

Multimedia

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, 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

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 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 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 troubleshooting 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, 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).



NOTE Every modern motherboard comes with sound processing capabilities built in. By default, techs talk about built-in sound as either built-in sound or as a *sound card*, even when there's no expansion card for sound.

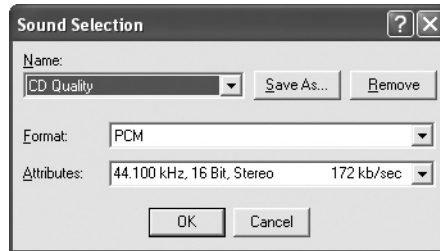
Sounds vary according to their loudness (*amplitude*), how high or low their tone (*frequency*), and the qualities that differentiate the same note played on different instruments (*timbre*). All the characteristics of a particular sound wave—amplitude, frequency, timbre—need to be recorded and translated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

The number of characteristics of a particular sound captured during sampling is measured by the *bit depth* of the sample, the number of bits used to describe the characteristics of a sound. 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.

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 20-1 shows the configuration settings for the Windows Sound Recorder.

Figure 20-1
Sound Recorder
settings



Hey, wait a minute! Did you notice the Format setting in Figure 20-1? 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*.



NOTE 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.

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.

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 what notes to play, how long, how loud, on which instruments, and so forth. Think of a MIDI file as a piece of electronic sheet music, with the instruments built into your sound card.



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

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 song 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!



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

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. Apple wraps downloaded songs in a Digital Rights Management (DRM) encapsulation called FairPlay that gives them control over distribution of those songs.
- **AIFF** Audio Interchange File Format files are a popular sound format used on Macintosh computers. These files 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 play other sound file types as well. The full name of the format is Microsoft Advanced Streaming Redirector.
- **AU** This popular format is often seen in the Windows world. Many players can play these files, including players on non-Windows systems, such as Sun, Next, UNIX, and Macintosh.
- **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 20-2 shows the default Media Player for Windows Vista.



Figure 20-2 Windows Media Player

You can download many other players, of course, including iTunes, Apple's media program for Windows and 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. The three most popular streaming media players are Windows Media Player, Winamp, and Apple's iTunes. With the spread of broadband Internet, the quality of streaming radio has improved dramatically. In fact, it is common to see Internet stations streaming 128 Kbps and better MP3 files. Some sites even have surround sound music for those who have the speakers to appreciate it.

Essentials

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.



NOTE The hardware portion of sound-processing equipment in the PC comes either as a chip built into the motherboard or as an expansion card. Techs call both forms sound cards, though technically the first type is not a card at all. Still, the generic term has stuck for the time being.

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.



NOTE 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.



NOTE 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!

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. 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 playing DVDs on their PCs. The card shown in Figure 20-3, for example, has outputs for many speakers.

Figure 20-3

A sound card with multiple speaker connections



Another popular speaker addition is a subwoofer. A *subwoofer* provides the amazing low-frequency sounds that give an extra dimension to all of your sounds, from the surround sound of a game to the music of a simple stereo MP3 file. 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 20-4 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

Figure 20-4
Surround
speakers (photo
courtesy of Klipsch
Group, Inc.)



is expressed in *decibels*. The smaller the number, the worse the card is for recording, because you're more likely 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 20-5).

Figure 20-5
The EMU 1820
advertises its
excellent
112-decibel signal-
to-noise ratio for
recording.

Features Specifications Software Requirements Reviews Accessories

Email Page Print Page

► **Digital Audio System**

The E-MU 1820 Digital Audio System delivers everything you need to produce audio on a PC with professional results- 24-bit/192kHz converters, hardware-accelerated effects and mixing, and seamless compatibility with your favorite PC audio/sequencer software. The 1820 offers musicians a comprehensive array of I/O options to cover every recording application at an unbeatable price.

The E-MU 1820 features:

- **Premium 24-bit/192kHz converters** - 112dB signal-to-noise ratio for pristine recording and playback of your tracks
- **Hardware-accelerated effects** - over 600 standalone and E-MU Power FX VST plug-in effects with no CPU overhead
- **PatchMix™ DSP zero-latency hardware mixing and monitoring** - with super-flexible patchbay - no external mixer needed

Hardware

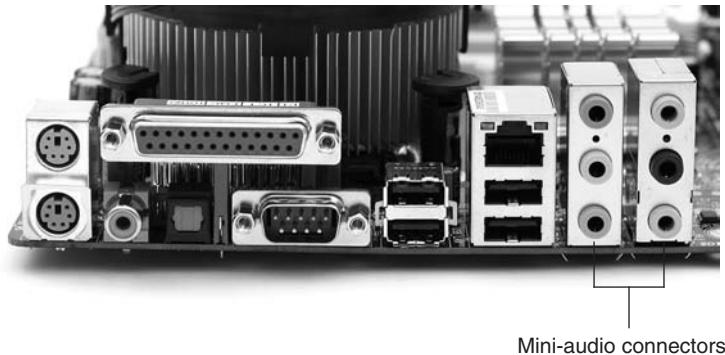
PATCHMIX

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 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 (Figure 20-6).

