

Emmett Bradley: "Sir, are you telling me that your only real flight time is at the controls of a video game?"

Troy: "No, see, it's not—it's not a video game, all right? It's a flight simulator."

—EMMETT BRADLEY AND TROY, *SNAKES ON A PLANE*



In this chapter, you will learn how to

- Describe how to implement sound in a PC
- Install and configure video capture hardware and software
- Set up a PC to view television signals

The PC long ago went well beyond a simple device used to create office documents and crunch numbers efficiently. With modern PCs, you can experience content on many levels, from realistic video to scintillating three-dimensional sound. Plus, you can add the hardware and software to turn the computer into a multimedia creation machine, capable of making movies and more.

This chapter looks at the many aspects of multimedia available in a modern PC. First, the chapter discusses how sound works in a PC, both to record and play it back. Second, you'll dive into video capture concepts, hardware, and software. Finally, the chapter rolls through the essentials of setting up the computer to bridge the gap into the entertainment world fully by installing and configuring TV tuner hardware and software. Rolling...and...action!

■ Sound

You're racing down the virtual track, pixels flying across the screen, hearing the engine roar as you take another turn and press down the accelerator—or you're surfing the Web for lovely scenic nature photos, with the sweet, mellifluous music of Mozart filling the room. Sound has become an integral component of the computing experience. Setting up and optimizing sound for the PC has become an integral skill for all computer techs.

Correctly setting up sound for a PC requires that you know about quite a few things, because the sound process has many components. You need a properly installed sound card (or built-in sound device) with the correct drivers loaded, reasonably high-quality speakers, support software such as the API for a particular game correctly configured in Windows, and a properly set up application that can use the features of the sound card. And every great tech needs to know the troubleshooting techniques to handle both routine and uncommon problems with sound.

Historical/Conceptual

How Sound Works in a PC

Like the ripples that roll across a pond when you drop a rock in the center, sound flows from a source in invisible but measurable waves that cause the membranes in your ears to vibrate and create sound. The sophistication of the human ear enables most people to differentiate the melodious from the raucous, the loud from the soft. Computers aren't nearly as sophisticated as the human ear and brain, so clear standards are a must for converting music into a format that a PC can use to record and play sound. Computer folks use the terms *capture* and *output* instead of record and play.

Sound-Capture Basics

Virtually every PC today comes with four critical components for capturing and outputting sound: a sound card or sound device built into the motherboard, speakers, microphone, and recording/playback software. Computers capture (record) sound waves in electronic format through a process called **sampling**. In its simplest sense, sampling means capturing the state or quality of a particular sound wave a set number of times each second. The sampling rate is measured in units of thousands of cycles per second, or kilohertz (KHz). The more often a sound is sampled, the better the reproduction of that sound. Most sounds in the PC world are recorded with a sampling rate of from 11 KHz (very low quality, like a telephone) to 192 KHz (ultra-high quality, better than the human ear).

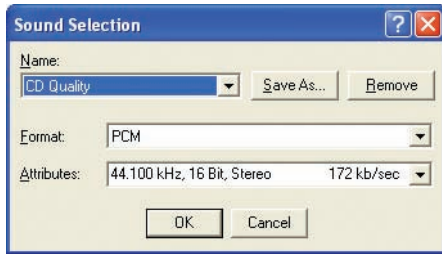
Sounds vary according to their loudness (**amplitude**), how high or low their tone (**frequency**), and the qualities that differentiate the same note played on different instruments (**timbre**). All the characteristics of a particular sound wave—amplitude, frequency, timbre—need to be recorded and translated into ones and zeros to reproduce that sound accurately within the computer and out to your speakers.



Tech Tip

Sound Terminology

Every modern motherboard comes with sound processing capabilities built in. By default, techs refer to built-in sound as either built-in sound or as a sound card, even when there's no expansion card for sound. I'll do the same in this chapter.



• **Figure 25.1** Sound Recorder settings



WAV and MP3 are only two among a large number of file formats for sound. Not all sound players can play all of these formats; however, many sound formats are nothing more than some type of compressed WAV file, so with the right codec loaded, you can play most sound formats.



Tech Tip

Compressing WAV Files to MP3 Format

Using MP3 compression, you can shrink a WAV file by a factor of 12 without losing much sound quality. When you compress a WAV file into an MP3 file, the key decision is the bit rate. The bit rate is the amount of information (number of bits) transferred from the compressed file to the MP3 decoder in 1 second. The higher the bit rate of an MP3 file, the higher the sound quality. The bit rate of MP3 audio files is commonly measured in thousands of bits per second, abbreviated Kbps. Most MP3 encoders support a range of bit rates from 24 Kbps up to 320 Kbps (or 320,000 bits per second). A CD-quality MP3 bit rate is 128 Kbps.

The number of characteristics of a particular sound captured during sampling is measured by the **bit depth** of the sample. The greater the bit depth used to capture a sample, the more characteristics of that sound can be stored and thus re-created. An 8-bit sample of a Jimi Hendrix guitar solo, for example, captures 2^8 (256) characteristics of that sound per sample. It would sound like a cheap recording of a recording, perhaps a little flat and thin. A 16-bit sample, in contrast, captures 2^{16} (65,536) different characteristics of his solo and reproduces all the fuzzy overtones and feedback that gave Hendrix his unique sound.

The last aspect of sound capture is the number of tracks of sound you capture. Most commonly, you can capture either a single track (**monaural**) or two tracks (**stereo**). More advanced captures record many more sound tracks, but that's a topic for a more advanced sound capture discussion and well beyond CompTIA A+.

The combination of sampling frequency and bit depth determines how faithfully a digital version of a sound captures what your ear would hear. A sound capture is considered **CD quality** when recorded at 44.1 KHz, with 16-bit depth and in stereo. Most recording programs let you set these values before you begin recording. Figure 25.1 shows the configuration settings for Windows Sound Recorder.

Hey, wait a minute! Did you notice the Format setting in Figure 25.1? What's that? You can save those sampled sounds in lots of different ways—and that's where the term *format* comes into play.

Recorded Sound Formats

The granddaddy of all sound formats is **pulse code modulation (PCM)**. PCM was developed in the 1960s to carry telephone calls over the first digital lines. With just a few minor changes to allow for use in PCs, the PCM format is still alive and well, although it's better known as the WAV format so common in the PC world. WAV files are great for storing faithfully recorded sounds and music, but they do so at a price. WAV files can be huge, especially when sampled at high frequency and depth. A 4-minute song at 44.1 KHz and 16-bit stereo, for example, weighs in at a whopping 40-plus MB!

What's interesting about sound quality is that the human ear cannot perceive anywhere near the subtle variations of sound recorded at 44.1 KHz and 16-bit stereo. Clever programmers have written algorithms to store full-quality WAV files as compressed files, discarding unnecessary audio qualities of that file. These algorithms—really nothing more than a series of instructions in code—are called compressor/decompressor programs or, more simply, **codecs**. The most famous of the codecs is the Fraunhofer MPEG-1 Layer 3 codec, more often called by its file extension, **MP3**.

MIDI

Every sound card can produce sounds in addition to playing prerecorded sound files. Every sound card comes with a second processor designed to interpret standardized **musical instrument digital interface (MIDI)** files. It's important to note that a MIDI file is not an independent music file, unlike a WAV file that sounds more or less the same on many different PCs. A MIDI file is a text file that takes advantage of the sound processing hardware to enable the PC to produce sound. Programmers use these small files to tell the sound card which notes to play; how long, how loud, and on which

instruments to play them; and so forth. Think of a MIDI file as a piece of electronic sheet music, with the instruments built into your sound card.

The beauty of MIDI files is that they're tiny in comparison to equivalent WAV files. The first movement of Beethoven's Fifth Symphony, for example, weighs in at a whopping 78 MB as a high-quality WAV file. The same seven-minute piece as a MIDI file, in contrast, slips in at a svelte 60 KB.

MIDI is hardware dependent, meaning the capabilities and quality of the individual sound card make all the difference in the world on the sound produced. Sound cards play MIDI files by using one of two technologies: FM synthesis or wave table synthesis.

FM Synthesis Early processors used electronic emulation of various instruments—a technique often called **FM synthesis**—to produce music and other sound effects. Software developers could tell the sound processor to reproduce a piano playing certain notes, for example, and a sound resembling a piano would pour forth from the speakers. The problem with FM synthesis is that although the modulation sounds okay for a single note, such as middle C, it sounds increasingly electronic the farther up or down the scale you go from that prime note.

Wave Table Synthesis To address the odd techno-sound of early sound processors, manufacturers began embedding recordings of actual instruments or other sounds in the sound card. Modern sound cards use these recorded sounds to reproduce an instrument much more faithfully than with FM synthesis. When asked to play a C note on a piano or on a viola, for example, the sound processor grabs a prerecorded WAV file from its memory and adjusts it to match the specific sound and timing requested. This technique is called **wave table synthesis**. The number of instruments a sound card can play at once is called the **polyphony** of that card—typically 64 sounds on better cards. Most modern sound cards have samples of 128 instruments—a veritable symphony orchestra on a chip!

Other File Formats

The WAV, MP3, and MIDI formats may account for the majority of sound files, but plenty of other less common formats are out there. Here are the extensions of some other sound file formats you may run into in the PC world:

- **AAC** Advanced Audio Coding is the native format for songs downloaded into the Apple iTunes music library. The AAC format is part of the MPEG-4 standard, offers better compression algorithms than MP3, and is freely distributed.
- **AIFF** The Audio Interchange File Format is a popular sound format used on Mac computers. AIFF are often seen at Web sites, and you can use the well-known QuickTime Player to play them.
- **ASM** Assembly Language Source files are compressed sound files often seen on the Internet and used in streaming sound (streaming media is discussed later in this chapter).
- **ASX** Microsoft created the ASX format to facilitate streaming audio over the Internet through Windows Media Player. It's more than just a format, though; it acts like a super playlist and enables you to



MIDI files have the file extension .MID in the PC world.



MIDI files are much less popular than other recorded formats on computers, but every Windows computer and every sound card still fully supports MIDI.

play other sound file types as well. The full name of the format is Microsoft Advanced Streaming Redirector.

- **AU** Many players can play these files, including players on non-Windows systems, such as Sun, Next, UNIX, and Mac.
- **FLAC** The Free Lossless Audio Codec is an open format that can compress sound files without losing any data—it can even decompress a file back into an exact copy of the original. FLAC can reduce the size of audio files by up to 60 percent.
- **OGG** The Vorbis format is an open-source compression codec that competes well with the proprietary AAC and WMA codecs, as well as MP3. Vorbis files are saved with the .OGG filename extension, so you'll hear them (incorrectly) referred to as "Ogg" files.
- **RM** RealMedia files play either just audio or audio and video. They are proprietary to RealMedia, a popular player often used on the Internet. You must have RealMedia Player installed on your computer to play these files.
- **WMA** Windows Media Audio is Microsoft's proprietary compression format.

This list scratches the surface of the 100-plus sound file formats available, but it represents those you're most likely to encounter.

Playing Sounds

A large number of programs can play sounds on a typical Windows computer. First, virtually every Windows computer comes with Windows Media Player, possibly the most popular of all sound players. Figure 25.2 shows the default Media Player for Windows 7. You can download many



• Figure 25.2 Windows Media Player

other players, of course, including iTunes, Apple's media program for Windows and Mac OS X. This is good, because not all sound players can play all sounds.

