PC

Now we get to the core of it: Custom computing is taken to extremes when it comes to gaming. Gaming PCs require almost all the resources mentioned previously: a powerful, multicore CPU; lots of fast RAM; one or more SSDs (SATA Express or PCI Express); advanced cooling methods (liquid cooling if you want to be serious); a high-definition sound card; plus a fast network adapter and strong Internet connection.

But without a doubt, the most important component is the video card. Typical end-user video cards cannot handle today's PC games. So, a high-end video card with a specialized GPU is the key. Also, a big monitor that supports high resolutions and refresh rates couldn't hurt. (And let's not forget about *mad* skills.)

All of this establishes a computer that is expensive and requires care and maintenance to keep it running in perfect form. For the person who is not satisfied with gaming consoles, this is the path to take.

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A gaming PC requires a high-end video with specialized GPU, a high-definition sound card, an SSD, and high-end cooling.

Games are some of the most powerful applications available. If even just one of the mentioned elements is missing from a gaming system, it could easily ruin the experience. You might think you could do without an SSD; however, SSDs provide faster load times of games and levels, but don't do too much after that. However, when you look at the mammoth size of some of today's games, that's enough reason to install one. As of the writing of this book (2019), many gamers rely on M.2 drives.

Don't forget, the video card is the number one component of this equation. Gamers are always looking to push the envelope for video performance by increasing the number of frames per second (frames/s or fps) that the video card sends to the monitor. One of the ways to improve the video subsystem is to employ multiple video cards. It's possible to take video to the next level by incorporating NVIDIA's Scalable Link Interface (SLI) or AMD's CrossFire (CF). A computer that uses one of these technologies has two (or more) identical video cards that work together for greater performance and higher resolution. The compatible cards are bridged together to essentially work as one unit. It is important to have a compatible motherboard and ample cooling when attempting this type of configuration. Currently, this is done with two or more PCI Express video cards (×16/version 3 or higher) and is most commonly found in gaming rigs, but you might find it in other PCs as well (such as video editing or CAD/CAM workstations). Because some motherboards come with only one PCIe ×16 slot for video, a gaming system needs a more advanced motherboard: one with at least two PCIe ×16 slots to accomplish SLI. It is costly being a gamer!