Figure 20-6

Typical audio connections on a motherboard sound card



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

- **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 cassette or CD player. This enables you to output sounds from your computer.
- **Line in** The line in port connects to an external device such as a cassette or CD 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 later in this chapter 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, DB15 female connection, but few motherboards or sound cards include the port these days.

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, DVD receiver, and surround sound speaker connection capabilities; 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 20-7 shows a version of the Creative Labs SoundBlaster breakout box. These features aren't for everyone, but they are compelling to many consumers.

Figure 20-7
Breakout box for
a SoundBlaster
Live! Platinum
sound card



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 (Figure 20-8).

Figure 20-8
High-quality
speaker set
(right) versus
another manufac-
turer's low-end
speaker set (left)



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 (Figure 20-9). The two speakers share a single jack that connects to the sound card. Most cheap speakers are stereo speakers.

Figure 20-9
Stereo speakers



A 2.1 speaker system consists of a pair of standard stereo speakers—called *satellites*—combined with a subwoofer (Figure 20-10). 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.

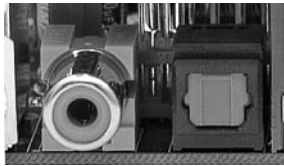
Figure 20-10
Typical 2.1
speakers



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

Figure 20-11
S/PDIF
connectors



or receiver (Figure 20-11). 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 20-11). 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.



NOTE 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.

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 positional 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 20-12 shows an EAX setup screen.

Figure 20-12
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 supports it. All current sound cards support DirectX and EAX.



NOTE 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.

Microsoft changed the way audio works in Windows Vista from the way it works in previous versions of Windows. Most notably, Vista 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. Other developers have gotten behind the OpenAL API to provide environmental audio effects in Vista. 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.

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 microphone jack on one of the speakers or on a control box.

Installing Sound in a Windows System

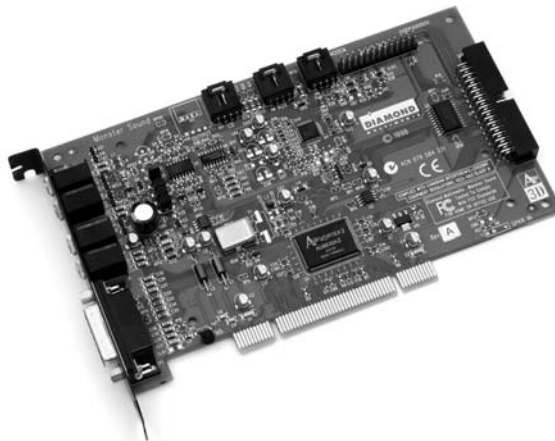
You've got two choices for sound hardware on today's PCs: a separate sound card or on-board sound built into the motherboard. The installation process for a sound card is basically the same as the process for any other card. You snap the card into a slot, plug some speakers into the card, load a driver—and 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 (Figure 20-13), 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 20-13

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 a CD-ROM 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 CD-ROMs that step you through the process (Figure 20-14).

Figure 20-14

Typical autorun screen for a sound card





NOTE 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.

You might run into one of the USB sound cards out on the market (Figure 20-15), 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, especially Windows XP and Vista, probably have basic drivers for these USB sound cards, but don't take a chance—always install the drivers first.

Figure 20-15
USB sound card



After your sound card and driver are installed, make a quick trip to the 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 step is to configure the sound card by using configuration programs and test it by using an application. Most sound cards come with both special configuration programs and a few sound applications on the same CD-ROM that supplies the drivers. Take a look at these extra bits of software that I call *sound programs*.

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, Sounds and Audio Devices in Windows XP, or Sounds and Multimedia in Windows 2000. Whatever the name, this applet (or applets) performs the same job: it provides a location for performing most or all of the configuration you need for your sound card. Consider the

Sounds and Audio Devices applet in Windows XP, for example; the Sounds and Multimedia applet in Windows 2000 works roughly the same, although it may have one control or another in a different place.

The Sounds and Audio Devices applet 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 20-16.

Figure 20-16
Advanced Audio
Properties
dialog box



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 (Figure 20-17) 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.)

