Audio Device Client

Better and Faster Audio I/O on Web

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Google Chrome

Web Audio API Spec Editor (Audio WG)

Proposal: Audio Device Client

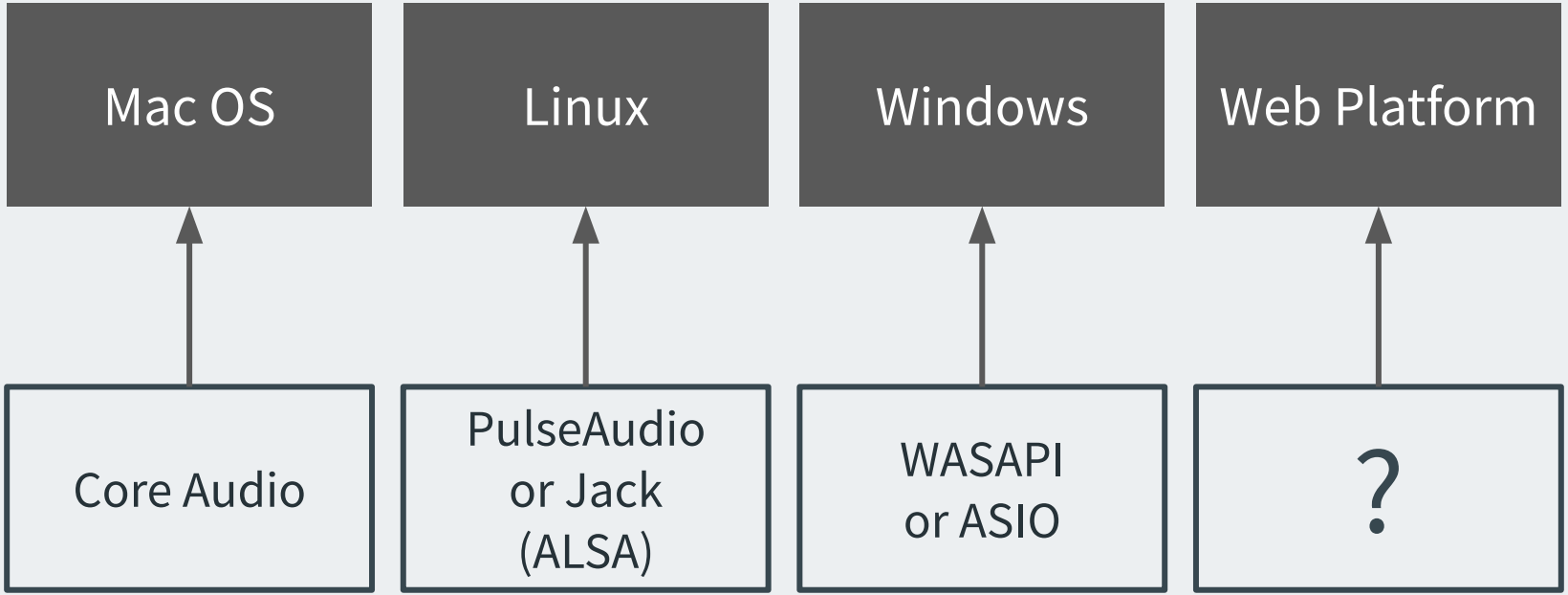
- Work-in-progress! (in Audio CG)

Proposal: Audio Device Client

- Low-level audio I/O
- Better access to hardware
- A dedicated scope runs on RT thread

"But... why?"

"To close the *App Gap* for audio."