Many applications, especially games, play sounds too. In the not-too-distant past, a game or an application sometimes had its own sound format, but most applications and games today use standard WAV, MP3, or MIDI files.

Streaming media is a broadcast of data that is played on your computer and immediately discarded. Streaming media is incredibly popular on the Internet. Streaming media has spawned an entire industry of Internet radio stations and music databases. Two popular Internet radio players include Windows Media Player and Apple's iTunes. You can use streaming services like Spotify and Pandora to pick and choose the music you want to hear. With the spread of broadband Internet, the quality of streaming music has improved dramatically.



Try This!

Play Sounds in Windows

The typical Windows PC comes with a number of applications for playing sound files. Take a tour of a typical Windows system to see these applications. This exercise uses Windows XP, but almost any version of Windows will also work. For this exercise, you need a Windows system with a functioning sound card, microphone, and speakers.

1. Using the file search feature in Windows, locate all of the files on your computer that have the extension *.wav*—all versions of Windows come with a number of WAV files. Double-click one of the files to play it. What program is associated with WAV files?
2. Repeat step 1, but this time look for files with the extension *.mid*. Not all versions of Windows have MIDI files. Double-click one of the files to play it. What program is associated with MIDI files?
3. From the Start button, search for any sound programs that may be on your system. You'll almost certainly run into Windows Media Player and Sound Recorder, but check to see whether any third-party programs are installed.
4. If possible, install a popular sound player such as Winamp or iTunes on your system. Both programs are free. You can get Winamp at www.winamp.com and iTunes at www.apple.com/itunes. Check Winamp's help files to see what types of file formats Winamp supports—a lot of formats!
5. If you have an Internet connection, try running some streaming audio. If you have Windows Media Player versions 7 through 10, go to the Radio Tuner. If you are running Windows Media Player 11 or later, go to the Media Guide. If you have Winamp, try going to www.shoutcast.com. With iTunes, just click the Radio link in the Library.

Getting the Right Sound Hardware

Modern motherboards come with built-in sound processing, plus you can buy a sound card that plugs into a PCI or PCIe expansion slot or into a USB port. Sound cards come with many features, including two separate sound processors (one for all of the recorded formats such as WAV and another for MIDI), recording capabilities, support for MIDI instruments, and more. All sound cards, from the cheapest to the most expensive, can play music and drive a pair of speakers, so techs need to delve a little deeper to understand the crucial differences among low-, mid-, and high-end sound cards. Sound cards differ in six basic areas: sound standard, processor capabilities, speaker support, recording quality, jacks, and extra features.

But the sound card itself is only one part of the equation. You also need good-quality speakers if you have any intention of listening to music or enjoying some of the more advanced features such as surround sound.

Sound Card Standards

Most sound cards follow one of two standards, AC'97 or Intel High Definition Audio, although no rule says manufacturers must follow these standards. This applies both to the sound processing hardware built into motherboards and to add-on sound cards.

The **AC'97** standard applies to lower-end audio devices, having been created when most folks listened to stereo sound at best. Both playback and recording capabilities of such sound cards offer adequate quality, certainly enough for the typical office PC. When you want to go beyond average, though, turn to a motherboard or add-on sound card that offers a newer standard.

Intel designed the **Intel High Definition Audio (HDA)** standard to support features such as true surround sound with many discrete speakers. Technically speaking, whereas AC'97 offers support for up to six channels at 48 KHz/20-bit quality, HDA cranks that up to eight channels at 192 KHz/32-bit quality, a substantial improvement. HDA also supports sending multiple streams of audio from one computer to different output devices, so you can enjoy Internet radio in one room, for example, and listen to a CD in another room, both played on the same computer.

Processor Capabilities

Sound processor capabilities differ dramatically from the low end to the high end, even though the prices don't reflect the great divide. The sound processor handles the communication among the application, operating system, and CPU and translates commands into sounds coming out of the speakers. Low-end sound processors do little more than translate, which means that the CPU has to do the heavy lifting on the processing front.

Better sound processors, in contrast, shoulder much of the processing burden and bring a series of extra features to the table. By handling a lot of the processing on board, these better sound processors free up the CPU for other duties and—in effect and in name—*accelerate* the sound process.



As they do with new microprocessor models, Intel gave the HDA standard a codename as well. Look for motherboards offering the *Azalia* sound option. That's Intel High Definition Audio.



Tech Tip

Azalia's Not Just for Intel Boards

Most chipset makers have adopted Intel High Definition Audio for their better motherboard offerings. That includes direct Intel competitors, such as NVIDIA. Everybody plays Azalia these days!

These decent sound processors also provide excellent sound reproduction, so your MP3s sound as awesome on your PC as they do on your stereo.

Most mid-range and all high-end sound processors offer support for various surround sound standards, enabling equally equipped games and other applications to provide positional audio effects and detailed sound modeling—features that make PC gaming take on a whole new dimension. You'll learn about the various standards in detail in the "Speakers" section of this chapter, but for now let an example suffice. With properly implemented positional audio, when you're sneaking down the hall, ready to steal the Pasha's treasure, you will hear behind you the sounds of the guards marching up to capture you. Such added realism has many potential benefits beyond games, but games are currently the primary beneficiary of this technology.

Speaker Support

Every sound card supports two speakers or a pair of headphones, but many better sound cards support five or more speakers in discrete channels. These multiple speakers provide surround sound—popular not only for games but also for those who enjoy watching movies on their PCs. The card shown in Figure 25.3, for example, has outputs for many speakers.

Another popular speaker addition is a subwoofer. A **subwoofer** provides the amazing low-frequency sounds that give an extra dimension to your movies, music, and games. Almost all modern sound cards support both surround sound and a subwoofer and advertise this with a nomenclature such as Dolby Digital or DTS. Figure 25.4 shows one type of surround speaker system. (You'll learn more about surround sound in the upcoming "Speakers" section.)

Recording Quality

Almost every sound card has an input for a powered microphone, but the high-end cards record with substantially lower amounts of noise or other audible artifacts. The measure that describes the relative quality of an input port is **signal-to-noise ratio** and is expressed in **decibels**. The smaller the number, the worse the card is for recording, because you're more likely to get noise. Most sound cards at the low end and in the mid range have a signal-to-noise ratio of 30 to 50 decibels, which makes them unacceptable for recording. High-end cards offer a 96 to 100+ signal-to-noise ratio, a level near what professional musicians use. Check the documentation before you buy or recommend a sound card for recording purposes (see Figure 25.5).

Jacks

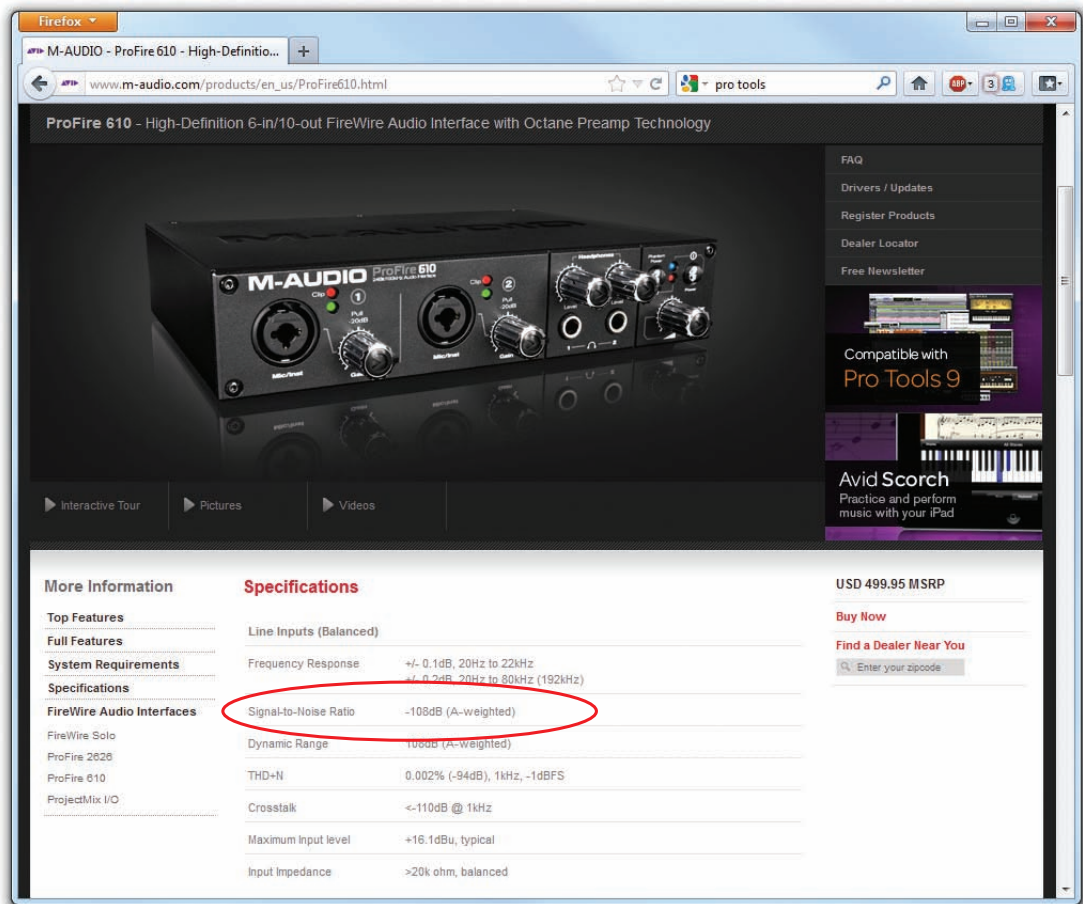
Virtually every sound card comes with at least three connections: one for a stereo speaker system, one for a microphone, and one for a secondary input called line in. If you look at the back of a motherboard with a built-in sound card, you'll invariably see these three connections. On most systems, the



• **Figure 25.3** A sound card with multiple speaker connections



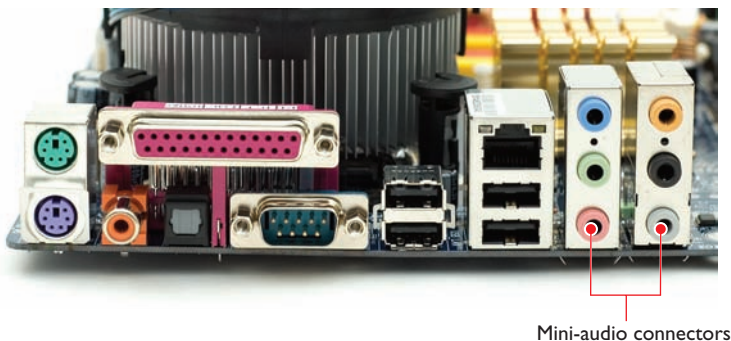
• **Figure 25.4** Surround speakers (photo courtesy of Klipsch Group, Inc.)



• **Figure 25.5** The M-AUDIO ProFire 610 advertises its excellent 108-decibel signal-to-noise ratio for recording.

main stereo speaker connector is green, the line in connector is blue, and the microphone connector is pink. You'll often find plenty of other connectors as well (see Figure 25.6).