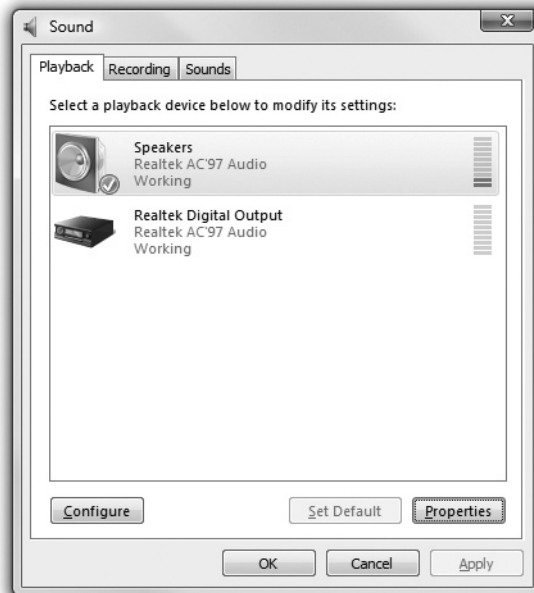
Figure 20-17
Audio tab



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

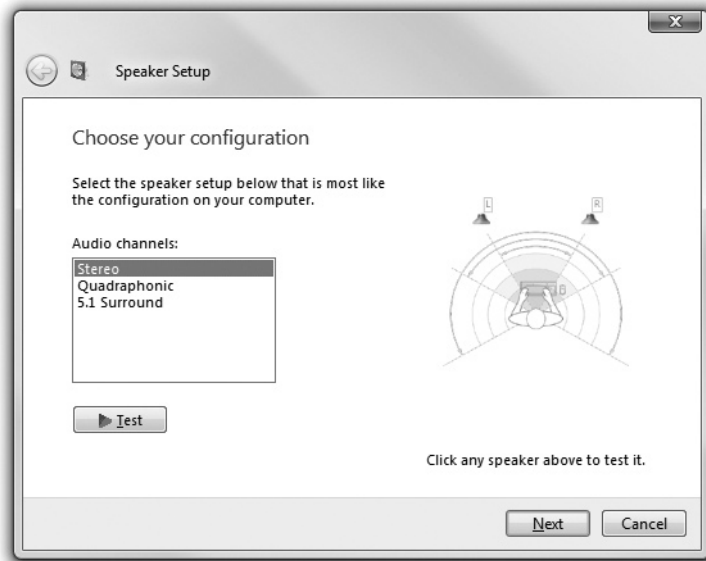
To configure speakers, go to Control Panel and click Hardware and Sound; then click Sound if in Category View or double-click the Sound applet if in Classic View. Either route opens the Sound applet (Figure 20-18).

Figure 20-18
Sound applet in
Windows Vista



Select the Speakers option and click the Configure button to open the Speaker Setup dialog box (Figure 20-19). Select the audio channel option that's appropriate for your setup, such as the 5.1 system selected for my setup at the office and shown in Figure 20-19. 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.

Figure 20-19
Speaker Setup
dialog box in
Windows Vista



Proprietary Configuration Applications Many sound cards install proprietary software to support configuration features not provided by Windows. Figure 20-20 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 20-21 shows the applet that came with my motherboard. One of its many interesting features is to detect what types of devices are installed into the sound ports and adjust 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 20-20
Creative Labs
Speakers and
Headphone panel



Figure 20-21
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 (Figure 20-22)—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.

