

Sound

In this chapter, you will learn how to

- Describe how sound works in a PC
- Select the appropriate sound card for a given scenario
- Install a sound card in a Windows system
- Troubleshoot problems that might arise with sound cards and speakers

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 sounds 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).

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.



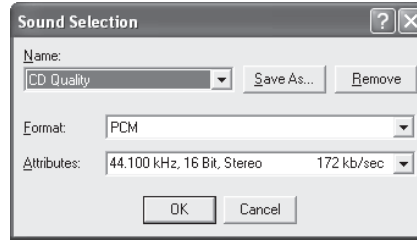
NOTE The most famous of all sound cards is the Creative Labs SoundBlaster series.

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 different 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 18-1 shows the configuration settings for the Windows Sound Recorder.

Figure 18-1
Sound Recorder
settings



Hey, wait a minute! Did you notice the Format setting in Figure 18-1? 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 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.

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 18-2 shows the default Media Player for Windows Vista. 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.



Figure 18-2 Windows Media Player



NOTE Using MP3 compression, it is possible to 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 one 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.

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 will sound 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 5th Symphony, for example, weighs in at a whopping 78 MB as a high-quality WAV file. The same 7-minute composition 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 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 iTunes music library. This is Apple Computer's proprietary format, though, so it's not nearly as friendly as MP3, even though the compression algorithm is good.

- **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.
- **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 different 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 out there, but it represents those you're most likely to encounter.

Video

Recorded audio files and MIDI files aren't the only files that play sounds on your computer. Video files also have sound built into them. However, to play the sound that accompanies the video, the video player program must support the particular video file format. The most common video formats in the PC world are Audio Video Interleave (AVI), Moving Pictures Experts Group (MPEG), QuickTime (MOV), Advanced Streaming Format (ASF), Real Media (RM), Windows Media Video (WMV), DivX, and Flash. The popular video sharing site YouTube was made possible by the amazingly small size of Flash-based video.

Applications

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

Streaming media is incredibly popular on the Internet. Streaming media is a broadcast of data that is played on your computer and immediately discarded. 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. ASF and RM are compressed audio/video file formats that were specially created to stream over the Internet. 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 Card

Sound cards come with many built-in features, including two separate sound processors (one for all of the recorded formats such as WAV and another for MIDI), support chips for joysticks and other pointing devices that plug into the game port, 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 five basic areas: 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 on 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.

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

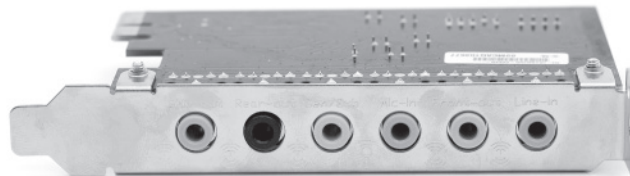
detail in the “Speakers” section of this chapter, but for now let an example suffice. With properly implemented positional audio, when you’re sneaking down the hall, ready to steal the Pasha’s treasure, you will hear behind you the sounds of the guards marching up to capture you. Such added realism has 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 18-3, for example, supports up to eight speakers.

Figure 18-3

A sound card with multiple speaker connections



Another popular speaker addition is a subwoofer. Subwoofers provide the amazing low-frequency sounds that give all of your sounds, from the surround sound of a game to the music of a simple stereo MP3 file, an extra dimension. Almost all modern sound cards support both surround sound and a subwoofer and advertise this with a nomenclature such as Dolby Digital, DTS, or 5.1. The 5 denotes the number of speakers: two in front, two in back, and one in the center. The .1 denotes the subwoofer. Figure 18-4 shows one type of surround speaker system. (You’ll learn more about surround sound in the upcoming “Speakers” section.)

Figure 18-4

Surround speakers
(photo courtesy of Klipsch)



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'll 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 (see Figure 18-5) before you buy or recommend a sound card for recording purposes.

Figure 18-5
The E-MU 1820
advertises its
excellent 112-decibel
signal-to-noise ratio
for recording.