Here's a list of some of the standard connectors:



• **Figure 25.6** Typical audio connections on a motherboard sound card

- **Main speaker out** Just what it sounds like, the main speaker output is where you plug in the standard speaker connector.
- **Line out** Some cards will have a separate line out connector that is often used to connect to an external device such as a CD or MP3 player. This enables you to output sounds from your computer.
- **Line in** The line in port connects to an external device such as a CD or MP3 player to allow you to import sounds into your computer.
- **Rear out** The rear out connector connects to the rear speakers for surround sound audio output.

- **Analog/digital out** The multifunction analog/digital out connection acts as a special digital connection to external digital devices or digital speaker systems, and it also acts as the analog connection to center and subwoofer channels. (See the “Speakers” section for a discussion of surround sound.)
- **Microphone** The microphone port connects to an external microphone for voice input.
- **Joystick** The now-obsolete joystick port connects a joystick or a MIDI device to the sound card. The joystick port is a two-row, DB-15 female connection, but few motherboards or sound cards include the port these days.



• **Figure 25.7** Breakout box for a SoundBlaster Live! Platinum sound card

Extra Features

With all motherboards including built-in sound these days, expansion sound card makers have responded by adding a host of extra goodies and capabilities to their cards that, for some folks, prove irresistibly tempting. These include a digital output to integrate the PC with a home entertainment unit and surround sound speaker setup; a breakout box that adds recording and output ports in a 5.25-inch bay; and a FireWire connection for direct gaming, file sharing, and immediate MP3 playing from a portable MP3 device. Figure 25.7 shows a version of the Creative Labs SoundBlaster breakout box. These features aren’t for everyone, but they are compelling to many consumers.



• **Figure 25.8** High-quality speaker set (right) versus another manufacturer’s low-end speaker set (left)

Speakers

It always blows me away when I walk into someone’s study and hear tinny music whining from a \$10 pair of speakers connected to a \$2000 computer. If you listen to music or play games on your computer, a decent set of speakers can significantly improve the experience. Speakers come in a wide variety of sizes, shapes, technologies, and quality and can stump the uninformed tech who can’t easily tell that the \$50 set on the right sounds 100 times better than the \$25 pair on the left (see Figure 25.8).

Speaker Standards

The advent of surround sound in the computing world has created a number of speaker standards. You should know these standards so you can choose the speakers that work best for you and your clients.

Stereo is the oldest speaker technology you’ll see in the PC world. Stereo speakers are just what you might imagine: two speakers, a left and a right (see Figure 25.9). The two speakers share a single jack that connects to the sound card. Most cheap speakers are stereo speakers.



• **Figure 25.9** Stereo speakers



• **Figure 25.10** Typical 2.1 speakers

A **2.1** speaker system consists of a pair of standard stereo speakers—called **satellites**—combined with a subwoofer (see Figure 25.10). The average 2.1 speaker system has a single jack that connects to the sound card and runs into the subwoofer. Another wire runs from the subwoofer to the two stereo speakers. If you want to enjoy great music and don't need surround sound, this is your speaker standard of choice.

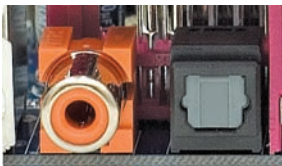
Going beyond standard two-channel (stereo) sound has been a goal in the sound world since the 1970s. However, it wasn't until the advent of Dolby Laboratory's **Dolby Digital** sound standard in the early 1990s that surround sound began to take off. The Dolby Digital sound standard is designed to support five channels of sound: front-left, front-right, front-center, rear-left, and rear-right. Dolby Digital also supports a subwoofer—thus, the term **5.1**. Another company, **Digital Theatre**

Systems (DTS), created a competing standard that also supported a 5.1 speaker system. When DVDs were introduced, they included both Dolby Digital and DTS 5.1 standards, making 5.1 speakers an overnight requirement for home theater. If you want to enjoy your DVDs in full surround sound on your PC, you must purchase a full 5.1 speaker system. A number of 5.1 speaker systems are available for PCs. The choice you make is usually determined by what sounds best to you.

Many sound cards also come with a special **Sony/Philips Digital Interface (S/PDIF)** connector that enables you to connect your sound card directly to a 5.1 speaker system or receiver (see Figure 25.11). Using a single S/PDIF instead of a tangle of separate wires for each speaker greatly simplifies your sound setup. S/PDIF connections come in two types, optical and coaxial. The optical variety looks like a square with a small door (at right in Figure 25.11). The coaxial is a standard RCA connector (at left), the same type used to connect a CD player to your stereo. It doesn't matter which one you use; just make sure you have an open spot on your receiver or speakers.

Games can also take advantage of 5.1, 6.1, and 7.1 speakers, but they use the DirectX standard. **DirectX** offers numerous commands, also known as APIs, that issue instructions such as “make a sound on the right speaker” or “play music in both the right and left channels.” DirectX simplifies the programming needed to create sound and video: rather than having to program sounds in different ways for each sound card option, games can talk DirectX. The hardware manufacturers simply have to ensure that their sound cards are DirectX compatible.

DirectX version 3 introduced **DirectSound3D (DS3D)**, which offered a range of commands to place a sound anywhere in 3-D space. Known as **positional audio**, it fundamentally changed the way most PC games were played. DS3D could not handle all sound information, but it supported extensions to its instructions for more advanced sound features. This challenged the sound card designers to develop more fully the concept of posi-



• **Figure 25.11** S/PDIF connectors

Only a few 5.1 PC speaker sets come with S/PDIF. In most cases, you'll have to use the regular audio outputs on the sound card. You'll find the connector more common on 6.1 and 7.1 sets.

tional audio. Creative Labs responded by rolling out **environmental audio extensions (EAX)**, a set of audio presets that gave developers the capability to create a convincing sense of environment in entertainment titles and a realistic sense of distance between the player and audio events. Figure 25.12 shows an EAX setup screen.

In late 2000, a number of EAX effects were incorporated into the DirectX audio component of DirectX 8.0. This signaled the acceptance of EAX as the standard for audio effects in gaming. Shortly afterward, Creative Labs started releasing audio cards that were Dolby 5.1 compatible out of the box. This let you plug a 5.1 speaker system directly into your sound card. The sound card automatically decoded the Dolby/DTS sound track when you played a DVD and the EAX effects when you played a game that supported it. All current sound cards support DirectX and EAX.

Microsoft changed the way audio works in Windows Vista/7 from the way it works in previous versions of Windows. Most notably, Vista/7 doesn't support direct hardware access to sound, so DirectSound does not work. Third-party developers have created various workarounds for this lack of support to enable some older games and hardware to function in Windows Vista/7. Other developers have gotten behind the OpenAL API to provide environmental audio effects in Vista/7. Specific OpenAL drivers for games have to be included to provide that support.

Speaker Features

Speakers also come with a few other features that you should consider when choosing a set for yourself or your clients. Speakers offer a variety of power sources, controls accessibility, and headphone jacks.

Most speakers have volume controls as well as an on/off switch. Get a system that provides easy access to those controls by placing them on an easy-to-reach speaker or on a special control box.



Not all cards support Dolby Digital/DTS. Most software DVD players and some sound cards support Dolby Digital. DTS support is a little harder to come by. Check the manufacturer's Web site to determine whether your card will work with DTS.



• Figure 25.12 EAX setup screen

The problem with headphones is that you need to plug them into the back of the sound card and then tell Windows to output to them from the Sound applet on the Control Panel. Save yourself a lot of hassle and get a speaker system that has a handy headphone jack on one of the speakers or on a control box.

Microphones

Speakers are great for listening to music, but what if you're a musician looking to record your own music? You'll need to plug a *microphone* into your sound card if you want to input audio into your PC (see Figure 25.13). A microphone records sound by detecting vibrations and turning them into an electronic signal. Microphones are most commonly used for recording voices, though you can easily record any other sounds. (Many musical instruments can be plugged into the line in port of your sound card, either directly or through a converter box.)

You can also buy microphones that connect via USB instead of the microphone port.

Microphones can also be used with speech-to-text programs that listen to what you say and then type it out on the screen. These programs can be finicky to use, but they're still fun to play around with. If you do use speech-to-text programs, look for a headset that has a built-in microphone (see Figure 25.14). The quality will be lower, but it will keep your hands free. (These headsets are also great for voice chatting while playing games on your PC.)

When searching for a microphone, you'll most likely be picking between *condenser* and *dynamic* microphones. I won't go too deeply into the science of recording sound, but here's a very quick rundown:

- Condenser microphones are often found in recording studios because they can record a wide range of sound at a high quality, but they are larger, more delicate, and must be powered.
- Dynamic microphones use a different technology to record sound, but are often found at live music events because they're much more rugged, don't need to be powered, and still sound great.



• **Figure 25.13** A standard microphone



• **Figure 25.14** Headsets are great for gaming.

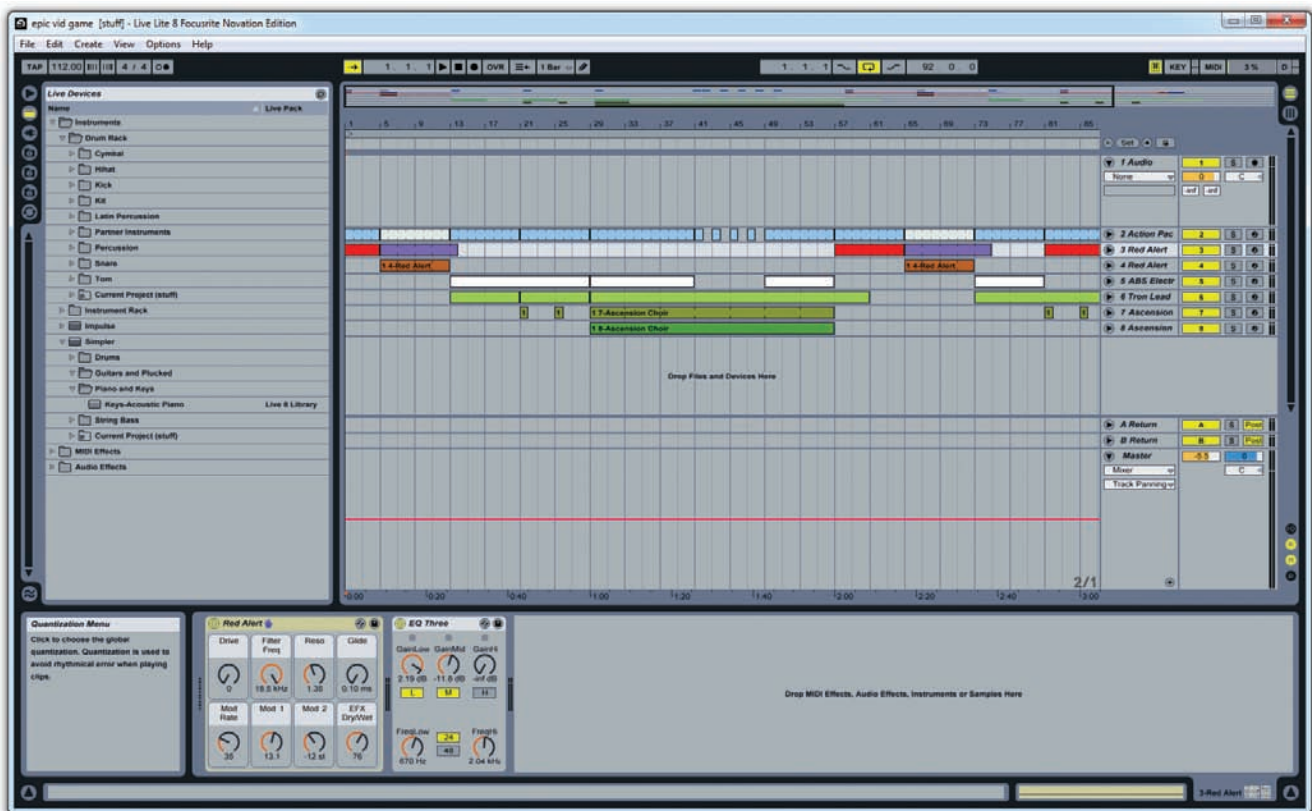
Look for something that combines audio quality with affordability. The best condenser microphones can cost hundreds or thousands of dollars, but most people don't need a recording studio level of quality. A nice dynamic microphone or less-expensive condenser microphone will record great sound for about \$100 to \$200.