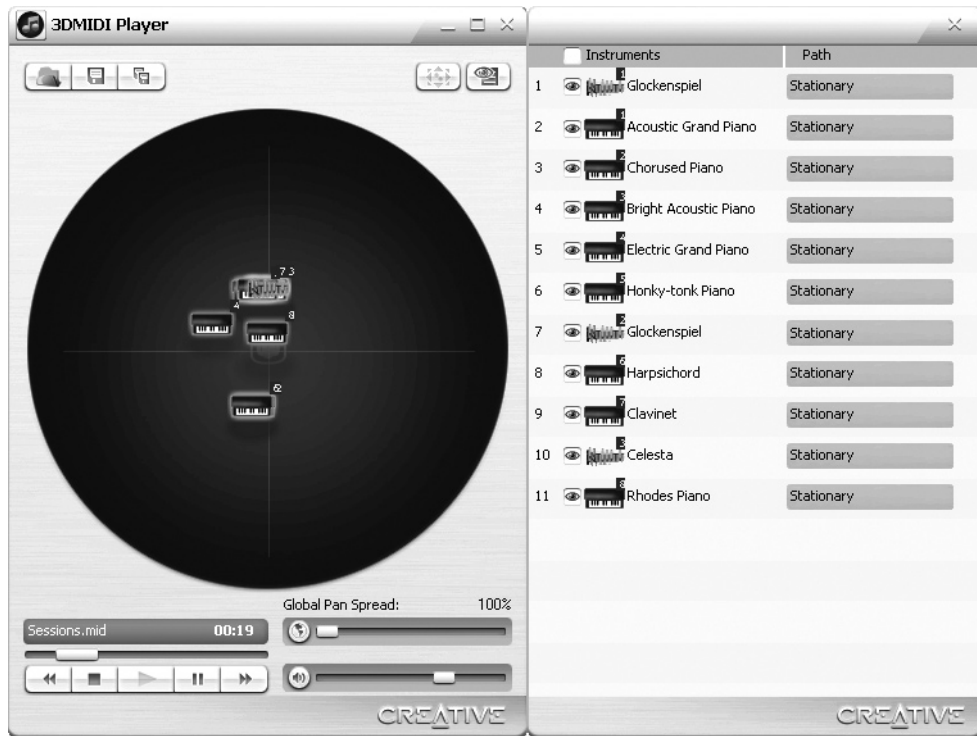


Figure 20-22 Creative Labs 3DMIDI Player program

Practical Application

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.

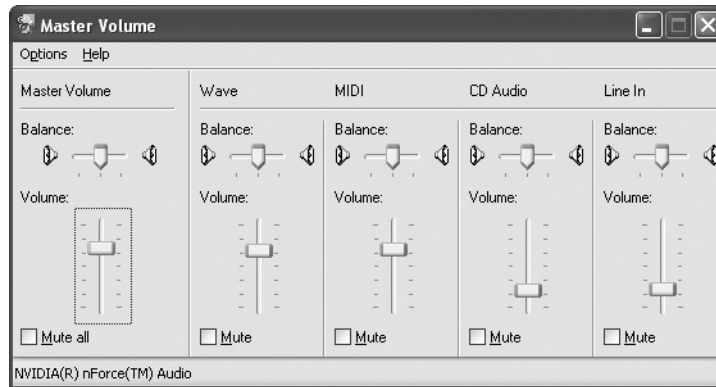
Hardware Problems

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 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 (Figure 20-23).

Figure 20-23
Volume controls
in Windows XP



NOTE If your system tray (i.e., the *notification area*) is cluttered and the little speaker icon hard to find, you can access the Play Control dialog box by opening the Sounds and Audio Devices applet in the Control Panel. On the Volume tab—the one that's on top by default—click the Advanced button under Device 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 Sound and Audio Devices Properties dialog box, Volume tab. Presto!

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.

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.

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.



NOTE 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.

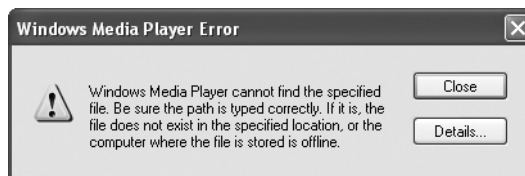
The first place to check is the Device Manager. If the driver has a problem, you'll see it right there. Try reinstalling the driver. If the driver doesn't show any problems, again try playing a sound and see if the player acts as though the sound is playing. If that's the case, you need to start touring 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 (Figure 20-24). 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 built-in help has some support, but help systems tend to be a little light in providing real fixes.

Figure 20-24
Sample error
message



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 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, 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. Then save it in some form for upload a la YouTube or save it to DVD or other removable media.

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 FireWire out port on the camcorder to the FireWire port on your computer. If the camcorder doesn't offer FireWire, it'll most likely use Hi-Speed USB. 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 blueBox pictured in Figure 20-25, for example, offers two different dedicated video connections (S-Video on the left and the yellow RCA jack next to it), stereo RCA audio jacks, plus a FireWire port (on the expansion card for it) for direct connection to FireWire onboard the camcorder. The breakout box uses a proprietary connection to plug into the PC.

Figure 20-25

A video capture device



NOTE The FireWire connection seems redundant—just go straight to FireWire on the PC, right? But it's there to accomplish two goals. First, many PCs don't have a FireWire port, so you would either need to add a FireWire expansion card or use a different type of port. Second, Sony produced a series of Hi-8 camcorders some years ago that had a FireWire connector. Some translation has to happen to turn the analog signal digital.

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.

Software

With video editing applications, such as Pinnacle Studio or Apple Final Cut, you can import video and then work with it directly. Figure 20-26 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.



Figure 20-26 Importing video in Adobe Premier Elements

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 20-27 shows the storyboard from Final Cut Pro and a how-to video my team produced in-house.



