

# **REAL-TIME REMOTE JAMS WITH** WEBRTC AND WEB MIDI

# PHILIP MILLER

# Real-time remote jams with WebRTC and Web MID

aka WebMIDIRTC



#### About me

• Located in Hamilton, ON, Canada



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#### About me

• Sr. DevRel Engineer @ Daily



#### About me

• Drummer turned synth nerd





## The web is coming of age and we're finally starting to reap the benefits

### Video calls

#### 1964



The Picturephone has Touch-Tone controls to make calls and control the television screen so you can see the person you're talking to, be seen yourself, or have a darkened screen. Attended service between New York, Washington and Chicago began in 1964.

So elegant

#### 1964







We had to start somewhere :)





#### Is this the metaverse?

## Audio / MIDI

#### 1982\*



\*This model is from 1985 but the ad was too good not to use

#### 1982\*





\*This model is from 1985 but the ad was too good not to use



#### Wait, this is in a browser?



### What if we combined the two?





#### **But first:**

A brief aside about online music collaboration and latency







#### AKA: you can't change the speed of light

1. Add it



#### l to ninjam.com as justin

13/16 @ 120 BPM

- 1. Add it
- 2. Centralize it



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<u>, 1</u> €	1 3 Drummer	5			9	11	13	15
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:	Track 4	MS	Default	ر د دهه الله	undis Note I op	مراجع المراجع المراجع المراجع المراجع		De
:	Track 5	MS						
:	Track 6	MS						



- 1. Add it
- 2. Centralize it
- **3.** Minimize it



- 1. Add it (and synchronize)
- 2. Centralize it
- **3.** Minimize it
- 4. Embrace it



#### **Digitakt Tracks**





### But how do we "embrace" it?





### **Embracing it**

1. Have a single audio "host"



### **Embracing it**

- 1. Have a single audio "host"
- 2. Make it primarily loop based





### **Embracing it**

- 1. Have a single audio "host"
- 2. Make it primarily loop based
- **3.** Focus on things that can *feel* immediate, even if they're not
  - Changing phrases/loops (MIDI PC)
  - Changing sound parameters (MIDI CC)

#### FX parameters reverb

Parameter name	Description	CC MSB	CC LSB	CC min	CC max	NRPN MSB	NRPN LSB	NRPN min	NRPN max	O
Reverb predelay		21	53	0	127	2	20	0	127	0-
Reverb decay time		74		0	127	2	21	0	127	0-
Reverb shelving frequency		75		0	127	2	22	0	127	0-
Reverb shelving gain		22	54	0	127	2	23	0	127	0-
Reverb highpass filter		76		0	127	2	24	0	127	0-
Reverb lowpass filter		77		0	127	2	25	0	127	0-
Reverb mix volume		23		0	127	2	26	0	127	0-

#### FX master

Parameter name	Description	CC MSB	CC LSB	CC min	CC max	NRPN MSB	NRPN LSB	NRPN min	NRPN max	O
Input L volume		24	56	0	127	2	30	0	127	0-
Input R volume		25	57	0	127	2	32	0	127	0-
Pan L		78		0	127	2	3	0	127	0-
Pan R		79		0	127	2	33	0	127	0-
Maxter chorus send		26	58	0	127	2	34	0	127	0-
Master delay send		27	59	0	127	2	35	0	127	0-
Master reverb send		28	60	0	127	2	36	0	127	0-
Master overdrive		29	61	0	127	2	37	0	127	0-
Master		95		0	127	2	38	0	127	0-



#### WEBMIDIRTC

or: How I learned to stop worrying and love the browser

#### The Stack - WebRTC

WebRTC is an open-source project to "*enable rich, high-quality RTC applications to be developed for the browser, mobile platforms, and loT devices, and allow them all to communicate via a common set of protocols*".

- Support in most\* modern browsers
- Peer-to-peer

\*implementation varies



#### The Stack - WebRTC (cont'd)

Daily is built on top of WebRTC, with developer-time-tovalue, and call quality and reliability as north stars.

- User friendly APIs
- Global infrastructure
  - p2p <> SFU
  - recording
  - live streaming
- Fully featured Prebuilt UI
- World class support
- Call data and analytics





#### 3:26 🔊

AA

C

#### 





#### 8 people in call

በ

2 people are screen sharing

#### The Stack - Front end

Vue is a "progressive [javascript] framework for building user interfaces."

- Incrementally adoptable
- Core library + supporting libraries
- Great standard tooling (vue-cli)
- Single File Components (SFC) are approachable (IMO)

```
<template>
  <main class="page-container">
   <div class="daily-call-container">
     <div class="daily-call" id="call-wrapper"></div>
   </div>
    <div class="controls-container">
     <div class="main-controls">
       {{ message || "[See incoming changes here]" }}
        <div class="call-controls">
         <div class="daily-controls">
           <h3>Call controls</h3>
           <button class="join-button" @click="joinCall()" :disabled="joined">
             Join
           </button>
         </div>
         <div>
           <h3>Playback</h3>
           <div class="button-container">
             <button class="play-button" @click="controlMessage('play')">
               <img class="icon-control" :src="playIcon" alt="Play" />
             </button>
             <button class="stop-button" @click="controlMessage('stop')">
               <img class="icon-control" :src="stopIcon" alt="stop" />
             </button>
           </div>
         </div>
        </div>
        <div class="column-section">
         <div>
           <h3>Digitone Tracks</h3>
           <div class="control-section">
             <h4>Mute</h4>
             <div class="button-container">
               <button @click="controlMessage('muteDN', 1)">1</button>
               <button @click="controlMessage('muteDN', 2)">2</button>
               <button @click="controlMessage('muteDN', 3)">3</button>
               <button @click="controlMessage('muteDN', 4)">4</button>
             </div>
           </div>
           <div class="control-section">
             <h4>Unmute</h4>
             <div class="button-container">
               <button @click="controlMessage('unmuteDN', 1)">1</button>
               <button @click="controlMessage('unmuteDN', 2)">2</button>
               <button @click="controlMessage('unmuteDN', 3)">3</button>
               <button @click="controlMessage('unmuteDN', 4)">4</button>
             </div>
           </div>
         </div>
         <div>
```