MIDI-enabled Devices

Music composition has changed dramatically over the past few decades. What used to be a painfully analog process of writing out music on paper, recording it to tape, and hoping for the best has become almost entirely digital. Hardware and software exist that enable you to record analog sounds to digital storage, and create entirely digital sound with special audio production software. One type of software, called a *digital audio workstation*, enables you to input MIDI information using an external **MIDI-enabled device** (see Figure 25.15). *Music notation* software also exists that enables you to write out notes on sheet music either by hand or with a MIDI device.

MIDI-enabled devices, also known as *MIDI controllers*, come in several form factors, but most look and feel like standard music keyboards (see Figure 25.16). Others use a grid or row of square buttons—the best ones light up, too! Keep in mind that these devices don't play music; they are incapable of making noise on their own. Only combined with the proper software will a MIDI device be able to make music. In the past, MIDI devices

External microphones are great for more than just your PC. Look for digital cameras and camcorders that include microphone ports. Built-in microphones are notoriously poor in quality and pick up all the noise made by the camera. Another way to increase your audio quality is via a pop filter, which you place between you and the microphone to minimize the poppy noise of *plosive* sounds (like the letters p and b).



• Figure 25.15 Ableton Live, a digital audio workstation



• **Figure 25.16** A MIDI keyboard

used MIDI-to-serial or MIDI-to-joystick adapters, but almost all modern MIDI controllers use USB connections.

Many MIDI controllers can do more than just play music. More elaborate models include extra knobs, sliders, and buttons for controlling the digital audio workstation software. Your audio software should include options and instructions for configuring the MIDI device, but for many applications, you can just plug it in and start playing.

Installing Sound in a Windows System

You've got two choices for sound hardware on today's PCs: a separate sound card or onboard sound built into the motherboard. The installation process for a sound card is basically the same as the process for any other card. You snap the card into a slot, plug some speakers into the card, load a driver—and for the most part, you're finished. With onboard sound, you need to make sure the sound is enabled in your CMOS and then load the driver. As with most of the devices discussed in this book, sound card installation consists of three major parts: physical installation, device driver installation, and configuration.

Physical Installation

Physical installation is easy. Onboard sound is already physically installed, and most sound cards are run-of-the-mill PCI cards (see Figure 25.17), although you can find PCIe and USB versions too. The real trick to physical installation is deciding where to plug in the speakers, microphone, and so on. The surround sound devices so common today feature a variety of jacks, so you will probably want to refer to your sound card documentation for details, but here are a few guidelines:



• **Figure 25.17** Typical sound card

- The typical stereo or 2.1 speaker system will use only a single jack. Look for the jack labeled Speaker or Speaker 1.
- Surround speakers either use a single digital (S/PDIF) connection, which in most cases runs from the sound card to the subwoofer, or they need three separate cables: one for the front two speakers that runs to the Speaker 1 connector, one for the back two speakers that runs to the Speaker 2 connector, and a third cable for the center channel and subwoofer that runs to the digital/audio out or Speaker 3 connector.

Here's a quick look at sound card installation. As with any expansion card, you'll need a Phillips-head screwdriver to install a sound card, as well

as your electrostatic discharge (ESD) prevention equipment. Of course, you'll also need the sound card itself, a set of speakers, an audio cable if it's an older system, and a microphone if you want to be able to record sounds.

1. Shut down your computer, unplug it, and open the case.
2. Find an open PCI or PCIe slot and snap in the sound card.
Remember to handle the card with tender loving care—especially if you're installing an expensive, high-end card! Make sure the card is securely seated, and secure it to the chassis with a hex screw.

Installing Drivers

Once the sound card is installed, start the system and let Windows install the card's drivers. This applies to expansion cards and onboard sound. As you might expect by now, you'll probably have a choice between the built-in Windows drivers and the driver that comes on an optical disc with your sound card. Just as with other cards, it's always best to install the driver that comes with the card. All sound devices have easy-to-use autorun-enabled installation discs that step you through the process (see Figure 25.18).

You might run into one of the USB sound cards out on the market (see Figure 25.19), in which case the installation process is reversed. The only secret to these devices is to follow the important rule of all USB devices: *Install the drivers before you plug in the device.* Windows probably has basic drivers for these USB sound cards, but don't take a chance—always install the drivers first.

After your sound card and driver are installed, make a quick trip to Device Manager to ensure that the driver was installed correctly, and you're two-thirds of the way there. Installing the driver is never the last step for a sound card. Your final steps are to configure the sound card by using configuration programs and to test it by using an application. Most sound cards come with both special configuration programs and a few sound applications on the same installation disc that supplies the drivers. Take a look at these extra bits of software that I call *sound programs*.



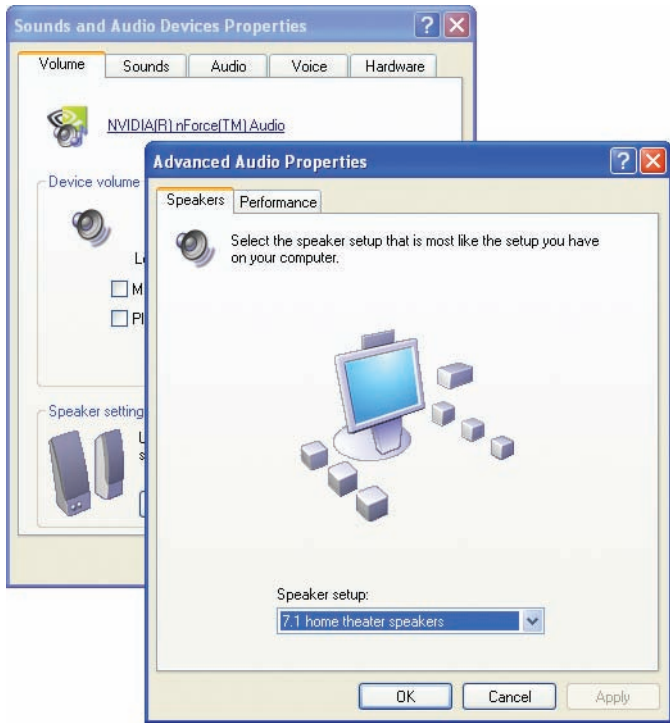
Sound card drivers are updated occasionally. Take a moment to check the manufacturer's Web site to see whether your sound card has any driver updates.



• **Figure 25.18** Typical autorun screen for a sound card



• **Figure 25.19** USB sound card



• **Figure 25.20** Advanced Audio Properties dialog box



• **Figure 25.21** Audio tab



What you see in Windows Vista/7's Sound applet will vary depending on your installed audio devices. Don't be alarmed if your Sound applet looks a lot different than Figure 25.22.

Installing Sound Programs

You've already seen that you need a program to play sounds on your PC: Windows Media Player, Winamp, or something similar. But several other classes of sound programs also reside on your computer: programs for the configuration of your sound card—tools built into Windows as well as proprietary tools—and special applications that may or may not come with your sound card.

Windows Configuration Applications Every Windows computer comes with at least one important sound configuration program built right into the operating system: the Control Panel applet called Sound in Windows Vista/7 and Sounds and Audio Devices in Windows XP. Whatever the name, the applet performs the same job: it provides a location for performing most or all of the configuration you need for your sound card.

The Sounds and Audio Devices applet in Windows XP has five tabs: Volume, Sounds, Audio, Voice, and Hardware. The Volume tab is the most interesting. This tab adjusts the volume for the speakers, and it allows you to set up the type of speaker system you have, as shown in Figure 25.20.

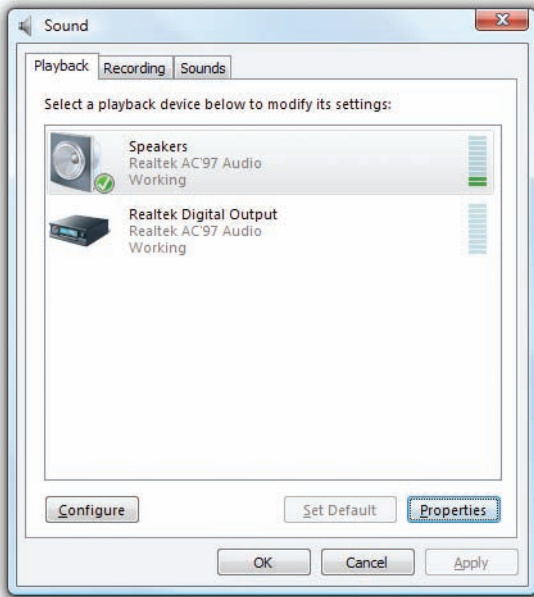
The Sounds tab allows you to add customized sounds to Windows events, such as the startup of a program or Windows shutdown. The Audio tab (see Figure 25.21) and Voice tab do roughly the same thing: they allow you to specify the device used for input and output of general sounds (Audio tab) and voice (Voice tab). These settings are handy for folks like me who have a regular microphone and speakers but also use a headset with microphone for voice recognition or Internet telephone software. By telling Windows to use the microphone for normal sounds and to use the headset for voice recognition, I don't have to make any manual changes when I switch from listening to an MP3 to listening to my brother when he calls me over the Internet.

The Hardware tab isn't used very often, but it does have one interesting feature: it shows you all of the audio and video codecs installed in your system. (See the section on "Missing Codecs" later in this chapter for more details on codecs.)

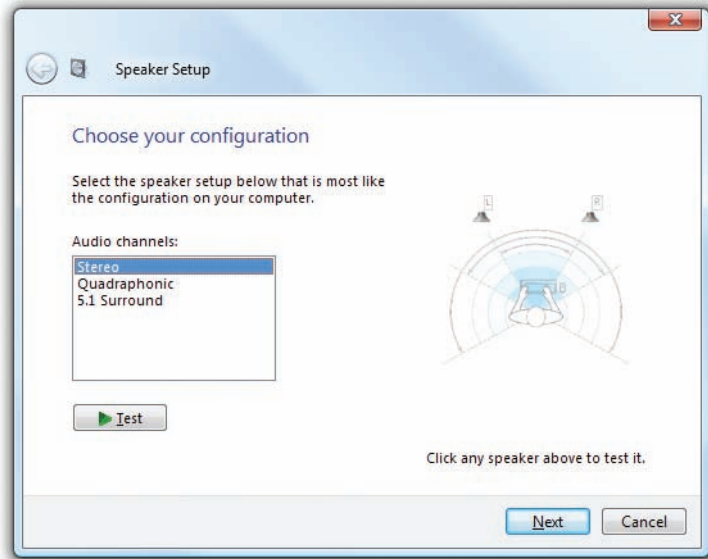
Microsoft changed a few things between Windows XP and Windows Vista/7 when it comes to configuring sound. The Sound applet offers better support for multiple speaker setup, for example, and integration with televisions with HDMI configuration options.

