3.13.3 Sound Card Facts

A *sound card* is an expansion card (or an integrated component on the motherboard) that manages sound input and output.

This lesson covers the following topics:

- Sound card components
- File types

Sound Card Components

Because computers use digital data, sound cards must convert analog sound into digital data, and digital data into analog sound. The following components are used to do this:

- The Analog-to-Digital Converter (ADC) converts analog sound into digital data.
- The Digital Signal Processor (DSP) is an onboard processor that handles analog and digital conversion.
- The Digital-to-Analog Converter (DAC) converts digital data into analog sound (in preparation to be played on speakers).

When purchasing a sound card, be aware of the following considerations:

Component	Description
Bus Support	Sound cards can be installed via an expansion slot (e.g., PCI or PCIe x1) on the motherboard. When selecting a sound card, make sure the bus type is compatible with your motherboard. Most new motherboards have an onboard sound card.
Channels	Audio can be split into multiple channels, which increases the sound quality and makes it more realistic. Some standard channel configurations are as follows: - 2 channel audio is stereo. Examples of 2 channel audio include standard TV and radio. - 4 channel audio is quadraphonic audio and was an early attempt at surround sound. - 5.1 channel audio, also known as surround sound, has 6 audio channels: five speakers and one low-frequency effects subwoofer (LFE) channel. - 7.1 channel has 8 audio channels: 7 speakers and one LFE subwoofer channel. This is the first technology providing error correction.

Sampling Rate	The *sampling rate* is the number of analog signal samples taken in over a period of time. Sample rates are expressed in cycles per second, called hertz (1,000 hertz (Hz) = 1 kilohertz (kHz)). A high sampling rate gives a more accurate representation of the sound. Examples of different sampling rates include:
	
	- 8 kHz (telephone) This is adequate for conversation because the human voice's full range is about 4 kHz.
	- 22 kHz (radio quality).
	- 44 kHz (CD quality) This sample rate can accurately reproduce the audio frequencies up to 20,500 hertz, covering the full range of human hearing.
	- 48 kHz (Digital TV, DVD movies).
	- 96 kHz (DVD audio).
	- 192 kHz, used by:
	    - LPCM (Linear Pulse Code Modulation), a DVD-music production format.
	    - BD-ROM (Blu-ray Disc-ROM).
	
	Higher sample rates require more bits of data per sample.
	
	- 8-bit sound cards use a sampling size of 256.
	- 16-bit sound cards use a sampling size of 65,536.
	- 20-bit sound cards use a sampling size of 1,048,576.
	- 24-bit sound cards use a sampling size of 16,777,216.
	- 32-bit sound cards use a sampling size of 4,294,967,296.
	
	The bit portion of a sound card's sampling size *does not* correspond with the bus size.

Feature Support	Additional features on sound cards provide higher quality sound or additional functionality. - DirectSound 3D allows a computer to play audio in surround sound. - EAX is a high-definition sound technology originally developed for video games. This technology provides such realistic nuances that audio can actually cue gamers.

	- THX is a sound quality standard, originally created for film, now available on sound cards. This is a sound card feature that allows computers to present theater quality sound output. - Dolby Digital is a technology that broadcasts sound at a frequency the human ear can hear and diminishes collateral sound. This is a sound card feature that allows computers to present higher quality sound output. - DTS (Digital Theater Systems) Digital requires an optical reader to decode physical data and send it to a computer for processing. This is a sound card feature that allows computers to present theater quality sound output. - SDDS (Sony Dynamic Digital Sound) was originally developed for theater sound. SDDS decoders provide error correction. - MIDI (Musical Instrument Digital Interface) is a protocol for recording and playing audio created on digital synthesizers. This feature allows the computer to become an integrated component to a musical instrument.
Analog Input and Output	Analog output jacks allow you to play sound on your computer through external devices: - The speaker out connector sends signal to external speakers. This signal is amplified and the computer controls the sound level that is sent. - The line out connectors send audio to other sound devices. This signal is unamplified. Analog input jacks allow you to record audio through the sound card. - The line-level (line-in) connector receives signals from CD players and musical instruments coming from the line out port of the other device. - The mic-level (mic in) connector receives signals from a microphone.
Digital Audio	Most audio devices, such as stereo consoles, TVs, and speakers require analog audio. Newer devices, such as some CD players, DVD players, and HDTVs, are capable of processing digital audio signals. Digital audio support in a sound card: - Allows you to play digital audio directly from an internal CD player - Allows for compression of audio data to support Dolby Digital or DTS surround sound - Can use fiber optic cables to eliminate electrical interference Sound cards support digital audio in the following ways: - An internal connector on the sound card connects to a digital audio output connector on a CD/DVD drive. Through this connection, you can play CDs directly through the sound card. - An internal connector on the sound card sends HD audio, such as from a DVD or Blu-ray disc, to an audio pass-through on a video card. This allows the HD audio signal to be combined with the video signal through an HDMI connector. - Sony/Philips Digital Interface Format (S/PDIF) is a consumer standard for digital audio. These are either optical or coaxial external connectors and allow input and output between other digital audio-capable devices.
Additional Ports	In addition to audio input and output ports, some sound cards also include the following ports: - MIDI port to interface with MIDI sound devices - FireWire - Some high-end audio cards include HDMI video processors and video output, combining the features of an audio card with a video card. The sound card might have 1 or 2 HDMI ports (for input and/or output).

File Types

Sound card drivers and other software save digital audio into several different file types. Common file types include:

- WAV (Windows standard), a widely used and compatible file type
- AIFF (Audio Interchange File Format), the Macintosh equivalent of the WAV
- AU (UNIX standard), supported by most web browsers
- MP3 (MPEG-2 Layer III), a highly effective audio compression standard
- AAC (Advanced Audio Coding), also known as MPEG-2, a compression expected to replace MP3
- WMA (Windows Media Audio), a highly compatible standard developed to compete with Real Audio
- MIDI, not a true audio file, but contains data to reproduce sounds through electronic synthesis