MKAudio

Cross-platform low-end audio API in Rust

Minjae Kim

05/17/2024

Modern operating systems have their own audio backend. Windows has CoreAudio(also called WASAPI), macOS has CoreAudio, Linux has ALSA, PulseAudio, and UNIX systems have JACK. Some third-party company provides their own audio backend like ASIO by Steinberg and HDX by AVID. Native audio backends use C, and third-party audio backends use C++, which both are unsafe for memory area and data race. Developers can easily make mistake without warning, which could be crucial in development time and user experience. However, Rust, a new language that supports low level control with safety in memory area, threads, and data race, is strongly suggested to replace C and C++ by many and government and independent organizations, such as NSA. (United States) Development of audio API based on Rust is inevitable to engage safety and experience for the user.

MKAudio is a low-end audio API written in rust that can be used on any system. MKAudio is constructed with AudioBuffer and AudioDevice, which AudioDevice contains two AudioBuffers. Data can be exchanged via AudioDevice struct, which has name, input and output buffers, and I/O. Type of an input is std::io::BufReader<R : std::io::Read>, and type of an output is std::io::BufWriter<W : std::io::Write>, which let users to use any std::io implied objects, such as file stream, usb, thunderbolt, web, and many others interfaces. User can use their own interface to send and receive data.

The little endian formatted data is consisted with two parts : state data and buffer.

[buffer size * 32 + 8 : 8]	[7 : 0]
Buffer	State Data

A single byte formatted state data can have sample rate, and buffer size, and channel count changes. First 2 bits determines which data is changed, which are mapped as below.

$00	NO CHANGE
$01	SAMPLE RATE
$10	BUFFER SIZE
$11	CHANNEL AMOUNT

Later 6 bits has changed data. For sample rate change, 0 - 15 will be multiplied by 22,050 after being added by 1, and 16 - 31 will be multiplied by 24,000 after being subtracted by 15. Buffer size change will be multiplied by 32. Channel count will be remained the same, which result 64-channel can be received per one logical device.

Bit depth will be determined as below :

Length of Buffer / Buffer Size * 8(bits)

Buffer contains interleaved audio data sample by sample, channel by channel. If bit depth is 24 bits and channel count is 2, buffer will be laid out as below :

[0][0]	[0][0]	[0][0]	[1][0]	[1][0]	[1][0]	[0][1]	[0][1]	[0][1]	[1][1]	[1][1]	[1][1]	…

Input and output of the buffer can be either integer or floating point. User can also get output or set input with slice type.

MKAudio is a Rust low-level cross-platform audio that can be used in any device that Rust std library supports. With support of opened data format and library source code, it can be easily implied and safely used.

Citation

United States, National Security Agency, Media Relations. *Software Memory*

Safety, 04/2023