To configure speakers, go to the Control Panel and click Hardware and Sound; then click Sound if in Category View or double-click the Sound applet if in Classic View/Icon View. Either route opens the Sound applet (see Figure 25.22).

Select the Speakers (Speakers/Headphones on some systems) option and click the Configure button to open the Speaker Setup dialog box (see Figure 25.23). Select the audio channel option that's appropriate for your



• **Figure 25.22** Sound applet in Windows Vista



• **Figure 25.23** Speaker Setup dialog box in Windows Vista

setup, such as the 5.1 system selected for my setup at the office and shown in Figure 25.23. You can click on individual speaker icons to test if the speakers are set up properly, or click the Test button to cycle through the whole range of speakers.

Proprietary Configuration Applications Many sound cards install proprietary software to support configuration features not provided by Windows. Figure 25.24 shows one such application. This special configuration application comes with Creative Labs sound cards to add a few tweaks to the speaker setup that the Sounds and Audio Devices applet doesn't support.

Most sound cards come with some form of configuration program that works with the Control Panel applet to tweak the sound the way you want it. Figure 25.25 shows the applet that came with my motherboard. One of its many interesting features is that it detects what types of devices are installed into the sound ports and adjusts the system to use them. In other words, I don't even have to look where I'm plugging in anything! If I plug a microphone into the front speaker port, the system just adjusts the outputs—very cool. Software and sound cards that can do this are called **autosensing**.

Take some time to experiment with the program that comes with your sound card—this is a great way to learn about some of the card's features that you might otherwise not even know are there!



• **Figure 25.24** Creative Labs Speakers and Headphone panel



• **Figure 25.25** Autosensing software detecting connected devices

Specialized Applications Some sound cards—Creative Labs sound cards are by far the most infamous for this—install one or more applications, ostensibly to improve your sound experience. These are not the configuration programs just described. These applications enable you to do anything from composing music to organizing your sound files. Personally, I don't have much use for an application such as the 3DMIDI Player (see Figure 25.26)—but you might be just the type of person who loves it. Be sure at least to install the applications that come with your card. If you don't like them, you can easily uninstall them.

Troubleshooting Sound

The problems you'll run into with sound seem to fall into one of two camps: those that are embarrassingly simple to repair and those that defy any possible logic and are seemingly impossible to fix. This section divides sound problems into three groups—hardware, configuration, and application problems—and gives you some ideas on how to fix these problems.

Hardware Problems

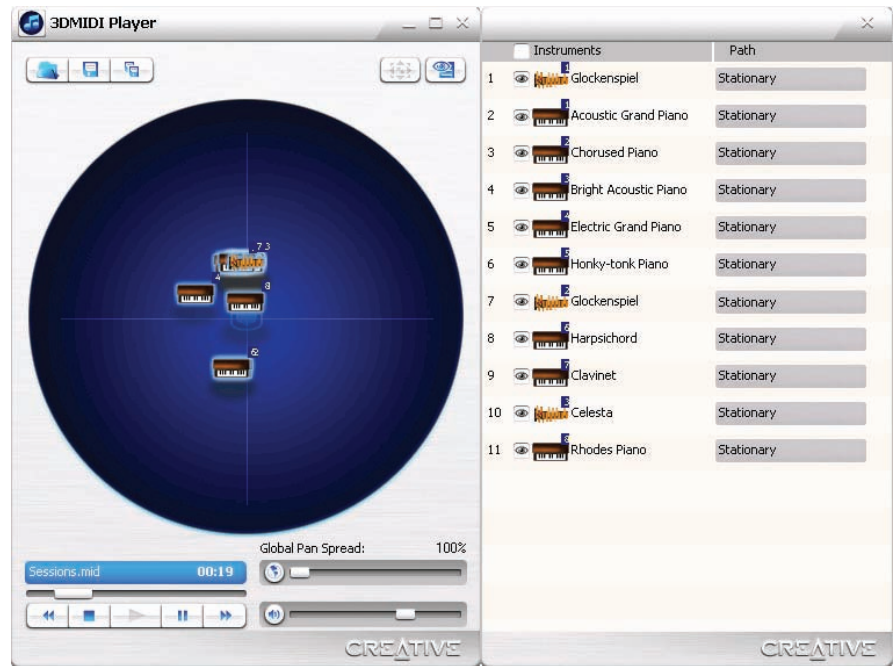
Hardware problems are by far the most common sound problems, especially if your sound card has worked for some amount of time already. Properly installed and configured sound cards almost never suddenly stop making sounds.

Volume The absolute first item to check when a sound dies is the volume controls. Remember that you can set the volume in two places: in software and on the speakers. I can't tell you the number of times I've lost sound only to discover that my wife turned down the volume on the speakers.



If your system tray (i.e., the *notification area*) is cluttered, making the little speaker icon hard to find, you can access the Play Control dialog box by opening the Sounds and Audio Devices applet in Windows XP's Control Panel. On the Volume tab—the one that's on top by default—click the Advanced button under Device volume. In Windows Vista/7, open the Sound applet and double-click on the playback device you want to adjust. Under the Levels tab in the Properties dialog box, use the slider to adjust the volume.

If you don't have a little speaker in your system tray at all in Windows XP, you can add it. Just check the box next to the *Place volume icon in the taskbar* option in the Sounds and Audio Devices Properties dialog box, Volume tab. In Windows Vista and Windows 7, right-click on the taskbar and select Properties. Click the Customize button under Notification area. Use the Notification Area Icons applet to enable the volume controls. Presto!



• **Figure 25.26** Creative Labs 3DMIDI Player program

If the speaker volume is okay, open the volume controls in Windows by clicking the little speaker icon on the system tray, and make sure that both the master volume and the volume of the other controls are turned up (see Figure 25.27).

Speakers The second place to look for sound problems is the speakers. Make sure the speakers are turned on and are getting good power. Then make sure the speakers are plugged into the proper connection on the back of the sound card. If this all checks out, try playing a sound, using any sound program. If the sound program *looks* like it is playing—maybe the application has an equalizer that is moving or a status marker that shows that the application is playing the sound—you may have blown speakers. Try another pair and see if the sound returns.

Configuration Problems

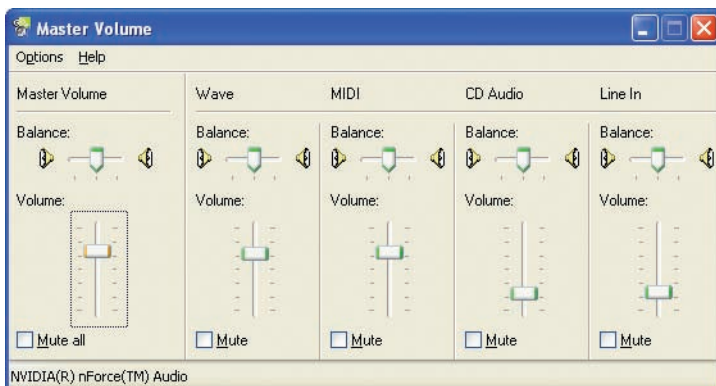
Configuration errors occur when the sound card is physically good but some setting hasn't been properly configured. I also include drive problems in this category. These errors happen almost exclusively at installation, but they can appear on a working system, too.

The first place to check is Device Manager. If the driver has a problem, you'll see it right there. Try reinstalling the driver. If the driver doesn't show any problems, again try playing a sound and see if the player acts as though the sound is playing. If that's the case, you need to start touring the Sound applet or Sounds and Audio Devices applet to see if you've made a configuration error—perhaps you have the system configured for 5.1 when you have a stereo setup, or maybe you set the default sound output device to some other device. Take your time and look—configuration errors always show themselves.

Application Problems

Application problems are always the hardest to fix and tend to occur on a system that was previously playing sounds without trouble.

First, look for an error message (see Figure 25.28). If an error code appears, write it down *exactly* as you see it and head to the program's support site. Odds are very good that if you have the error text, you'll get the fix right away from the support site. Of course, you can always hope the



• **Figure 25.27** Volume controls in Windows XP



Tech Tip

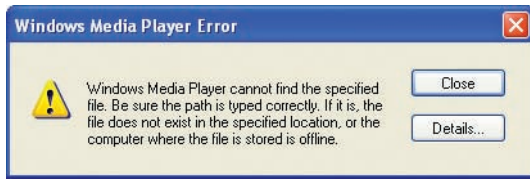
Sound Quality

Most of the time, speakers come in a matched set—whether it's a 2.1, 4.1, 5.1, or other system—and the manufacturer includes adequate connecting wires for the whole set. On occasion, you might run into a system in which the user has connected pairs of speakers from different sets or rigged a surround sound system by replacing the stock wires with much longer wires. Either option can create a perfectly functional surround sound system that works for a specific room, but you should make sure that all the speakers require the same wattage and that high-quality wire is used to connect them.

If you troubleshoot a system in which two of the speakers are very quiet and two are very loud, the wattages are probably different between the two pairs. A simple check of the labels should suffice to troubleshoot, or you can swap out one pair for a different pair and see if that affects the volume issues. Cheap wire, on the other hand, simply degrades the sound quality. If the speakers sounded good before being strung on long wires but they now have a lot of low-grade noise, blame the wires.



Technically speaking, turning down the volume in the volume control program isn't a configuration problem; it's just something I always check at the same time I check the volume on the speakers.



• **Figure 25.28** Sample error message

built-in help has some support, but help systems tend to be a little light in providing real fixes.

Don't always blame the sound application—remember that any sound file might be corrupted. Most sound players will display a clear error message, but not always. Try playing the sound file with a different application.

Last, a good approach almost always is to reinstall the application.

■ Video Capture

A microphone, sound card, and software enable you to capture audio, but with a camera capable of capturing full-motion video as well as sound, you can turn the PC into your very own movie studio. This is called **video capture**. To capture video from another source requires you to have the proper hardware installed to provide an interface with the camcorder or video player and, if the source is analog, provide translation of the signal as well; plus you need a properly configured application to do the capturing. Once captured, you can use an application to edit the video file and upload it to YouTube or save it to DVD or other removable media.



Some video capture devices are external, while others are internal PCI or PCIe cards. If you have an internal video capture card, install it into your PC as you would any other expansion card.

Hardware

You need the proper hardware installed to capture video. From a digital signal, such as a modern camcorder that records directly to its own internal solid state hard drive, you simply run a cable from the USB out port on the camcorder to the USB port on your computer. When capturing from an analog source, such as a VHS cassette player or a Hi-8 tape, you'll need some kind of connection and translation hardware.

The Pinnacle Studio MovieBox Ultimate (pictured in Figure 25.29), for example, offers two different dedicated video connections (S-Video in the middle and the yellow RCA jack next to it) and stereo RCA audio jacks. The box uses a USB 2.0 connector to plug into the PC.

You need a decent-grade computer with lots of free hard drive space and a substantial amount of RAM to import the video and audio streams from an external source. And you'll certainly need a serious processor when it comes time to edit and compile a new video from the source material. There's no simple rule for how much of any resource you'll need. Different projects have different demands on the hardware. If you're setting up a new computer for video capture, the simple rule is to get as powerful a system as possible with as much hard drive and RAM capacity as you can afford.