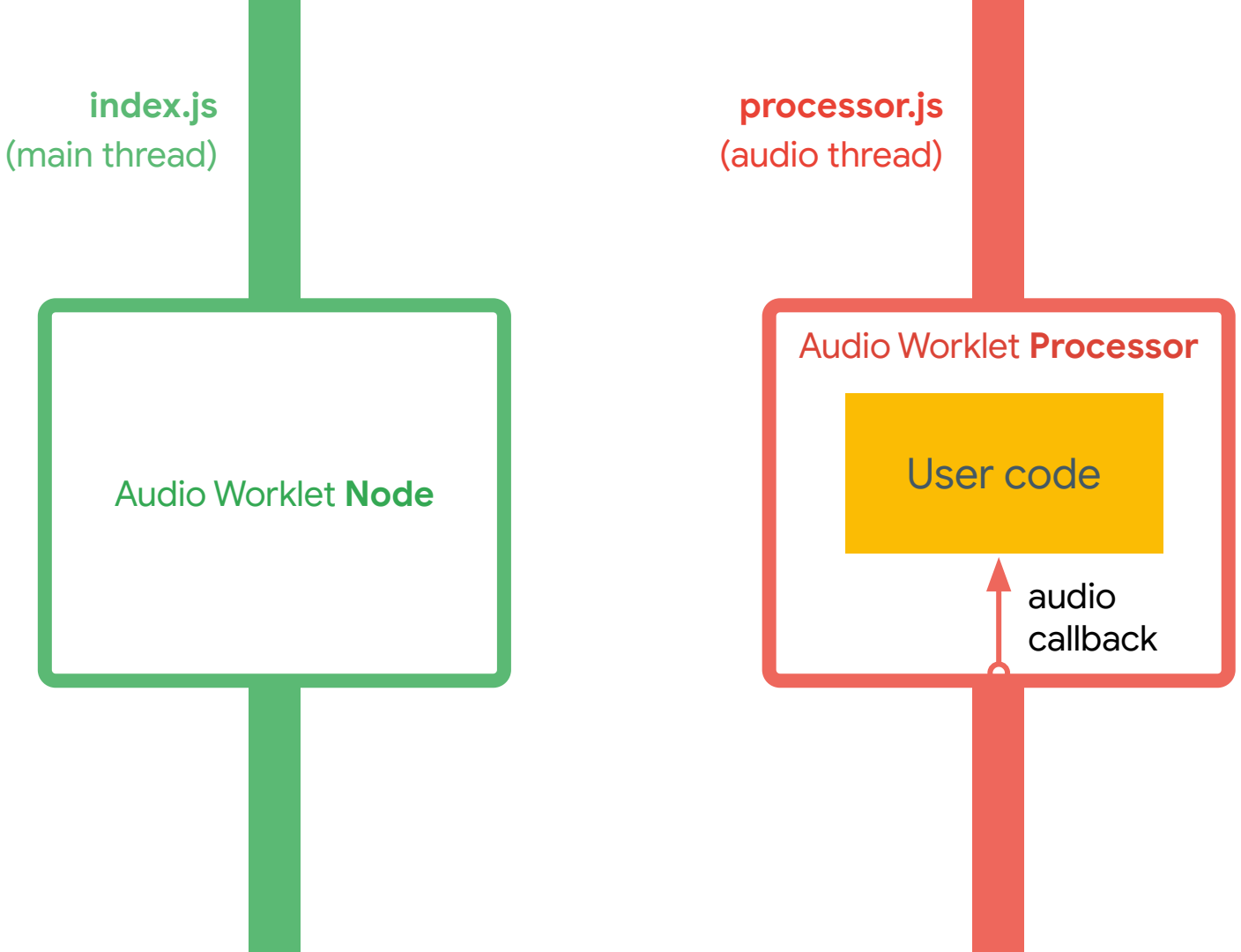

Mac OS
Linux
Windows
Web Platform
Core Audio
PulseAudio
or Jack
(ALSA)
WASAPI
or ASIO
?

"Web Audio API?"

Issues: Web Audio API (around 2013)

- Extensibility (W3C TAG review, 1st round)
  - No AudioNode subclassing
  - ScriptProcessorNode unfit for purpose

Audio Worklet


index.js
(main thread)
processor.js
(audio thread)
Audio Worklet Node
Audio Worklet Processor
User code
audio
callback