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 output called line out. If you look at the back of a motherboard with a built-in sound card, you'll invariably see these three connections (Figure 18-6). On most systems, the main stereo speaker connector is blue, the line-out connector is green, and the microphone connector is pink. You'll often find plenty of other connectors as well (Figure 18-7).

Figure 18-6
Typical audio
connections on
a motherboard
sound card

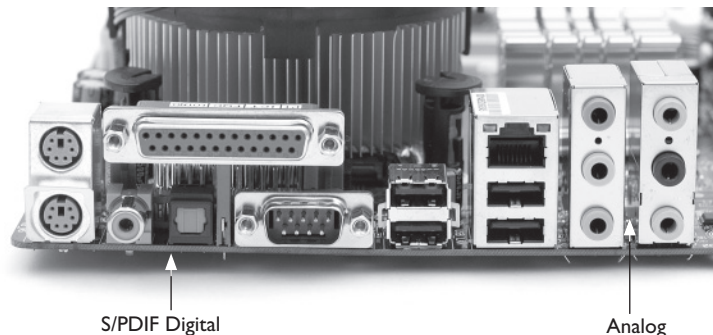
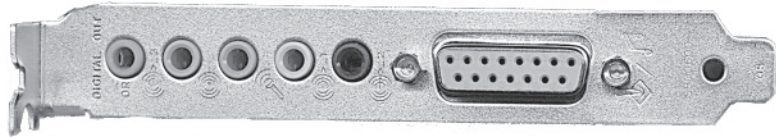


Figure 18-7

Lots of connections
on a high-end
sound card



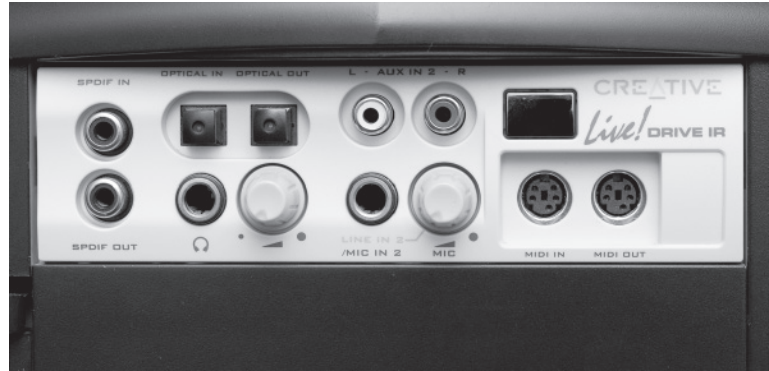
Take a look at what these connectors do for your sound card:

- **Line out** The line out is a secondary connector that is often used to connect to an external device such as cassette or CD player to allow 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 joystick port connects a joystick or a MIDI device to the sound card. The joystick port is a two-row DB15 female connection, but as more and more peripherals go to USB, more motherboard and sound card makers are dropping this venerable port from their models.

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 abilities 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 abilities; 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 18-8 shows a version of the Creative Labs SoundBlaster breakout box. These features aren’t for everyone, but they are compelling to many consumers.

Figure 18-8
Breakout box for a
SoundBlaster Live!
Platinum sound card



Audio Cables

In the days of yore, if you wanted to play audio CDs through your sound card, you needed a special cable that ran from your CD-ROM drive to the sound card. These cables have been around for a while, but the connectors were not standardized—for years, you had to use the cable that came with your sound card and hope that it would connect to your CD-ROM drive.

Today, a connector called *MPC2* is quite standard, and cables usually come with optical drives, not sound cards. To accommodate the many other types of connections that are still in use, a special cable called a *universal audio cable* is also available (Figure 18-9). Universal audio cables have a set of connectors to enable an optical drive to connect to any sort of audio card. Universal audio cables were important when CD-ROM audio connections were not standardized.

Figure 18-9
Universal audio cable



The early SoundBlaster line of audio cards came with a small, proprietary connection for CD-ROM drives. Because SoundBlaster dominated the field of sound cards for many years, you'll still run into audio cables with an MPC2 connector on one end and a SoundBlaster connector on the other end. These days, SoundBlaster cards use standard cables. You'll most commonly see MPC2 connections on sound cards, and MPC2/MPC2 audio cables (Figure 18-10) included with any new optical drive.