Once you have the hardware in place, the true heavy lifting in video capture falls on the software.

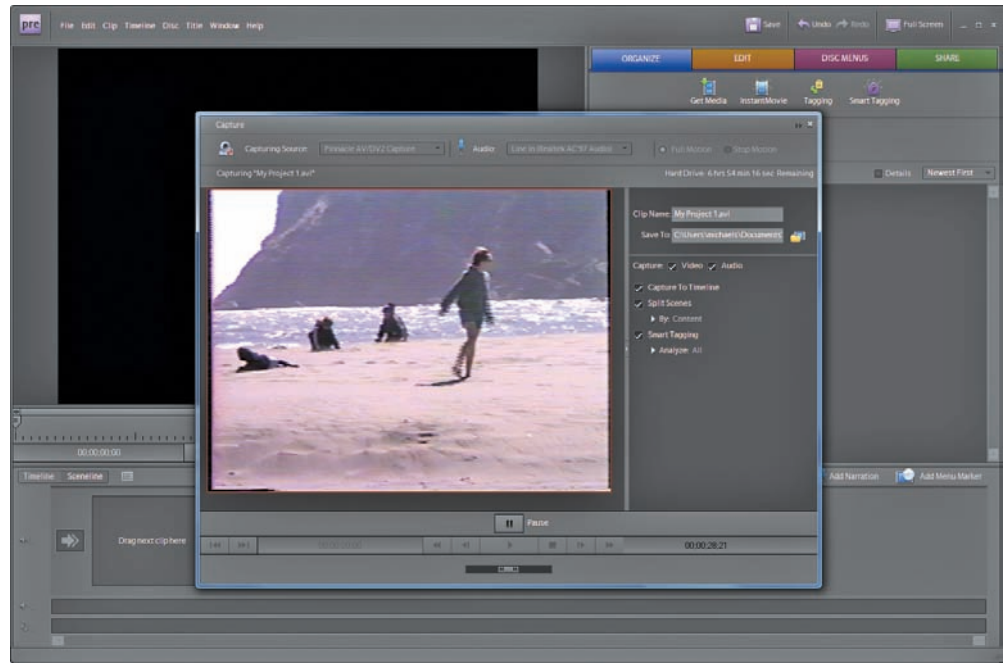


• **Figure 25.29** A video capture device

Software

With video editing applications, such as Adobe Premiere Elements or Apple Final Cut, you can import video and then work with it directly. Figure 25.30 shows the former software capturing video and audio translated through the Pinnacle blueBox from a Hi-8 camcorder. Most webcams—even those built into portable computers—are analog rather than digital devices. Thus some software automatically creates break points in the import to make the editing process easier.

The video editing software enables you to take video and audio from one or many sources and arrange clips into a time line. You can add and edit various transitions between clips, shorten clips, and so on. Figure 25.31 shows the storyboard from Final Cut Pro and a how-to video my team produced in-house.



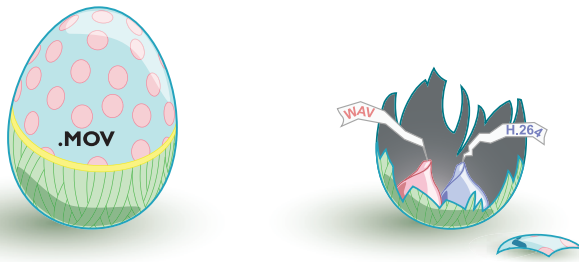
• **Figure 25.30** Importing video in Adobe Premiere Elements



• **Figure 25.31** Editing in Final Cut Pro

Once you've finished the editing process, you can export to a file for archiving, sending out on optical disc, or posting to a video sharing site. With an audio file, as discussed earlier, this is a simple process. You pick a format such as MP3 and save the file. Video is far more complicated.

A video is two or more separate tracks—moving picture and audio—that each go through a compression algorithm. Otherwise, the resulting files would be huge, even for short videos. The compressed tracks then get wrapped up into a **container file**, what's often called a **wrapper**. When you receive a file saved in a standard wrapper, such as .MOV for a QuickTime Movie file, you have no way to know for certain which codecs were used to compress the video or audio tracks inside that container file (see Figure 25.32).



• **Figure 25.32** A standard container file holds multiple tracks, each encoded separately.

Codecs

Video files use standard audio codecs for the audio tracks, such as WAV or MP3, but vary wildly in the type of video codecs used. Just as with audio codecs, video codecs take a video stream and compress it by using various algorithms. Here are some of the standard video codecs:

- MPEG-2 Part 2, used for DVDs
- MPEG-4 Part 2, a codec often used for Internet broadcasts; you'll find implementations of it with other names, such as DivX
- H.264, used for high-definition movies for Blu-ray Discs, among others
- Windows Media Video (WMV), the family of Microsoft-developed codecs
- Theora, an open-source codec developed to go with the Vorbis audio codec as part of the Ogg project
- TrueMotion VP6, used in Adobe Flash; and VP7, used for Skype video conferencing, among others
- VC-1 is a Microsoft-designed codec that competes with H.264 and other higher-end codecs for the hearts and minds of Blu-ray Disc developers. You'll usually find it wrapped in a WMV container file (see the following section).

Wrappers

When both the video and audio streams of your video file are compressed, the file is placed into some sort of container file or wrapper. The key thing to note here is that the wrapper file doesn't necessarily specify how the video or audio tracks were encoded. You can look at two seemingly identical movie files, for example, both saved with the .MOV file extension, and find that one will play audio and video just fine in Windows Media Player, but the other one might play only the audio and not the video because

Media Player lacks the specific codec needed to decode the video stream. (More on this in the “Troubleshooting Video Capture and Playback” section.) Here are some of the standard video wrappers:

- ASF, a container used mainly for WMA and WMV streams; note that you can also have a WMV wrapper for a WMV-format file.
- AVI, the standard container file for Windows
- Flash Video (.FLV) contains streams encoded with various codecs, such as H.263 or VP6; it can also handle H.264 codec. Flash Video has become the dominant standard for displaying video content on the Web through places such as YouTube and Hulu.
- MOV, the standard container file for Apple QuickTime for both Mac OS X and Windows
- MPEG-2 Transport Stream (MPEG-TS), a container for broadcasting that can handle many streams
- Ogg, a container file made for the open source Vorbis and Theora codecs

Troubleshooting Video Capture and Playback

Video capture and playback suffer from several quirks. On the capture side, you’ll find dropped frames, problems synchronizing video and audio when capturing content from an analog device, and generally poor-quality captures. On the playback side, the only real issue is missing codecs.

Dropped Frames

Many things cause an initial capture to drop frames, the end result of which is loss of video information and choppy playback. This happens with both analog and digital sources, so it’s not necessarily a conversion issue, and it’s maddeningly common.

The most common fix for dropped frames is to *turn stuff off*. Some of this is obvious. If you’re surfing the Web or doing instant messaging while trying to capture video, you’ll drop frames with wild abandon. Don’t do it. In fact, disconnect the computer completely from the Internet so no traffic happens in the background. Only do video capture on that machine and use another computer if you need to multitask.

Often the viewing of content you’re capturing—while in the capture process—causes dropped frames. Best practice is to know what you’re importing, turn off the playback or preview feature, and then start the capture. But the obvious programs aren’t necessarily the primary cause of dropped frames.

Windows is a wildly extensible operating system, and programmers love to dump helper applications to run in the background to optimize their specific application. Install Apple’s iTunes, for example, and you’ll get more than you bargained for in programs installed. To go along with the iTunes player, the installation puts in automatic update-checking tools, iPod helpers, a quick-launch for QuickTime, and more.

The best solution is to have a machine dedicated to video capture. If you have a machine with multiple functions, however, you can turn off some of the automatically loading helper applications before you start the video capture process. You do this by stopping processes and services through Task Manager.



There's also a common problem of video and audio going out of sync in the process of burning from a hard drive to a DVD, but that's a distinctly different problem than a lack of A/V sync in the capture process.

Sync Problems

Capturing a video stream and an audio stream simultaneously can be tough, because it takes the computer a lot longer to encode the video stream than the audio stream. This can lead to significant disconnection between the video and audio streams, so they become desynchronized. It's surprisingly easy to create a movie that's very badly lip-synced! The process of synchronizing audio and video is called **A/V sync**.

You can fix this problem sometimes by changing software or even versions of software. Alternatively, if you're having problems with an analog capture, you can record the analog signal into a digital video camcorder and then try to capture from the digital device—a bit clunky, perhaps, but it can work. Finally, you do the last solution in processing, where you manually separate the audio and video streams and then put the whole thing back together synced properly.

Dealing with video capture can be difficult and time consuming, especially in the analog to digital process. A good resource to start learning the detailed ins and outs is with the folks at the Digital FAQ: www.digitalfaq.com.

Poor Capture Quality

Numerous factors can degrade the quality of a video capture, including background programs, marginal hardware for the job, and poor-quality source materials. For the background program issue, follow the same procedures as you did above with the dropped frames. If the computer or the capture components can't do the job, the only fix is to upgrade. The best things to upgrade are the capture hardware and the CPU. It goes almost without saying that you'll need gobs of RAM too.

There's very little you can do if your source material, such as an old video cassette, has degraded. You're simply not going to get a pristine capture from a damaged source. You can sometimes get better quality by having the heads on the camcorder or player cleaned or by using the camcorder on which the tape was initially recorded.

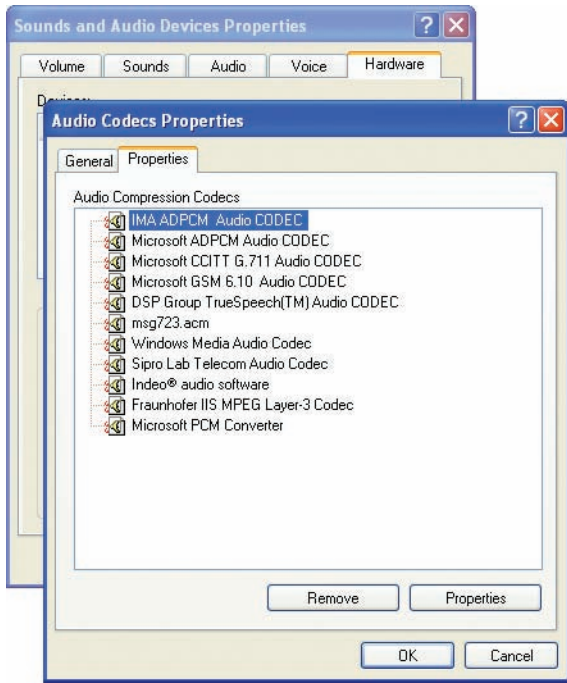
Missing Codecs

All versions of Windows come with some audio and video codecs installed. The default audio codecs will handle most common music formats, though you'll need to download the Vorbis codec if you want to use that format. Video codecs are a different animal.

