

WebX0X Version 2

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ABSTRACT

WebX0X Version 2 is a performance-oriented drum synthesizer and sequencer built using the Web Audio API.

1. Introduction

WebX0X takes its name from the classic drum machines made by Roland in the 1980s, most notably the TR-606, TR-707, TR-808 and TR-909. WebX0X Version 1 was launched in June 2015. It featured a rudimentary step sequencer and was limited to four synthesizer voices, with all sound generated in real time using subtractive synthesis methods. WebX0X Version 1 was presented at Web Audio Conference 2016 in Atlanta, GA.

2. Sequencer Redesign

WebX0X Version 2 retains the familiar 808-style step sequencer, but enhances it with several new features.

3. Independent Sequence Length and Resolution

Sequence length and step duration may be set independently for each track, which makes it possible to produce complex polyrhythmic and polymetric patterns.

3.1 Independent Step Velocity

Velocity may be set independently for each step in a sequence.

3.2 Step Randomization

Step muting and velocity may be randomized during sequence playback. Randomization depth may be set independently for each step. Muting randomization depth determines the probability that steps will be muted (or unmuted) without concern for the state chosen by the user. Velocity randomization depth sets a window around the value chosen by the user, within which the velocity will be randomized.

3.3 Step Lock

The steps in each track may be locked together to allow one slider to set or scale the velocity and randomization depths for all steps at once.

3.4 Expressions

Step muting, velocity and randomization may be set manually with sliders, or based on mathematical expressions. The variable x is assigned to the index of each step before the expression is evaluated. For example, applying the expression $x \% 4 != 0$ to step muting will mute all steps except for the first in each group of four. Applying the expression $(\text{abs}(\sin(x * 0.2)) * 0.25) + 0.75$ to step velocity will create a slow, subtle velocity curve.

3.5 MIDI Output

Each track may be assigned to a separate MIDI port, channel and note number to control external MIDI devices.

4. Synthesizer Improvements

WebX0X Version 2 offers sample playback and subtractive synthesis on each voice. The subtractive synthesizer is similar to the design used in WebX0X Version 1 with the notable exception of the noise generator. Where WebX0X Version 1 used a ScriptProcessorNode to generate noise, Version 2 uses an AudioBuffer filled with the output of a pseudo-random binary sequence.

5. Audio Recording

WebX0X Version 2 uses the MediaRecorder API to record the synthesizer output in real time. Recordings are saved to cloud storage and may be downloaded in webm or wav format.

6. Architecture

The accompanying system diagram provides a high-level view of the WebX0X Version 2 architecture.

1. Sequencer Web Worker: The sequencer runs in a web worker to avoid running repetitive or expensive operations on the UI thread.
2. Project: Manages switching between sequencers. There may only be one active project.
3. Sequencer: Stores state and manages operations for a single sequence or pattern. The project may contain many sequencers.
4. Sequencer Track: Stores state and manages operations for a single track within a sequence. Each sequencer may contain many tracks.
5. Sequencer Step: Stores state and manages operations for a single step within a track. Each sequencer may contain up to 32 steps.
6. Sequencer Web Worker Interface: Manages messaging between the sequencer web worker, user interface, drum synthesizer and project/recording storage.
7. Project UI: Renders the active sequencer and audio recorder/player components. Provides controls to perform project-level operations like setting the project name.
8. Sequencer UI: Renders the active sequencer's tracks and provides controls to manage tracks.
9. Sequencer Track UI: Renders controls and steps for each track in the active sequencer.
10. Sequencer Step UI: Renders controls for each step in a track.

11. Drum Synthesizer: Generates sound for each track in the active synthesizer and manages the mix between tracks.
12. Audio Recorder: Records audio from the drum synthesizer's output.
13. Audio Recorder UI: Manages authentication with cloud storage providers for recordings. Provides controls to select and export previous recordings.
14. Audio Player UI: Provides transport controls for the currently selected recording.
15. Audio Converter Web Worker: Converts recordings from the browser's native format (webm) to wav format.

7. Roadmap

Planned features for WebX0X Version 2 include:

- Multiple patterns per project with pattern sequencing
- FM synthesis
- Additional effects processors
- MIDI input for control of sequencer and synthesizer parameters
- MIDI learn functionality
- Synthesizer patch presets
- Social sharing of recordings
- Improved support for mobile browsers

8. Web Links

WebX0X Version 2 is currently in development. The most recent stable version can be viewed at <https://v2.webx0x.com>.

WebX0X Version 1 is publicly available and may be viewed at <https://webx0x.com>.

The website for Irritant Creative Inc. is located at <https://irritantcreative.ca>.

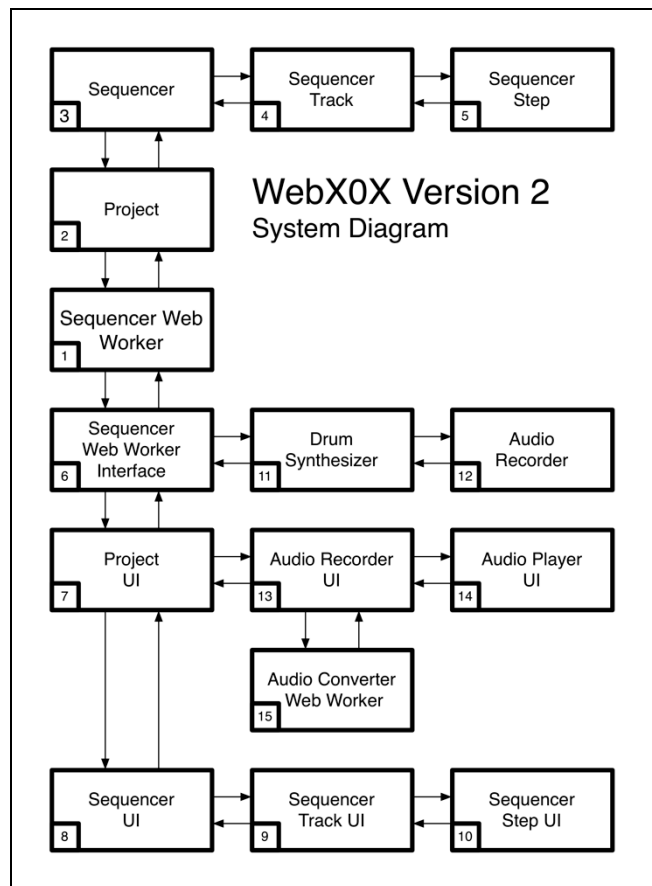


Figure 1: WebX0X Version 2 system diagram



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