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Echo in WebRTC; Why?

Echo is a distortion of voice that occurs either when you receive your own voice; or something unusual sound!

Echo is one of the biggest issues in current WebRTC implementations!

Why?

Echo occurs if input output audio devices are placed close together!

In old days; usage of the "headsets" was the only "suggested" solution to overcome the echo!

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Why?

Sometimes,

44.1 kHz and non-441.1 kHz simple rate mismatches causes echo!

Solution?

The **"ambient noise reduction"** which can be enabled on the built-in mic on Mac appears to cause a very small amount of echo.

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Solution?

Ensure both **capture** and **render** devices are set to either **44.1** or **48** kHz. You can do this through the **"Audio MIDI Setup"** application

Solution?

Disable **"ambient noise reduction“** on Mac.

Solution?

Make sure there is distance between input and output audio devices.

(Old guys suggested that) always prefer headphones over built-in speakers!

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Solution?

Suggest users to install third party software(s) to mimic echo.

E.g. Toshiba Echo Cancellation Utility

etc.

Acoustic Echo Cancellation (AEC) is a preferred solution!

Solution?

High volume can produce sound noise on some audio devices. The value may not be significant if audio device volume is controlled externally.

```
HTMLAudioElement.volume = 0.9;
HTMLAudioElement.play();
```

Acoustic Echo is what happens when sound from your speakers enters your microphone.

You may not hear it, but the people you are talking to will find it extremely irritating

Solution?

Don’t use “autoplay:true” for local streams.

Manually set “muted:false” and “volume:0”:

```
HTMLVideoElement.volume = 0;
HTMLVideoElement.muted = 0;
```

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Solution?

The GainNode is a simple element that lets us control the volume of the audio that’s coming into it.

```
var context = new webkitAudioContext(),
var sineWave = context.createOscillator();
var gainNode = context.createGainNode();
sineWave.connect(gainNode);
gainNode.connect(context.destination);
sineWave.noteOn(0);
gainNode.gain.value = 0.9;
```

Try this demo locally to control volume using GainNode.

Solution?

No concrete solution!

Browser vendors landed some patches; however, still echo issues occur on Firefox, Chrome and Opera!

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Solution?

Patches (getUserMedia constraints API):

googEchoCancellation

googAutoGainControl

googNoiseSuppression

googHighpassFilter

googNoiseReduction

googLeakyBucket

Ref: mediaconstraintsinterface.h

Acoustic Echo Cancellation (AEC)

Acoustic Echo Cancellation (AEC) solves echo/noise issues by analyzing the sound being played out from your speakers and removes it from the sound captured by your microphone.

Current AEC implementation in chromium uses less CPU and improves voice quality.

AEC & mobile platforms?

Echo Controller works with 8k/16k sampling rate however there are special processes in chromium to make Echo Controller work for iSAC codec i.e. 32k sampling audio; and opus codec i.e. 48k.

AEC may not work for mobile platforms with complex implementations; only AECM could work which has performance issues.

AECM provides poor quality; causes very loud background noise. However, unfortunately, it seems that 40% of android devices are unable to handle AEC.

AEC & mobile platforms?

AECM is unable to handle double talk.

AEC may fail to handle distorted input due to linear algorithms.

AECM is limited to 8k/16k sampling rate; so skip opus usage on android devices until AEC gets improved in chromium!

Should mobile users compromise?

Hmm, unfortunately!

Conclusion?

- It is said that echo occurs when sound from the speakers is picked up by the audio input devices i.e. microphones. You need to place both devices away from each other.
- People usually suggest to mute participants' audio while they're idle. Remember, voice-activity-detection is "already" enabled by default on chrome. RTP packets are streamed accordingly. So, there are less chances of echo in such scenario.
- You either need to install echo cancellation software according to your platform and devices; or try to use microphone/headphone.

References?

- WebRTC Eco Cancellation
- WebRTC improvement optimized aecacoustic echo cancellation
- mediaconstraintsinterface.h
- https://github.com/muaz-khan/WebRTC-Experiment/issues/95#issuecomment-24562690
- https://code.google.com/p/webrtc/issues/detail?id=2580

Thanks!

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