

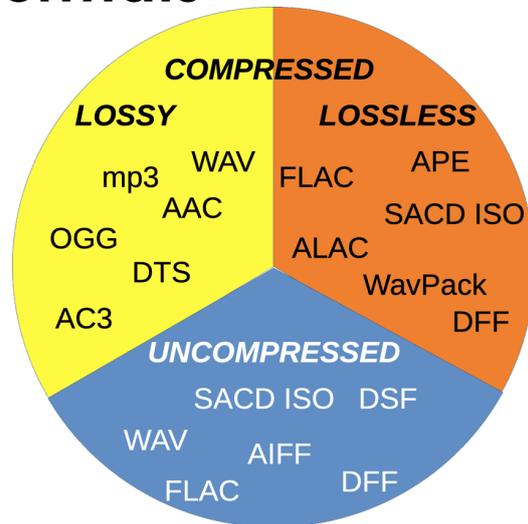


DIGITAL CONSUMER FORMATS

AoS 3: SOFTWARE AND HARDWARE: DIGITAL

Digital Audio File Formats

- **Uncompressed** formats encode both **sound** and **silence** at the same bit rate (e.g WAV, AIFF)
- **Lossless** compression preserves the quality original audio data (e.g FLAC)
- **Lossy** compression loses some quality (e.g MP3)



Lossless – the compressed audio will be the same as the original audio source

WAV = Windows waveform audio format (standard for audio CDs at 44.1kHz and 16 bit) AIFF = Audio Interchange File Format

FLAC = Free lossless audio codec

Lossy compression produces smaller file sizes but lower-resolution audio

Bit rate = number of bits being handled per second (measures the band-width)
Impacts playback quality (measured in kbps – kilobits per second)

Higher bit rate = Higher file size

The definition of hi-res audio states that any music file recorded with a **sample rate and bit depth** higher than **44.1kHz/16-bit** is considered high definition (HD) audio.

Lossless Compression

- Stores data in less space by **removing unnecessary data**
 - Things like silences in a track would take up almost no space
- The original uncompressed data is recreated **exactly**
- Examples:
 - FLAC (.flac)
 - WavPack (.wv)
 - ALAC (.m4a)



ALAC Apple Lossless Audio Codec

- Any data removed during compression can be restored when restored to its original form
- Like a .zip file

Lossy Compression

- Enables greater reductions in file size by **removing some audio data**
 - Results in reduced audio quality
- Techniques such as psychoacoustic manipulation can be exploited to help minimise the reduction in audio quality
- Examples:
 - MP3 (.mp3)
 - Musepack (.mpc)
 - WMA Lossy (.wma)



- Data removed during compression is not recoverable when restored to its original form
 - Loss of frequency content and dynamic detail
- Consumers don't mind the trade off between audio quality and convenience
 - Small file sizes

Pros and Cons of Compressed Audio

Advantages	Disadvantages
Easy to share	Some formats remove data
Makes it easy to buy/stream albums	Lack of a physical product
Some formats don't compromise on data loss	Piracy becomes easier

- Can be attached to emails or shared using cloud services
- Lossless compression doesn't affect the quality of the audio
- Lossy formats can introduce unwanted artefacts onto a track due to the loss of data
- Can also result in increased noise present and uneven frequency responses
- Formats like vinyl are popular due to the fact that certain albums with interesting artwork can become collectibles
- The nature of digital formats makes for the illegal copying and sharing of audio to be hard to police
 - Can affect the income of a musician

CD

- Stores data as pits on a disk read by a laser
- Can hold up to 80 minutes of audio
- Can store up to 700mb of data



- CD = Compact Disc
- Pits are created by being burned into the disk using a laser
- Longer playing time when compared to vinyl

Pros and Cons of CD

Advantages	Disadvantages
Better SNR compared to tape/vinyl	Scratches can cause problems with playback
Doesn't deteriorate due to continued use	Not as 'warm' as analogue formats
Cheaper to produce than tape/vinyl	
Better frequency response	
Access to track indexing	
Ease of data transfer	
More portable than vinyl	

- Track indexing allowed for specific tracks on a disc to be located faster
- Moving music between a CD and a computer was easy
- Some consider the timbre of digital formats such as CDs to be 'brittle' and 'unmiscal' when compared to the analogue warmth provided with formats such as vinyl

Online Streaming

- Gained popularity in recent years due to consumer trends
- Compressed audio formats are used for streaming
- The equipment most consumers use to listen to music compensates for the poorer quality



- More people are streaming music compared to buying physical CDs or vinyls
- Audio quality isn't as good as CD audio
 - Services like TIDAL offer Hi-Fi streaming options with uncompressed files
- Spotify streams at a normal bit rate of 96kbps
 - Will sound perfectly fine on a pair of ear buds
 - Won't sound as great on a high quality speaker system