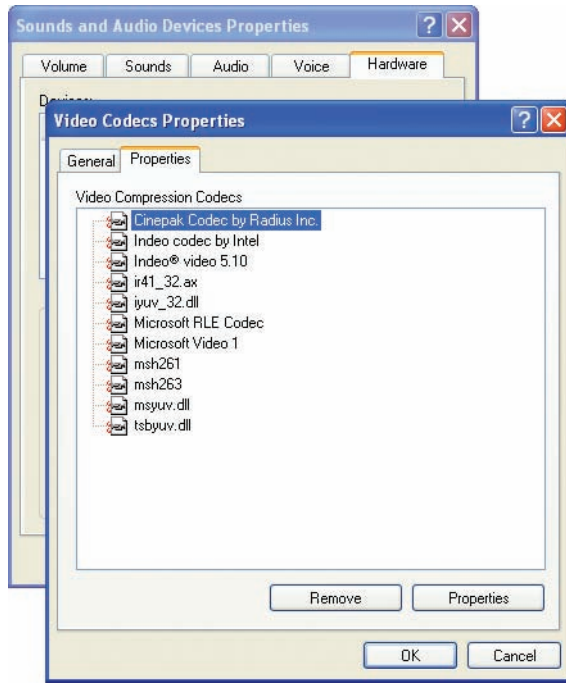
The first clue you might have that your computer doesn't have the codec to process a video file properly is that the sound will play but no picture will appear. Occasionally, whatever media player you use will tell you that it's missing a video codec and attempt to go out onto the Internet to download a codec automatically. You can also download a codec or set of codecs manually.



A dedicated A/V computer should have a fast processor and a lot of RAM. You'll want plenty of hard drive storage space too.



• **Figure 25.33** Default audio codecs in Windows XP SP2



• **Figure 25.34** Default video codecs in Windows XP SP2

Windows XP makes it easy to see the installed codecs. In the Control Panel, open the Sounds and Audio Devices applet. Select the Hardware tab | Audio Codecs and click the Properties button. In the Audio Codecs Properties dialog box, select the Properties tab and you'll see all the installed audio codecs (see Figure 25.33).

Similarly, you can see the video codecs by choosing the Video Codecs option on the Hardware tab. Click through to the Properties tab. Figure 25.34 shows the default video codecs in Windows XP.

Microsoft made the codecs a bit more difficult to find in Windows Vista/7. In Vista/7, open Windows Media Player. Press CTRL-M to show the classic menus. Select Help | About Windows Media Player to open the About Windows Media Player dialog box (see Figure 25.35).

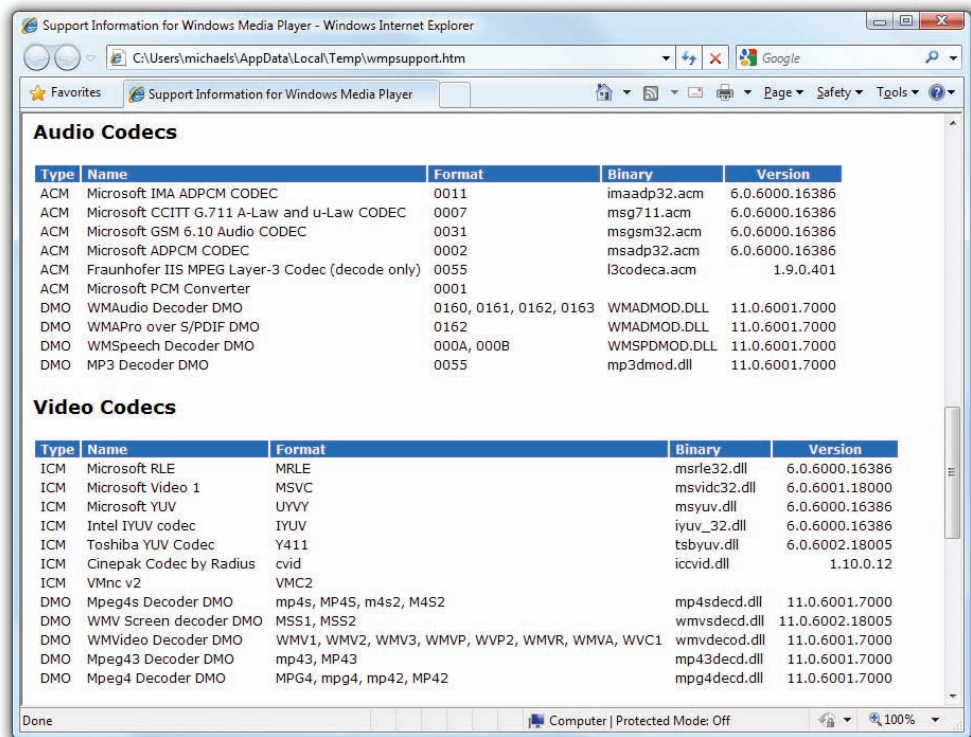
Click the link for Technical Support Information and Windows will open your default Web browser with a long page showing various multimedia settings. Scroll down the page and you'll find the audio and video codecs installed (see Figure 25.36).

If you don't have a codec that you need, you can download that specific codec. A great site for codec information is www.fourcc.org.

You can also download codec packs, such as the Vista Codec Package available at www.afreecodec.com. The packs contain just about everything you need to view and hear content found on the Internet.



• **Figure 25.35** About Windows Media Player dialog box in Windows Vista



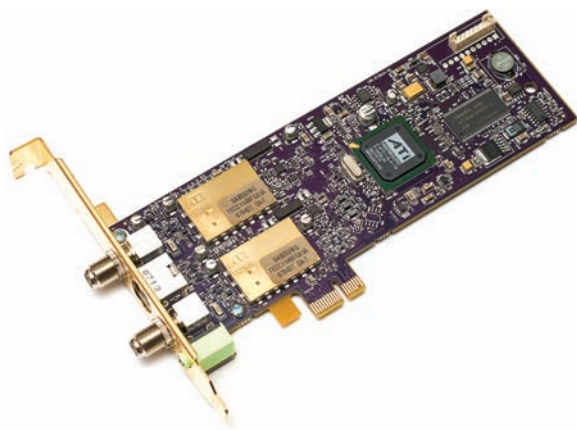
• **Figure 25.36** Viewing audio and video codecs installed in Windows Vista

■ TV Tuners



TV tuners often include components for video capture, so you can get both devices on one card or expansion device.

With a **TV tuner**, you can have it all in one package: a computer and the latest TV show as well. Most local stations (in the United States, at least) broadcast high-definition signals, so with the proper TV tuner, you can watch your HDTV without any of the artifacting you see with both cable and satellite feeds. Plus you can make use of typical cable or satellite feeds to watch television as you would with a regular TV. To make it all happen requires four components: a tuner device, an antenna or cable connection, a tuning application, and some sort of program guide. We'll look at troubleshooting at the end.



• **Figure 25.37** ATI TV tuner card

Tuner Hardware

TV tuners come in just about every expansion option available for computers: expansion cards that plug into PCI or PCIe slots on the motherboard; PC Card or ExpressCard for portable computers; or Hi Speed USB for desktop and laptop computers. Figure 25.37 shows a PCIe version of an ATI tuner card.

To install a TV tuner, follow standard installation procedures.

To pick up a signal on the TV tuner, just as with a stand-alone television, you need some source. Most can handle a



Cross Check

Monitor Quality

The signal is not the only thing that affects your picture quality with a TV tuner. The quality and settings of the monitor itself matter a lot too. Viewing an HDTV signal on a 15-inch dim LCD won't quite do the content justice! Refer to Chapter 21 and see if you can answer these questions. What sort of response rate works for full-motion video without blurring? What does "native resolution" mean and what's the effect of using a non-native resolution? What tool do you use to change video settings in Windows XP? What about Windows Vista or Windows 7?

cable TV connection, for example, or an over-the-air antenna. Figure 25.38 shows a USB Hauppauge HDTV tuner card with retractable antenna. For such a small device, it picks up HDTV signals quite well. You'll get the best results for uncompressed HD signals by using a serious, mounted-on-the-rooftop metal antenna with lots of tines.

Tuner hardware comes with a standard coaxial connection. You can plug in a cable or satellite source just as you would with any regular television.

Tuner Software

Once you've installed the hardware, you need to load the specific application or applications that make the tuner work as a tuner. If you have a copy of Windows Media Center, that will often be the tool of choice. Tuner card distributors bundle third-party applications with their cards. Figure 25.39 shows the EyeTV software enabling the computer to show television shows.



• **Figure 25.38** Hauppauge TV tuner with retractable antenna



• **Figure 25.39** EyeTV tuner application

Tuner Troubleshooting

The two biggest issues with TV tuner devices are operating system compatibility and poor reception. Some cards simply don't work with Windows Vista or Windows 7, due to driver incompatibility or some other issue. The only fix for this problem is to use one that does work.

The antenna that comes with your tuner should enable you to pick up TV broadcasts in most places, certainly around cities. But a small sliver of metal can only do so well, so you'll experience stuttering, essentially lost frames that may or may not make the program you're viewing viewable. So an antenna used primarily for portable computing, such as the telescoping model pictured in Figure 25.38, is great, but if you install a tuner in a static computer, consider investing in a proper outdoor antenna.

Beyond A+

Publishing Multimedia

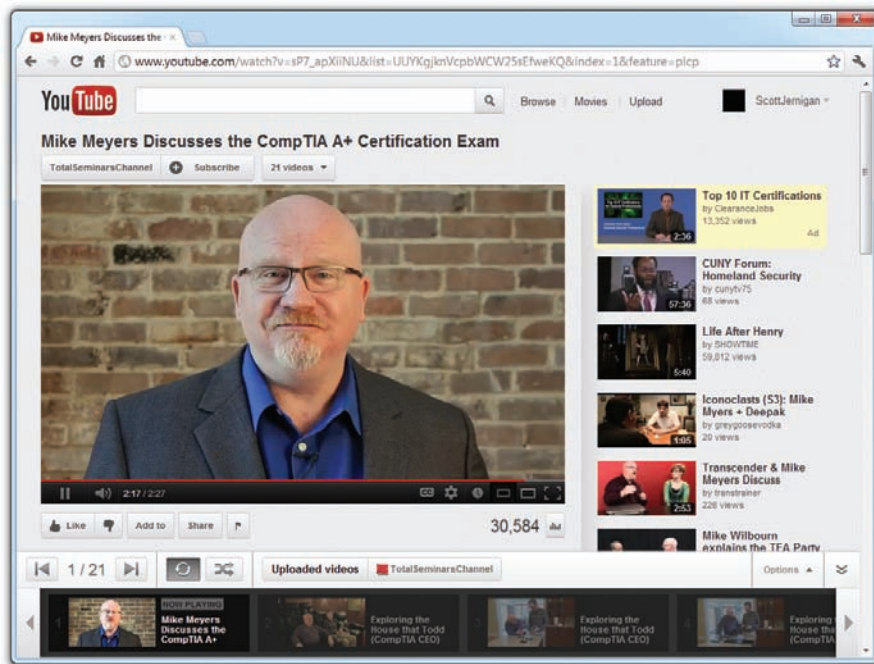
Created content needs an audience, whether that audience is close family, friends, or the general public. Once you've finished recording some original

music or creating the new great video, the Internet today offers many venues for sharing with others. Any Web site can host video and sound files, but social media sites like Facebook make it easy to share multimedia files. The 800-pound gorilla in the virtual room, though, is Google's YouTube.

You can get a YouTube account for free and start uploading multimedia files within minutes. The files can be made available to the public or kept private according to your preferences. With ad revenue capabilities, you can make money off multimedia files you post to YouTube as well. Finally, you can post to YouTube and then embed files into your Web site with ease.