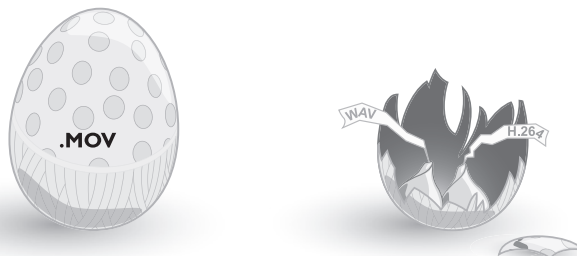
Figure 20-27 Editing in Final Cut Pro

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 (Figure 20-28).

Figure 20-28

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" 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; 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 Macintosh 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 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 the Task Manager.

In Windows Vista, get to the Task Manager by pressing **CTRL + SHIFT + ESC** or by pressing **CTRL + ALT + DELETE** and clicking the Start Task Manager option. The Processes tab shows your running processes. You can right-click any unnecessary process and close it by selecting *End process* or *End process tree* from the context menu (Figure 20-29). I generally go for the latter option, just in case some other process is running only because of the unnecessary process. That gets them all.

Once you've stopped processes, click over to the Services tab. You can quickly see what's running, by sorting services by status. Just click the Status column heading to sort. Right-click any unnecessary service and select Stop Service from the context menu (Figure 20-30). Couldn't be easier!

If you find you've stopped a necessary service, you can simply right-click it again and select Start Service from the context menu. Or, if the system has become unstable, a simple reboot will reload everything.



NOTE You can disable services in the Services applet in Administrative Tools, but it's usually better to stop a service first through Task Manager, just to see if it's truly unnecessary for system stability or function.

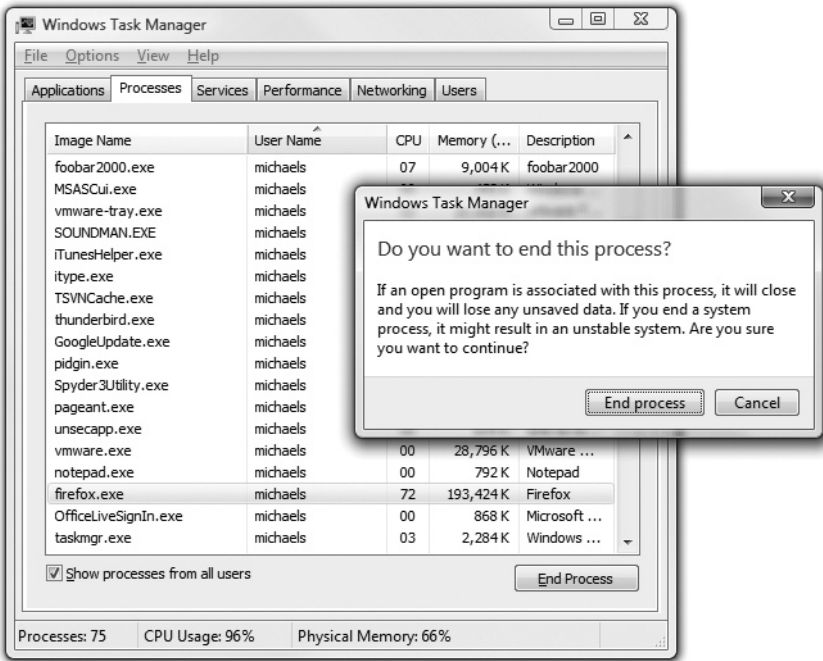
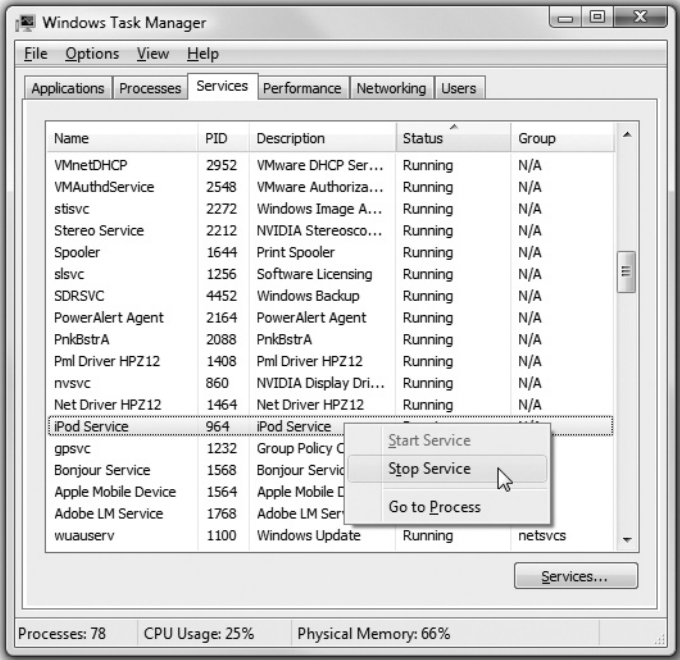


Figure 20-29 Ending a process

Figure 20-30
Stopping a service



Sync Problems

Capturing a video and audio stream simultaneously can be tough, because it takes the computer a lot longer to encode the video 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*.