Figure 18-10
MPC2/MPC2
audio cable



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 18-11).

Figure 18-11
High-quality
speaker set (right)
versus another
manufacturer'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 that you can choose the speakers that work best for you and your clients.

Stereo Stereo is the oldest speaker technology that you'll see in the PC world. Stereo speakers are just what you might imagine: two speakers, a left and a right (Figure 18-12). The two speakers share a single jack that connects to the sound card. Most cheap speakers are stereo speakers.

Figure 18-12
Stereo speakers



2.1 Systems A 2.1 speaker system consists of a pair of standard stereo speakers—called *satellites*—combined with a subwoofer (Figure 18-13). 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.

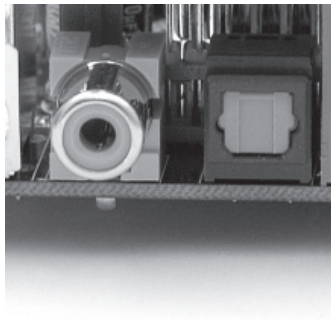
Figure 18-13
Typical 2.1 speakers



Surround Speaker Standards 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 (Figure 18-14). 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 18-14). 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.

Figure 18-14
S/PDIF connectors



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 18-15 shows an EAX setup screen.



Figure 18-15 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.

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.

Controls All 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.

Headphone Jack 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

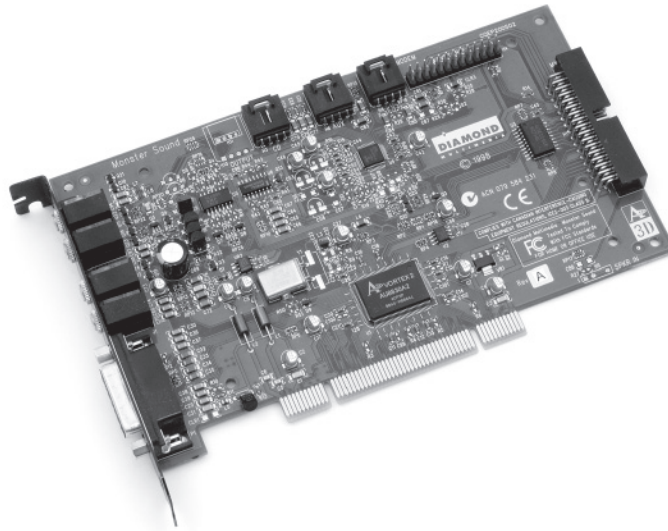
You've got two choices for sound hardware on today's PCs: onboard sound built into the motherboard or a separate sound card. The installation process for a sound card is basically the same as the process for any other card. You snap the card into a slot, plug some speakers into the card, load a driver—and for the most part, you're done. 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 18-16). 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:

- 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.

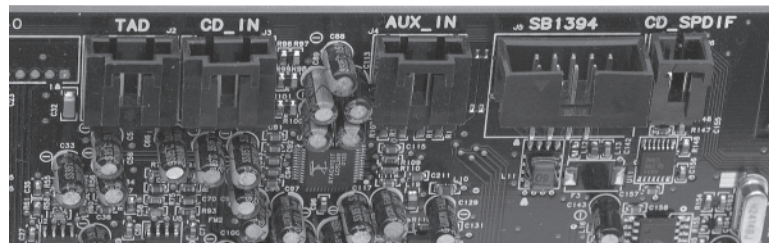
Figure 18-16
Typical sound card



Here's a quick look at sound card installation. As with any PCI 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, 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 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 that the card is securely seated, and secure it to the chassis with a hex screw.
3. Now connect the CD audio cable to the back of your optical drive, and plug the other end into the CD audio port on your sound card. Be sure to use the correct connector—many sound cards have multiple audio connectors. The one shown in Figure 18-17, for example, has separate connectors to use for an optical drive or modem.