#### The Stack - Front end (cont'd)

Web MIDI allows a browser to interact with MIDI devices via a standard set of APIs

- Supported in Chrome, Opera, Android WebView, Edge
- Possible in other browsers via Jazz-Plugin
- WebMidi.js
  - provides more convenient higher level APIs
  - much better DX

```
// Enable WebMidi.js
WebMidi.enable(function (err) {
  if (err) {
    console.log("WebMidi could not be enabled.", err);
  // Viewing available inputs and outputs
  console.log(WebMidi.inputs);
  console.log(WebMidi.outputs);
  // Reacting when a new device becomes available
  WebMidi.addListener("connected", function(e) {
    console.log(e);
  });
  // Reacting when a device becomes unavailable
  WebMidi.addListener("disconnected", function(e) {
    console.log(e);
  });
  // Display the current time
  console.log(WebMidi.time);
  // Retrieving an output port/device using its id, name or index
  var output = WebMidi.getOutputById("123456789");
  output = WebMidi.getOutputByName("Axiom Pro 25 Ext Out");
  output = WebMidi.outputs[0];
  // Play a note on all channels of the selected output
  output.playNote("C3");
  // Play a note on channel 3
  output.playNote("Gb4", 3);
  // Play a chord on all available channels
  output.playNote(["C3", "D#3", "G3"]);
  // Play a chord on channel 7
  output.playNote(["C3", "D#3", "G3"], 7);
  // Play a note at full velocity on all channels)
  output.playNote("F#-1", "all", {velocity: 1});
  // Play a note on channel 16 in 2 seconds (relative time)
  output.playNote("F5", 16, {time: "+2000"});
  // Play a note on channel 1 at an absolute time in the future
```

output.playNote("F5", 16, {time: WebMidi.time + 3000});

#### The Stack - Hardware

Digitakt

- Drum computer (8 tracks)
- Sampler
- MIDI Sequencer (8 tracks)

Digitone

- "Modern" FM synth
- 8 Voices (4 tracks)
- MIDI Sequencer (4 tracks)

o 🎧 Left	Right Input I	L Input R	MIDI In	MIDI Out Sync A	MIDI Thru Sync B	USB	DC In	Power	
		Drum Computer				eli O			
Master Volume			J (D)		A	в	c	D	
Level/Data Sound Browser	Digital	ct			E	F	G	н	
				Т	RIG SR	C FLTR	AMP	LFO	
FUNC	••• *	<b>≱</b> 1111	B	Qu	antize Assi	ign Delay	Reverb	Master	
	Imp/Exp Save	e Proj Direct	t Tap Tempo		res	$\wedge$		:4 2:4 3:4 4:4	
TRK	O	D		Sa	ve Ptn	Rtrg/Oct+	$\square$		
Chromatic	Сору	Clear	Paste		ad Ptn µTime	- Rtrg/Oct-	ך µTime+	PAGE Fill/Scale	
PTN	1	2	3	4	5	6	<u>7</u>	<u>8</u>	
Metronome	кіск	SNARE	том	CLAP	COWBELL	CLOSED HAT	OPEN HAT	CYMBAL Quick Mute	
BANK	9	10	<u>11</u>	12	13	<u>14</u>	<u>15</u>	<u>16</u>	
Mute Mode	MIDI A	MIDI B	MIDIC	MIDI D	MIDI E	MIDI F	MIDI G	MIDI H	

⊙ ∩ Left	Right Input L Input R		N Out MIDI Thru nc A Sync B	USB	DC In	Power
				2 ele	ktr	ON I
	Polyphonic Digital Synthesizer					
Master Volume		8197.3 A B 2.50 4:12		8	c	D
			-			
		DBK HIX				
Level/Data Sound Browser	Digitone		E	F	G	н
_		_	TRIG	SYN2 FU	TR AMP	LFO
FUNC	••• 🕸 💿	B	Setup Arp Menu	Chorus Del	lay Reverb	Master
MIDI	Imp/Exp Save Proj Unison	Tap Tempo	YES Save Ptn	Note/Oct+	54	24 34 44
MIDI Config	Copy Clear	Paste	NO <			PAGE
50 -0			Reload Ptn µTime -	Note/Oct- µTin	ne +	Fill/Scale
Add Notes/Arp	<u>1</u> <u>2</u> <u>3</u>	4 5	<u>6</u> 7	<u>7 8</u>	т	
PTN					Mute	Mute
BANK		12	14 11	5 36	T3	T4
Mute Mode					Mute	Mute



### A quick tour of the app





### Now let's look at the code





### So what next?

#### What next?

- 1. Add more PC/CC
- 2. More devices
- 3. Remote MIDI
- 4. Remote sampling/looping
- 5. More participant roles
- 6. Command queuing
- 7. Recording, Live streaming



#### **Digitakt Tracks**



#### **Practical applications**

- 1. Interactive live sessions/streams
- 2. Remote production
- 3. Music retail
- 4. Product launches / previews



### **Questions?**

#### Shout out to:

- All the OSS folks (Vue, WebMidi.js)
- Daily
- ADC21 Team





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