NOTE 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.

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.



EXAM TIP 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.

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

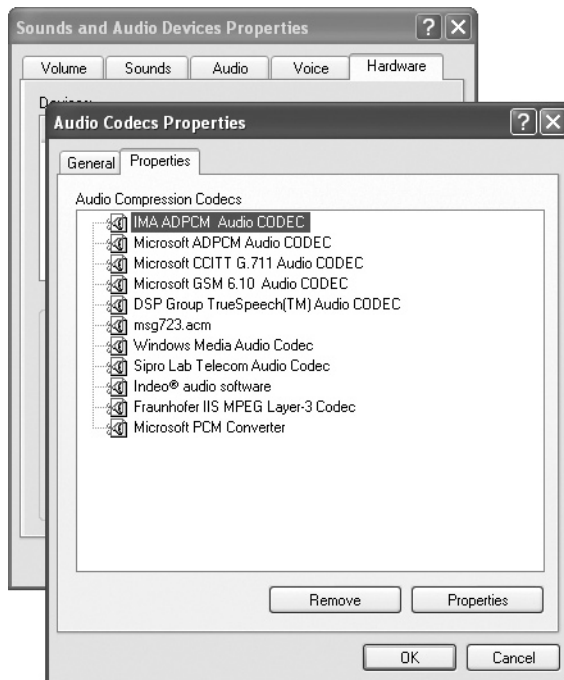
All versions of Windows come with some audio and video codecs installed. The default audio codecs will handle most common music formats, though you'll need to download the Vorbis codec if you want to use that format. Video codecs are a different animal.

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.

Windows XP makes it easy to see the installed codecs. In Control Panel, open the Sounds and Audio Devices applet. Select the Hardware tab | Audio Codecs and click the Properties button. In the Audio Codec Properties dialog box, select the Properties tab and you'll see all the installed audio codecs (Figure 20-31).

Figure 20-31
Default audio
codecs in
Windows XP SP2



Similarly, you can see the video codecs by choosing the Video Codecs option on the Hardware tab. Click through to the Properties tab. Figure 20-32 shows the default video codecs in Windows XP.

Microsoft made the codecs a bit more difficult to find in Windows Vista. In Vista, 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 (Figure 20-33).

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 (Figure 20-34).

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.

Figure 20-32
Default video
codecs in
Windows XP SP2

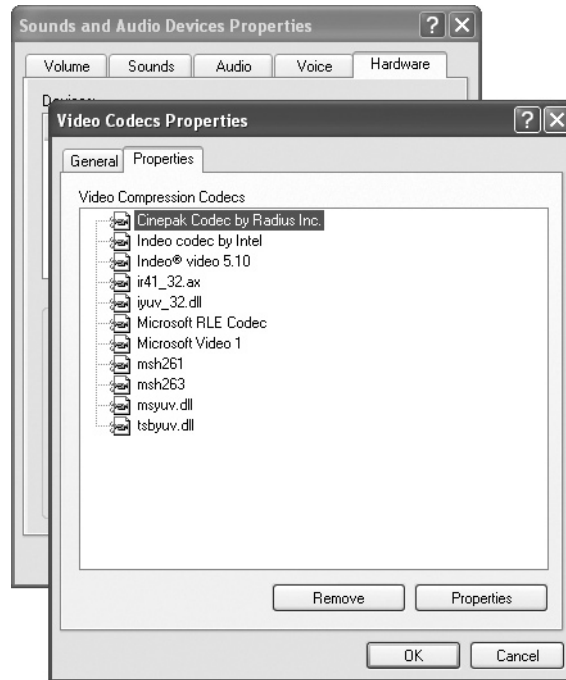


Figure 20-33
About Windows
Media Player
dialog box in
Windows Vista



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.