Figure 18-17
Sound card with
multiple audio
connectors



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 autoplay-enabled installation CD-ROMs that step you through the process (Figure 18-18).

Figure 18-18
Typical autoplay
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 18-19), 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, 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 18-19 USB sound card (photo courtesy of Creative)

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 using configuration programs and test it 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 two other classes of sound programs also reside on your computer: programs for the configuration of your sound card and special applications that may or may not come with your sound card.

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 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 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.

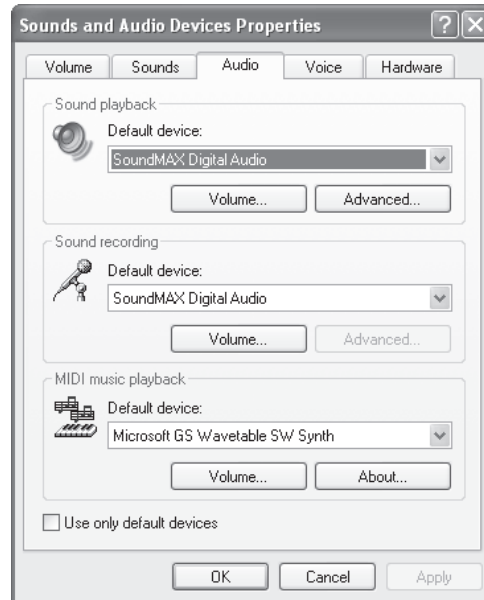
The Sounds and Audio Devices applet has five tabs: Volume, Sounds, Audio, Voice, and Hardware. The Volume tab is the most interesting. This tab adjusts the volume for the speakers, and it allows you to set up the type of speaker system you have, as shown in Figure 18-20.

Figure 18-20
Advanced Audio
Properties dialog box



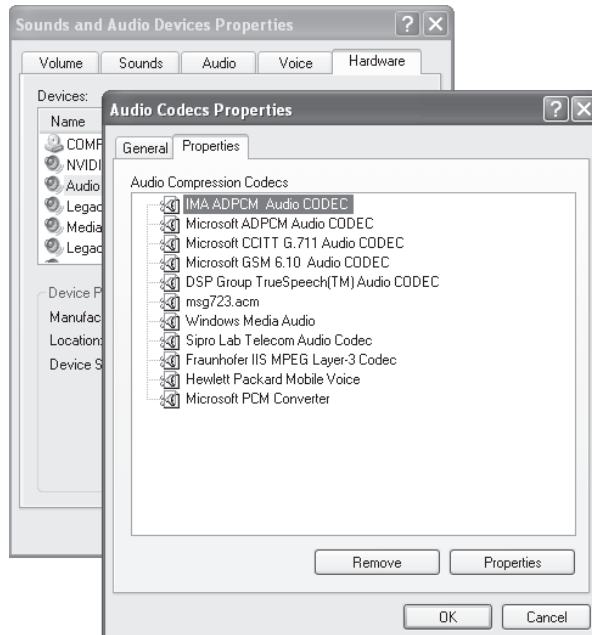
The Sounds tab allows you to add customized sounds to Windows events, such as the startup of a program or Windows shutdown. The Audio tab (Figure 18-21) and Voice tab do roughly the same thing: they allow you to specify the device used for input and output of general sounds (Audio tab) and voice (Voice 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.

Figure 18-21
Audio tab (note the
MIDI Music Playback
options)



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 (Figure 18-22). Not long ago, you had to install codecs manually in your system to play certain compressed file formats. Today, most audio players automatically detect whether a file is using an unrecognized codec and will download the proper codec for you.

Figure 18-22
Audio codecs



Proprietary Configuration Applications

Many sound cards install proprietary software to support configuration features not provided by Windows. Figure 18-23 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.

