Audio Codecs[1]

Sound is transmitted via vibrations in in the air. Our vocal chords, for example, vibrate the air around us, our ears detect the vibrations and our brains decode them into meaningful utterances

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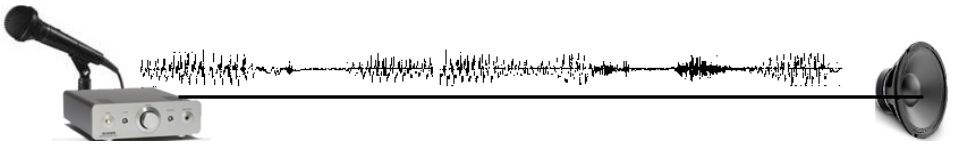
Electrical Transmission and Recording of Sound - Analog Audio

Air vibrations are converted to electrical signals by a microphone and amplifier system for transmission over a wire to a speaker that converts the electrical signals back to air vibrations.

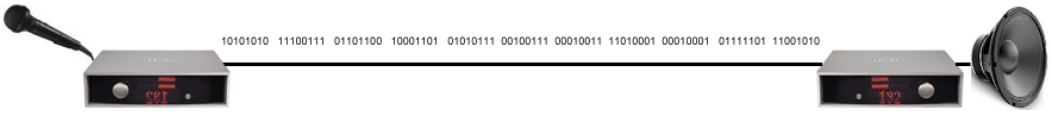


Microphone and Amplifier Speaker

The electrical vibration mirrors or is an analogue of the air vibrations.

Digital Transmission and Recording of Sound - Digital Audio

Sound wave vibrations in the air are converted to electrical signals by a microphone. The oscillating signal is sampled at a rapid rate and converted into a stream of numbers. At the other end, the stream is converted back into electrical signals which cause a speaker to emit sound waves into the air.



Analog to Digital Coder Digital to Analog Decoder

Sound can be recorded and played back digitally with greater fidelity than analog recorded sound (audio tapes and long-playing vinyl records, for example). Digital sound is more easily stored and more easily transmitted. Devices such as Mobile Phones, iPads, Digital Media Players, Smart TVs and Bluetooth and WiFi speakers use digital transmission technologies to make music more accessible

Digital sound transmission and recording was developed by telephone engineers who came up with many ways of encoding sound into numbers and decoding them back again into air vibrations. Media companies began distributing music digitally when the technology became mature enough to record sound with high fidelity. They usually employ DRM (Digital Rights Management) encryption to ensure their recordings can only be played by those who have purchased a legal right to them. Many different proprietary and public domain methods of coding and decoding digital sound are now in use. The phone engineers term: *audio codec* is still used to indicate which set of standards one's equipment must implement to be able to play a particular digital recording.

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[1] **Audio CODEC**: a standard for encoding sound digitally. Some common codecs are *WAV, MP3, AIFF, AAC, ALAC, FLAC* (digital file standards); *Audio CD* and *HiRes Audio* (Audio disc standards). Audio devices are equipped to handle a limited selection of codecs. Take care to obtain audio in a format that is compatible with your equipment. Some digital audio software, iTunes, for example, can convert audio files from one codec to another.

Which Codec Should I Use?

Details of an 18-track, 69-minute Audio CD album, recorded at various qualities, are listed below. Notice that the highest quality version occupies over seven times the storage space of the lowest quality. The larger the sound file, the longer it takes to download the more storage space it occupies. The smaller the sound file, the more music you can fit in your playing device, but the more likely you will have lost some of the detail from the original signal.

To the question: *What quality should I obtain?*, one answer is: *Obtain the highest quality you can appreciate when you listen on your equipment.* Experiment to discover where the point of no discernible difference lies for you.

Avan Lu plays Liszt's Schubert Song Transcriptions[2] - Album Track Listing

Track	*Duration*
01 - Winterreise, S 561 No 1, Gute Nacht.m4a	5.08
02 - Winterreise, S 561 No 2, Die Nebensonnen.m4a	3.54
03 - Winterreise, S 561 No 3, Mut.m4a	1.20
04 - Winterreise, S 561 No 4, Die Post.m4a	2.42
05 - Winterreise, S 561 No 5, Erstarrung.m4a	3.05
06 - Winterreise, S 561 No 8, Der Leiermann.m4a	2.16
07 - Winterreise, S 561 No 9, Täuschung.m4a	1.37
08 - Winterreise, S 561 No 10, Das Wirtshaus.m4a	4.50
09 - Schwanengesang, S 560 No 1, Die Stadt.m4a	2.49
10 - Schwanengesang, S 560 No 2, Das Fischermädchen .m4a	3.07
11 - Schwanengesang, S 560 No 4, Am Meer.m4a	4.36
12 - Schwanengesang, S 560 No 5, Abschied.m4a	4.28
13 - Schwanengesang, S 560 No 6, In der Ferne.m4a	6.49
14 - Schwanengesang, S 560 No 7, Ständchen.m4a	5.39
15 - Schwanengesang, S 560 No 9, Frühlingssehnsucht.m4a	2.40
16 - Schwanengesang, S 560 No 11, Der Atlas.m4a	2.36
17 - Schwanengesang, S 560 No 13, Die Taubenpost.m4a	4.36
18 - Schwanengesang, S 560 No 14, Kriegers Ahnung.m4a	6.42
	Total Playing Time 69 minutes

Album	*Quality*	*CODEC*	*Album Size*	*Compression*
Liszt Schubert Song Transcriptions	Audio CD	MP3	167.1 MB	Lossy
Liszt Schubert Song Transcriptions	Audio CD	ALAC	225.4 MB	Lossless
Liszt Schubert Song Transcriptions	Hires	ALAC	1,200.0 MB	Lossless

Table: The same album recorded via three different CODECs

Some Digital Audio Sampling Rates

Quality	*Sampling Rate*	*Resolution*	*Level of Loudness*
Phone Audio	8,000 samples per second	8 bit resolution	256
CD Audio	44,100 samples per second, stereo	16 bit resolution	65,536
Hires Audio	96,000 samples per second, stereo	24 bit resolution	16,777,216

Higher resolution audio is sampled more frequently
and levels are recorded more precisely.
As the step size decreases, the digital wave more and more closely matches
the smoothness of the analog signal.

[2] Avan Yu, Liszt: Schubert Song Transcriptions, Naxos Laureate Series..