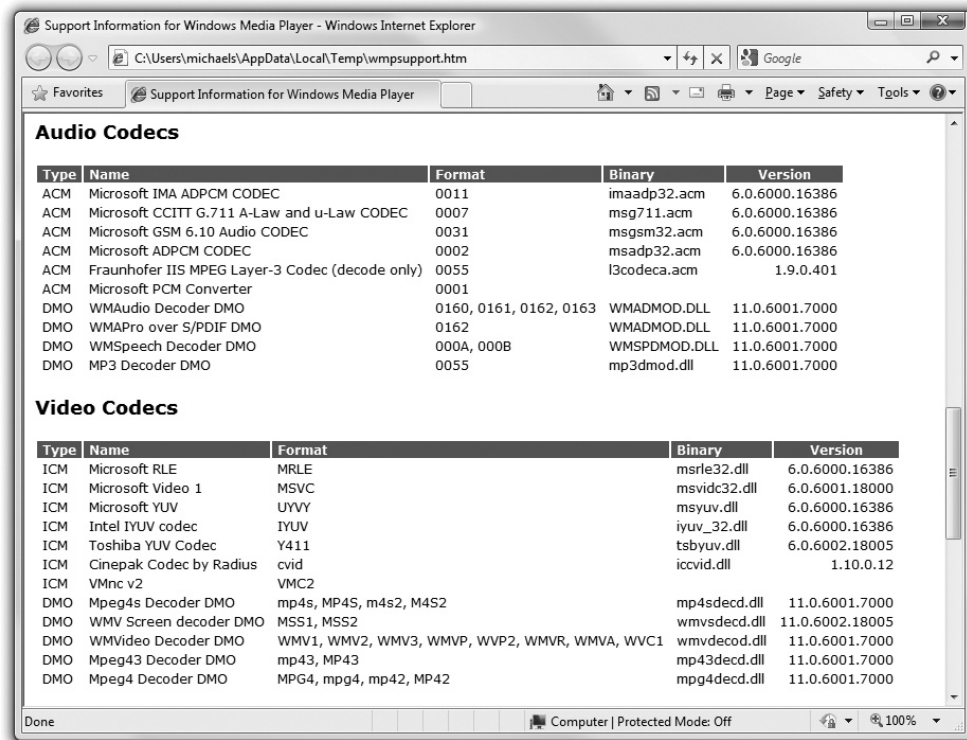


Figure 20-34 Viewing audio and video codecs installed in Windows Vista

TV Tuners

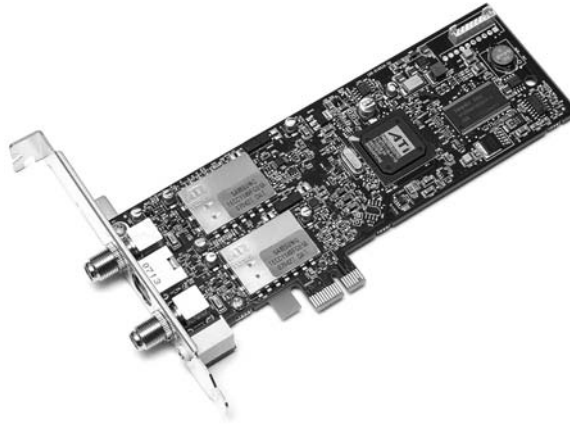
With a *TV tuner*, you can have it all in one package: a computer and the latest TV show as well. Most local stations (in the United States, at least) broadcast high-definition signals, so with the proper TV tuner, you can watch your HDTV without any of the artifacting you see with both cable and satellite 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.

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 20-35 shows a PCIe version of an ATI tuner card.

To install a TV tuner, follow standard installation procedures.

Figure 20-35
ATI TV tuner card



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

To pick up a signal on the TV tuner, just as with a standalone television, you need some source. Most can handle a cable TV connection, for example, or an over-the-air antenna. Figure 20-36 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.

Figure 20-36
Hauppauge TV
tuner with re-
tractable antenna



Tuner hardware comes with a standard coaxial connection. You can plug in a cable or satellite source just as you would 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 (through either that version of Windows XP or Windows Vista Ultimate), that will often be the tool of choice. Tuner card distributors bundle third-party applications with their cards. Figure 20-37 shows the EyeTV software enabling the computer to show television shows.

Figure 20-37
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, 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 20-36, is great, but if you install a tuner in a static computer, consider investing in a proper outdoor antenna.