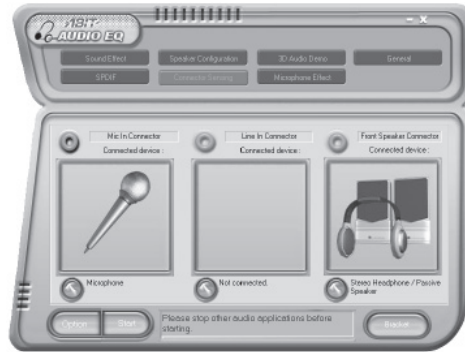


Figure 18-23 Creative Labs Speakers and Headphone panel

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 18-24 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 speakers 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 18-24
Autosensing
software detecting
connected devices



Installing 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 programs do anything from enabling you to compose music to organizing your sound files. Personally, I’m not a big fan of, for example, an 3DMIDI Player program (Figure 18-25)—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.

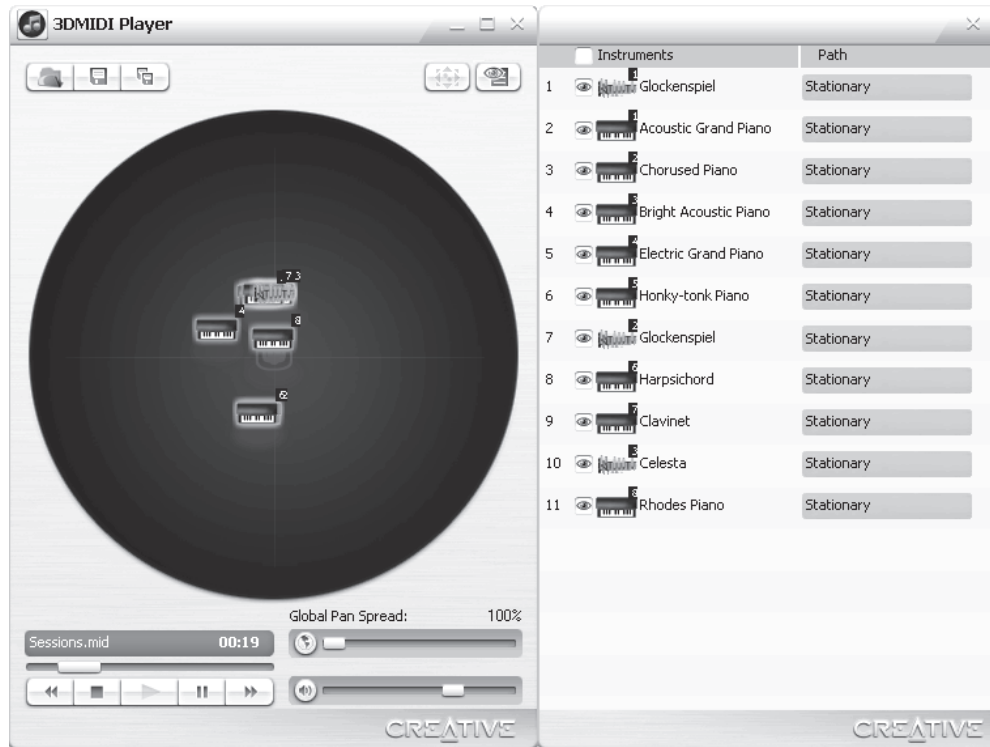


Figure 18-25 Creative Labs 3DMIDI Player program

IT Technician

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 (Figure 18-26) 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.

