

Digital Audio File Formats

Digital audio is stored on a hard drive or CD-ROM in the form of a file. This lets you use software to work with the digital audio data. You can cut, copy, and paste just like you can with a word processing program. You can modify and edit the data easily, because all you're doing is manipulating strings of numbers.

There are several common file formats for storing audio data. Some are quite familiar to anyone who works with audio in a computer. Some of them come in an **uncompressed (linear)** format, and some of them in a **compressed (non-linear)** format. Uncompressed data usually retains the highest sound quality.

Uncompressed Formats

1. **WAVE (.wav)** – This is probably the most well-known of all uncompressed file formats. It's a Windows-based format, created by Microsoft many years ago. WAVE files typically come in 8-bit, 16-bit, and now 24- and 32-bit resolution. They come in many sampling rates (8kHz and up). In 2004 the WAVE format became multi-channel compatible. Before that, it only handled mono or stereo.
2. **AIFF (.aif)** – This is the Apple 'equivalent' of the WAVE file format. It is identical in its capabilities to the WAVE file. It is uncompressed, and it offers multiple bit-depths, sampling rates, and channels. The AIFF format was designed from the beginning to allow flexible definitions of bit-depth, sampling rate, and # of channels. Apple chose this format because of its growth potential.

Both WAVE and AIFF are **uncompressed, linear** files. This means that an exact amount of data is required to store a certain duration of audio. If the audio is 1 minute long, sampled at 44/16, in stereo, the file size will be 10MB for either WAVE or AIFF. It doesn't matter if the audio is a complex piece of music or total silence – the file size is the same, and it is predictable.

3. **Sound Designer II (.sd2)** – This is a format that was developed by Digidesign, the first manufacturer of digital audio hardware and software in the world. The AIFF format, though it sounded fine, wasn't sufficient for them. So, Digidesign created Sound Designer II. This format is still used, but it's becoming rare, since both AIFF and WAV can do the job, even in ProTools.

Interleaved Stereo

A stereo audio file really contains two channels, one left and one right. One file, two channels. This is called an **interleaved stereo file**. Most software works with interleaved stereo files, but one popular program can't – ProTools. If you import an interleaved stereo file into ProTools, ProTools will separate the left & right channels, and create two separate files. For example, the stereo file "swoosh" becomes "swoosh.L" and "swoosh.R". These separated files are called '**split stereo**', or **deinterleaved**.

Compressed Formats

1. **MP3 (.mp3)** – This is easily the most familiar of all compressed file formats. It offers decent sound quality in a file that is about 1/10th the size of the original. It is actually the audio portion of a compressed video format called MPEG. The number ‘3’ comes from the fact that the 3rd layer of the MPEG file contains the audio information. Soon after this video format was developed, many musicians and audio engineers realized that the audio layer all by itself was extremely useful.

MP3 files are encoded using a preselected bit-rate, called kbps, or kilobits per second. A few common bit-rates are 128kbps, 192kbps, and 320kbps. The higher the bit-rate, the better the quality, but the larger the file!

MP3 is not an acceptable format for professional use. It’s great for sending examples of your work to a client, or posting sounds on the Internet. But the damage done by MP3 compression is permanent.

2. **AAC (.m4a)** – This is a proprietary format developed by Apple to compete with the MP3 spec.

3. **Windows Media (.wma)** – This is a proprietary format developed by Microsoft to compete with the MP3 format.

MP3, AAC, and Windows Media compression are **non-linear** processes. This means that the size of the file is not directly related to the duration of the music. Other factors are considered, such as frequency and amplitude content.

Sometimes you can select an option called **VBR**. This stands for **Variable Bit Rate**. It can make your MP3s more efficient by intelligently varying the bit rate depending on the content of the material. Some MP3 players may not work with VBR.

Calculating File Sizes

For 1 minute of audio...

FORMAT	44/16/Stereo	44/16/Mono	88/16/Mono	44/24/Stereo
.wav	10 MB	5 MB	10 MB	15 MB
.aif	10 MB	5 MB	10 MB	15 MB
.mp3 *128kbps	~1 MB	~500 k	~1 MB	??? (can you find out?)

Notice that wav and aif are the same size at the same sample rates.