

advancements and exploring their applications can help us harness its full potential. Embrace the future of multimedia and its transformative power.

WHAT IS DIGITAL AUDIO? HOW IS IT USED?

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Today digital audio is an integral part of our lives. From streaming our favorite music and podcasts to participating in virtual meetings and enjoying immersive video games, digital audio plays a pivotal role in how we consume and interact with media. This presentation will dive into the fundamentals of digital audio, exploring what it is, how it works, and the various ways it is utilized across different platforms and applications.

Let's start from the history of the sound:

The journey of sound recording and playback technology has seen remarkable transformations over the years, marking significant milestones in the evolution of audio.

1890 Thomas Edison invented the phonograph, which was capable of recording and playing back sound. This invention laid the groundwork for the audio industry and revolutionized the way people experienced music and voice recordings.

1920 Analog recording technology advanced significantly, allowing for the commercial production of vinyl records. This era saw the growth of the music industry, with records becoming a popular medium for listening to music at home.

1950 The introduction of transistors miniaturized electronics, making devices more portable and reliable. This technological advancement helped usher in the era of cassette tapes, which became a dominant format for personal audio recordings and music distribution.

1980 Digital audio technology emerged, transforming how sound is stored and reproduced. By converting audio signals into numeric data files, digital audio provided

higher fidelity and durability compared to analog formats, setting the stage for modern audio technologies like CDs, MP3s, and streaming services.

These milestones reflect the continuous innovation in audio technology, enhancing the quality and accessibility of sound for everyone.

In the real world, sound travels as continuous waves in the air. Digital audio takes these smooth waves and translates them into a language computers can understand: ones and zeros. Here's the gist:

1. **Sampling:** Imagine dipping a bucket into the ocean repeatedly. Each scoop (sample) captures a bit of water (sound) at that specific moment. The more scoops you take per second (sample rate), the more accurate a picture you get of the entire wave.
2. **Quantization:** Now, let's say the bucket only holds whole numbers of tablespoons (bits). You can't perfectly capture the in-between amounts of water (sound volume). This creates a slight distortion called quantization error. More bits per sample (bit depth) reduces this error.
3. **Digital Bits:** Those tablespoon measurements (samples) are converted into a binary code (0s and 1s) representing the sound level at that moment. This allows us to store and manipulate sound on computers.

By combining sampling rate and bit depth, we can achieve different levels of digital audio quality. This is the foundation for storing music, manipulating sound effects in movies, and sharing audio files.

Digital audio formats can be broadly categorized into two main types: uncompressed and compressed. Understanding these helps us choose the right format for different needs.

Uncompressed Formats

1. **WAV (Waveform Audio File Format):**

Description: Stores audio in its raw form without any compression.

Quality: Very high, as it retains all the original audio data.

Usage: Ideal for professional audio recording and editing where maximum sound quality is essential.

2. AIFF (Audio Interchange File Format):

Description: Similar to WAV, it stores uncompressed audio.

Quality: Equally high, often used in professional audio work, particularly on Apple systems.

Usage: Used in music production and by audio professionals.

Compressed Formats

Compressed formats come in two types: lossless and lossy.

1. Lossless Compression:

Description: Reduces file size without any loss of audio quality.

Examples:

FLAC (Free Lossless Audio Codec): Popular for high-quality music playback and archiving.

ALAC (Apple Lossless Audio Codec): Similar to FLAC, but used in Apple's ecosystem.

Quality: High, preserves all audio details.

Usage: Preferred by audiophiles and for archival purposes.

2. Lossy Compression:

Description: Reduces file size by removing some audio data, which may slightly affect quality.

Examples:

MP3 (MPEG Audio Layer III): Widely used for music distribution, portable devices, and streaming.

AAC (Advanced Audio Coding): Offers better sound quality than MP3 at the same bit rate, used in Apple Music and streaming services.

Quality: Variable, depending on the bit rate; higher bit rates provide better quality.

Usage: Ideal for everyday listening, streaming, and situations where storage space or bandwidth is limited.

Professionals in audio production rely on a variety of digital tools to shape sound. Software programs allow editing of audio files, applying effects like compression and reverb, and precise mixing of multiple tracks. Popular digital audio workstations include Pro Tools, Logic Pro, and Adobe Audition. These platforms give musicians and engineers control over many parameters to craft high-quality sound.

Access and Share Digital audio allows listeners to freely access music collections from anywhere through internet connections and mobile devices. Songs can be streamed or downloaded to personal devices, giving users portability and flexibility in how they enjoy audio.

Popular online platforms and streaming services make vast music libraries available at our fingertips. With a few taps or clicks, anyone can build personalized playlists and share them with others around the world. This widespread distribution has helped digital audio become the dominant format in modern music consumption.

Digital Audio's Impact Digital audio has revolutionized the music industry and beyond by allowing for new methods of creation, distribution and consumption. Technological advances now make it possible to easily record, edit and share high quality audio from anywhere via smartphones and online platforms. While this has disrupted traditional business models, it has also enabled new levels of accessibility and independence for artists and audiences alike. Overall, digital audio's transformation continues across entertainment, communication and more through innovative applications that enhance how people interact and experience sound.