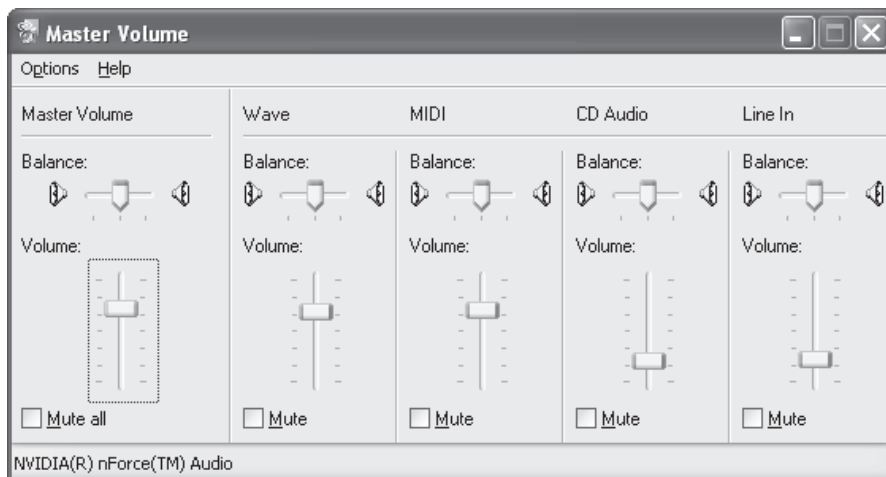


Figure 18-26 Volume controls in Windows



NOTE If your System Tray 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, you can add it. Just check the checkbox next to the *Place volume icon in the taskbar* option on the Volume tab of the Sound and Audio Devices Properties dialog box. Presto!

Speakers

The second place to look for sound problems is the speakers. Make sure that 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 will include 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 match in wattage required 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 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 getting 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 is not a configuration problem, but it's just something I always check at the same time I check the volume on the speakers.

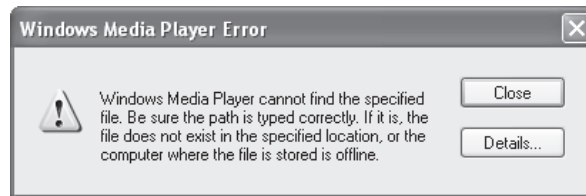
The first place to check is the Device Manager. If the driver has a problem, you'll see it right there. Try reinstalling the driver. If the driver doesn't show any problems, again try playing a sound and see if the player acts as though the sound is playing. If that's the case, you need to start touring the 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 18-27). 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 18-27
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 using another application.

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

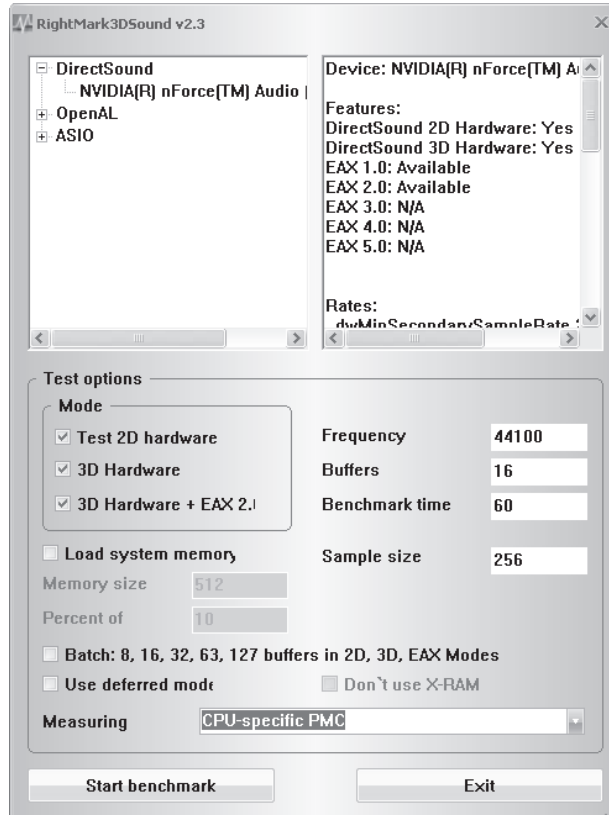
Beyond A+

Sound Card Benchmarking

Sound cards can demand a huge share of system resources—particularly CPU time—during intense work (like 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 recent 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 Pentium III system bogged down on yesterday's games! He could just forget about playing Half-Life 2 or Doom 3.

The folks at iXBT.com/Digit-Life make an excellent suite of sound card benchmarking utilities that helps you analyze the particulars of any sound card: RightMark 3DSound (Figure 18-28). It will run a system through fairly serious tests, from regular sound to 3-D positional audio, and will 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 18-28
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. Fraunhofer
 - 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. ASE, 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.