Beyond A+

Sound Card Benchmarking

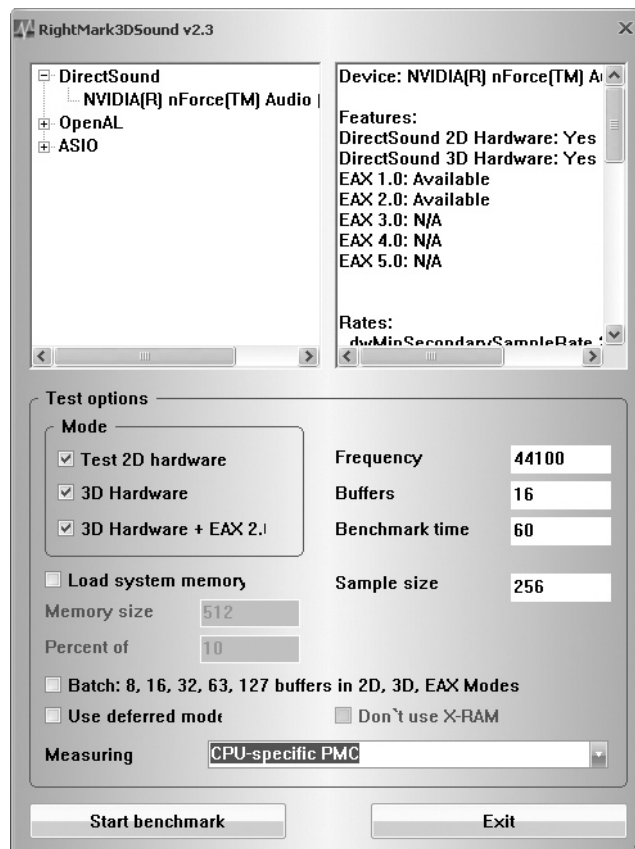
Sound cards can demand a huge share of system resources—particularly CPU time—during intense work (such as gaming). Most techs who find an otherwise serviceable PC stuttering during games will immediately blame the video card or the video

card drivers. What they don't realize is that sound cards can be the cause of the problem. A test of a client's built-in audio, for example, revealed that at peak usage the sound card took more than 30 percent of the CPU cycles. Thirty percent? Holy smokes! And he wondered why his system bogged down on yesterday's games! He could just forget about playing Crysis.

The folks at <http://audio.rightmark.org> make an excellent suite of sound card benchmarking utilities that helps you analyze the particulars of any sound card: RightMark 3DSound (Figure 20-38). It will run a system through fairly serious tests, from regular sound to 3-D positional audio, and reveal whether or not the sound processor—built-in or expansion card—is causing a problem with resource use. You can find the utility at <http://audio.rightmark.org>.

Figure 20-38

RightMark
3DSound



Chapter Review Questions

1. What refers to the number of characteristics of a particular sound captured when sampling?
 - A. Sample rate
 - B. Kilohertz
 - C. Bit depth
 - D. Quality rating
2. All recorded sound formats used in PCs today are derived from which format?
 - A. WAV
 - B. Fraunhoffer
 - C. MP3
 - D. PCM
3. Which sound format contains no actual sound recording but only a series of commands stored in a text file for the sound card to interpret?
 - A. WMA
 - B. WAV
 - C. MIDI
 - D. MP3
4. How many speakers are in a Dolby Digital 5.1 setup?
 - A. Five speakers plus a subwoofer
 - B. Six speakers plus a subwoofer
 - C. Seven speakers plus a subwoofer
 - D. Eight speakers plus a subwoofer
5. What is the name of the extensions to the DirectSound3D standard developed by Creative Labs?
 - A. EAX
 - B. MP3
 - C. Positional audio
 - D. Reverberation
6. What is the name of the standard digital connection that replaces many analog connections on some sound cards?
 - A. CD audio connector
 - B. AUX connector
 - C. TAD connector
 - D. S/PDIF connector

7. Which sampling rate would produce the highest quality sound?
 - A. 8 Hz
 - B. 8 KHz
 - C. 128 Hz
 - D. 128 KHz
8. What must be installed on your system to decode a sound file?
 - A. The proper codec
 - B. Sound application software
 - C. Speakers
 - D. Universal audio cables
9. Which of the following are valid audio file formats?
 - A. ASF, WMA, ASP
 - B. PCI, MP3, ASX
 - C. WAV, PCM, AU
 - D. MID, MPEG, AVI
10. Which term describes the stereo speakers in a 2.1 sound system?
 - A. Woofers
 - B. Satellites
 - C. Subwoofers
 - D. Twins

Answers

1. C. The bit depth refers to the number of characteristics of a particular sound captured when sampling.
2. D. All recorded sound formats used in PCs today are derived from PCM format.
3. C. MIDI files contains no actual sound recording, but only a series of commands stored in a text file for the sound card to interpret.
4. A. A Dolby Digital 5.1 setup has five speakers and one subwoofer.
5. A. Creative Labs developed the EAX presets.
6. D. The S/PDIF connector can replace analog connections on some sound cards.
7. D. The bigger the number, the better the quality, so 128 KHz is the king here.
8. A. You need a proper codec installed to decode a sound file.
9. C. WAV, PCM, and AU are audio file formats.
10. B. Stereo speakers are called satellites.