

BEATS TO BYTES

HOW MUSIC IS ENCODED THROUGHOUT THE YEARS

ANALOG ERA

VINYL & RECORD PLAYERS

have **grooves** for sound control—wider for volume, deeper for bass. A stylus followed the grooves, creating vibrations that turned into electric signals, and sent through an amplifier for music.



TAPE PLAYERS

and **magnetic tapes** use magnetism to encode and remember music. A microphone converts sounds into electromagnetic waves, influencing the tape's magnetic field. When decoded, the magnetized tape produces electrical currents, which are then amplified into sounds.



RADIO RECEIVERS

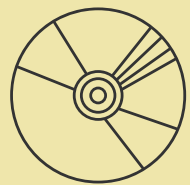
use **radio waves** to record and transmit sound, encoded through amplitude or frequency modulation



DIGITAL ERA

COMPACT DISKS

store digital audio through **sampling** and **conversion**. Sound is captured as binary code, translated into bumps on the CD. During playback, a laser reads these bumps, interpreting them into a binary series that transforms back into analog signals, producing the audible sound.



MP3 PLAYERS

utilizes analog-to-digital conversion like CDs but with compressed files for efficient storage. This **compression**, employing auditory masking, significantly reduces file sizes. During playback, the compressed bits are reversed to produce "near-CD-quality" sound.



INTERNET ERA

P2P SOFTWARE

organizes files in a **distributed system**, with independent nodes storing content-based files. Sharing involves placing files in accessible memory locations. P2P Distribution uses search algorithms and FTP for secure downloads, optimizing efficiency with 'Threshold-Based Sharing.'



STREAMING SERVICES

like YouTube optimize content delivery through **cloud-based** transcoding, adjusting formats and bitrates for efficiency. Content Delivery Networks (CDN) store content closer to users, ensuring faster and more reliable streaming.