I embed the CompTIA A+ videos I make at my Web site:

www.totalsem.com/videos



• Figure 25.40 Hi!

You can also access them directly from Total Seminars' YouTube channel (see Figure 25.40).

When you want to publish your multimedia files, go to www.youtube.com and create a new account. Don't forget to send me a link!

Chapter 25 Review

■ Chapter Summary

After reading this chapter and completing the exercises, you should understand the following aspects of multimedia.

Describe how to implement sound in a PC

- The process by which sounds are stored in electronic format on your PC is called sampling. Sampling means capturing the state or quality of a particular sound wave a set number of times each second. All the characteristics of a particular sound wave—amplitude, frequency, timbre—need to be recorded and translated into ones and zeros to reproduce that sound accurately within the computer and out to your speakers. Sounds are sampled thousands of times per second. The amount of information stored at each sampling is called the bit depth, and the higher the bit depth, the better the recording.
- The popular WAV file format (as well as most other recorded sound formats) is based on PCM. WAV files can be huge, especially when sampled at high frequency and depth, so compression is a popular way to reduce the file size of recorded sounds. The most popular compressed file type is MP3.
- To play sounds, you must have some form of player software, such as Windows Media Player. Not all players can play all types of sound files. Some file formats, such as RealMedia, require their own proprietary players.
- MIDI files are not recordings like WAV files. A MIDI file is a text file that takes advantage of the sound processing hardware to enable the PC to produce sound. Programmers use these small files to tell the sound card which notes to play, how long, how loud, and on which instruments to play them, and so forth.
- Sound cards use either FM synthesis or wave table synthesis to store notes for MIDI. FM synthesis electronically simulates various instruments, whereas wave table synthesis uses pre-recorded instruments.
- A large number of other sound file formats are available, such as AAC and WMA. Sounds can also be found in video formats, applications, and streaming media, such as the Flash videos on YouTube.
- Low-end sound processors do little more than translate, which means that the CPU has to do the heavy lifting on the processing front. Better sound processors, in contrast, shoulder much of the processing burden and bring a series of extra features to the table. Most mid-range and all high-end sound processors offer support for various surround sound standards, enabling equally equipped games and other applications to provide positional audio effects and detailed sound modeling.
- Every sound card supports two speakers or a pair of headphones, but many better sound cards support five or more speakers in discrete channels. These multiple speakers provide surround sound and thumping bass through a subwoofer.
- Better sound cards have a lower signal-to-noise ratio and support for multiple audio connections, such as a microphone, line in, and S/PDIF. The latter is for high-end audio.
- Speaker standards include stereo (which uses a left speaker and a right speaker), 2.1 (stereo with an additional subwoofer), and surround sound. Do yourself or your client a favor and spend the extra money for good speakers. They don't cost that much more than cheap speakers and they make an enormous difference for the user experience.
- Surround sound is popular for games and DVD/Blu-ray movies. A number of surround sound standards exist, but the most common are Dolby Digital and DTS. The Dolby Digital and DTS standards both require at least five speakers and a subwoofer.
- You can use input devices such as microphones and MIDI-enabled devices to create music on your PC. You'll need software that can work with these devices.
- Sound card installation can be divided into three major steps: physical installation, device driver installation, and configuration.

- Although the physical installation of a sound card is straightforward, knowing where to plug in multiple speakers can be a bit of a challenge.
- It is preferable to use the driver that comes with the sound card as opposed to the Windows built-in drivers.
- Look for configuration programs in the Control Panel applet for audio, and in any proprietary applications that are installed with the sound card.
- You can divide sound problems into three groups: hardware, configuration, and application problems. The two first places to check when you suspect a hardware problem are the volume controls and speaker connectivity. Configuration errors almost always take place at installation of the sound card. Application problems are often the most challenging of all sound problems. Your best hope is an error message; you can then check the program's Web site for help.

Install and configure video capture hardware and software

- To capture video from a source requires you to have the proper hardware installed to provide an interface with the camcorder or video player and, if the source is analog, to provide translation of the signal as well. You also need a properly configured application to do the capturing.
- With a fully digital device, you can capture directly to the PC by using a FireWire or USB connection. With analog devices, you need some sort of translation hardware.
- A computer dedicated to video capture and editing needs to be a pretty stout machine, with lots of hard drive space and RAM. The capture and editing software has a major role in determining the quality of the capture and any subsequent video.
- A video is two or more separate tracks—moving picture and audio—that each go through a

compression algorithm. The compressed tracks then get wrapped up into a container file or wrapper. A video can be compressed in one of the standard audio codecs, such as MP3, and one of many video codecs, such as H.264. The wrapper can likewise be one of many styles, such as AVI.

- Troubleshooting video capture generally falls into three categories: dropped frames, synchronization problems with audio and video, and general picture-quality issues. The simplest solution for dropped frames is to turn off any unnecessary program running, including processes and services. Sync problems generally require better software or additional hardware to solve. Poor-quality captures can be helped with better equipment or by turning off unnecessary programs, though a poor-quality source cannot be overcome.
- If you're missing a codec to play a video, you can download codec packs from a variety of sources. The place to start is www.fourcc.org.

Set up a PC to view television signals

- Setting up a PC to view television signals requires several components: a tuner device, an antenna or cable connection, a tuning application, and some sort of program guide. Tuner hardware comes in many forms, such as PCI or PCIe expansion cards and USB devices. Tuner devices come with a standard coaxial jack for connecting an exterior antenna or cable or satellite connection. Companies bundle specific tuner software and program guides with their cards.
- About the only issues you'll run into with tuner devices is software incompatibility (older cards, for example, might not have drivers for Windows Vista or Windows 7, or for any 64-bit operating system) and poor source. A small antenna simply can't capture the same quality or quantity of signal that a large, multi-tined traditional outdoor antenna can get.

■ Key Terms

2.1 (962)

5.1 (962)

AC'97 (958)

amplitude (953)

autosensing (969)

A/V sync (976)

bit depth (954)

CD quality (954)

codec (954)

container file (974)

decibels (959)
Digital Theatre Systems (DTS) (962)
DirectSound3D (DS3D) (962)
DirectX (962)
Dolby Digital (962)
environmental audio extensions (EAX) (963)
FM synthesis (955)
frequency (953)
Intel High Definition Audio (HDA) (958)
MIDI-enabled device (965)
monaural (954)
MP3 (954)
musical instrument digital interface (MIDI) (954)
polyphony (955)

positional audio (962)
pulse code modulation (PCM) (954)
sampling (953)
satellites (962)
signal-to-noise ratio (959)
Sony/Philips Digital Interface (S/PDIF) (962)
stereo (954)
streaming media (957)
subwoofer (959)
timbre (953)
TV tuner (978)
video capture (972)
wave table synthesis (955)
wrapper (974)

■ Key Term Quiz

Use the Key Terms list to complete the sentences that follow. Not all terms will be used.

1. A sound card can simulate a number of different instruments by using _____.
2. Unlike recorded sounds, _____ uses specialized text files that tell the sound card which sounds to play.
3. 44.1-KHz stereo is also known as _____ audio.
4. The process of capturing the state or quality of a particular sound wave a set number of times each second is called _____.
5. The most common compressed audio format is _____.
6. A series of instructions telling a computer how to read a compressed file is called a(n) _____.
7. You can view television channels on your computer by using a(n) _____.
8. To enable a computer to record full-motion video and sound, use _____.
9. The loudness of a sound is called its _____.
10. Better sound cards that can detect a device plugged into a port and adapt the features of that port are called _____ sound cards.

■ Multiple-Choice Quiz

1. CD-quality sound samples are recorded at 44 KHz, with 16-bit depth and what else?
 - A. Monaural
 - B. Stereo
 - C. 5.1
 - D. 2.1
2. What is the most common compressed sound format?
 - A. MP3
 - B. WAV
 - C. VOC
 - D. TXT
3. Almost all sound cards use which expansion bus?
 - A. ISA
 - B. AGP
 - C. Internal
 - D. PCI

4. Which audio file format can compress sound files without losing any data?
 - A. MP3
 - B. MIDI
 - C. WAV
 - D. FLAC
5. Which component of DirectX offered only a range of commands to place a sound anywhere in 3-D space?
 - A. DirectSound
 - B. DirectSound3D
 - C. EAX
 - D. A3D
6. What is the name of the direct competitor to Dolby Digital?
 - A. DirectSound
 - B. DirectSound3D
 - C. DTS
 - D. Surround Sound
7. To what does the .1 in 5.1 or 2.1 refer?
 - A. Volumetric sound positioning
 - B. Subwoofer
 - C. Subchannels
 - D. Reverb positional matrices
8. Which version of DirectX introduced DirectSound3D?
 - A. Version 8.0
 - B. Version 3
 - C. Version 2
 - D. Version 1
9. Jane's sound card is suddenly not making any sound. She suspects that the volume is turned down. She checks the speaker volume and sees that it is turned up. What should she check next?
 - A. The volume control program
 - B. The application
 - C. The speaker power
 - D. Device Manager
10. What type of file is a MIDI file?
 - A. Audio
 - B. Binary
 - C. MP3
 - D. Text
11. Which company created the SoundBlaster sound card?
 - A. Creative Audio
 - B. Creative Labs
 - C. EAX
 - D. Microsoft
12. You want to copy audio from a CD player onto your computer. To which jack on the sound card should you connect your CD player?
 - A. Line in
 - B. Microphone
 - C. Line out
 - D. Digital out
13. Which term refers to recording sound on a PC?
 - A. Import
 - B. Capture
 - C. Encode
 - D. Compress/decompress
14. What does PCM stand for?
 - A. Pulse code modulation
 - B. Pulse code manipulation
 - C. Peripheral component management
 - D. Packaged codec management
15. If the first movement of Beethoven's Fifth Symphony were saved as a computer file, which file type would be the smallest in size?
 - A. MP3
 - B. WAV
 - C. ASF
 - D. MIDI

■ Essay Quiz

1. Detail in your own words how you think sound aided the evolution of the computer. What aspects of sound are necessary to computers? Why is sound needed?
2. Outline how you could use the connections provided on a modern sound card to create a multimedia home theater with your computer. Be sure to include hardware discussed in previous chapters, such as Blu-ray Disc and DVD-ROM drives.
3. Write an essay on the kind of TV tuner you would need for your computer. Detail what you personally would like to accomplish with your computer and how a TV tuner card would help you.
4. Your clients have been having trouble with dropped frames on video capture. Write a memo describing the things that they should check before calling for a technician.
5. Your boss has decided that all systems in the office need new speakers because the company that games together has more cohesion and happiness. Write a few paragraphs describing the speaker choices available and why one is better than the others.

Lab Projects

• Lab Project 25.1

Take a tour of the Web site for Creative Labs: www.creative.com. What sound-related products are currently featured there? Check out the specs for Creative's various SoundBlaster cards. Do you see sound cards that use an interface other than PCI?

Which features are available only on high-end cards? Which model would you choose to upgrade your current system? Which would you choose if you were building a new system?

• Lab Project 25.2

Uninstall and reinstall the audio drivers on your system. First, check your sound card manufacturer's Web site for an updated driver. Reinstall, using the most recent driver you can find. Do any problems

crop up during the process? After you get the new driver installed and working, do you notice an improvement in performance?