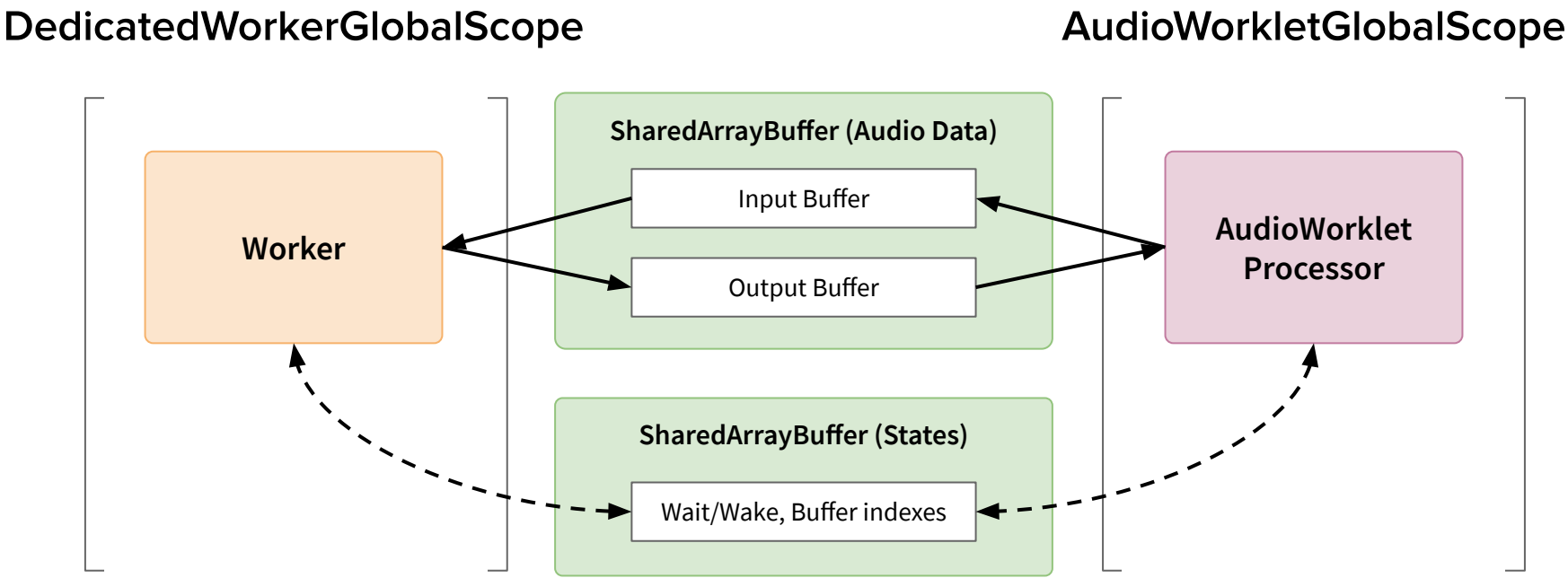
"How do I port X with it?"

Case study 1:
Audio Worklet + WASM

Problems: Audio Worklet + WASM

- Web Audio API render quantum == 128 sample frames (less than 3ms at 44.1Khz)
- Not suitable for large-scale audio application

Case study 2:
AW + SAB + WASM Worker


DedicatedWorkerGlobalScope
AudioWorkletGlobalScope
SharedArrayBuffer (Audio Data)
Input Buffer
Output Buffer
Worker
AudioWorklet Processor
SharedArrayBuffer (States)
Wait/Wake, Buffer indexes

Problems: AW + SAB + WASM Worker

- Low thread priority of Worker
- Overly complex setup for a basic task

Proposal: Audio Device Client

- Low-level audio I/O
  - Isochronous callback-based audio I/O
  - Suitable for WASM-powered audio processing

Proposal: Audio Device Client

- Better access to hardware
  - Configurable render block size, sample rate, and I/O channels
  - Constraints-based hardware configuration

Proposal: Audio Device Client

- A dedicated scope runs on RT thread (if permitted)
  - No more complex plumbing and thread hops
  - For optimum WASM-powered audio processing

Potential Use Cases

- Game audio engine
- Pro-audio applications (music production)
- Client-side spatialization (AR/VR)
- Teleconference

Code Examples

```
/* async scope: main global scope */
const devices = await navigator.mediaDevices.enumerateDevices();

// Scenario: device #0 and #2 are audio input and
// output devices respectively.
const constraints = {
  inputDeviceId: devices[0].deviceId,
  outputDeviceId: devices[2].deviceId,
  sampleRate: 32000,
  callbackBufferSize: 512,
  inputChannelCount: 2,
  outputChannelCount: 6,
};
```

Setting up device constraints

WIP

```
/* async scope: main global scope */
const client =
    await navigator.mediaDevices.getAudioDeviceClient(constraints);
await client.addModule('my-client.js');
client.start();


// when the application ended
client.stop();
```

AudioDeviceClient

WIP

```
/* my-client.js: AudioDeviceClientGlobalScope */
import Engine from './my-audio-engine.js';

/**
 * @params {Array<Float32Array>} input
 * @params {Array<Float32Array>} output
 */
const process = (input, output) => {
  Engine.process(input, output);
};

setDeviceCallback(process);
```

AudioDeviceClientGlobalScope

WIP

Design issues: Integration

- WASM
- AudioContext
- WebRTC

Security/Privacy Concerns

- Real-time priority thread
  - Mitigation: ADC only can be spawned by "top-level document".
- Autoplay policy and secure context by default

github.com/WebAudio/web-audio-cg

(explainer, IDL, code examples, and issue tracker)