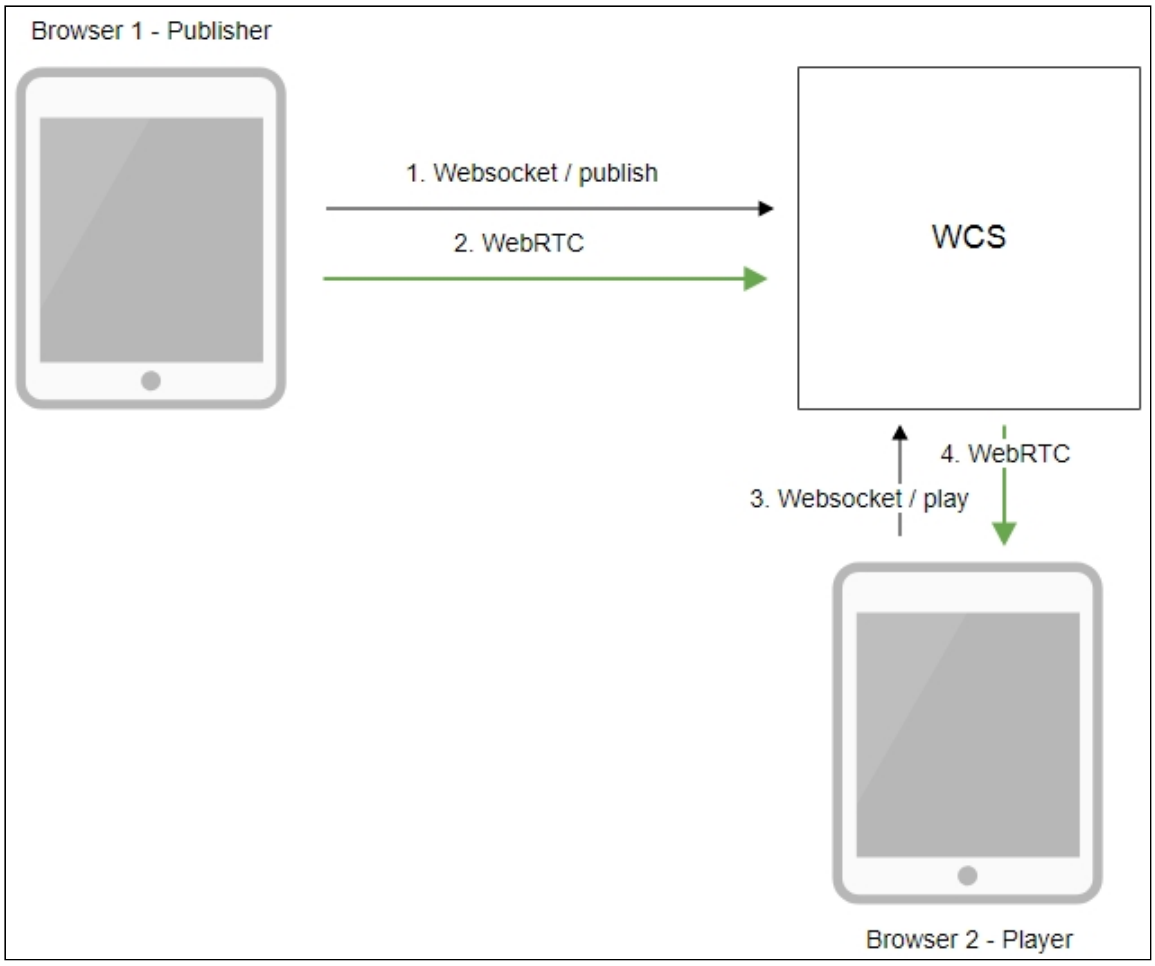
From an HTML5 Canvas element (whiteboard) in a browser via WebRTC

Overview

Supported platforms and browsers

	Chrome 66+	**Firefox 59+**	**Safari 14+**	**MS Chromium Edge**
Windows	✅	✅	❌	✅
Mac OS	✅	✅	✅	✅
Android	✅	❌	❌	✅
iOS	✅	❌	✅	❌

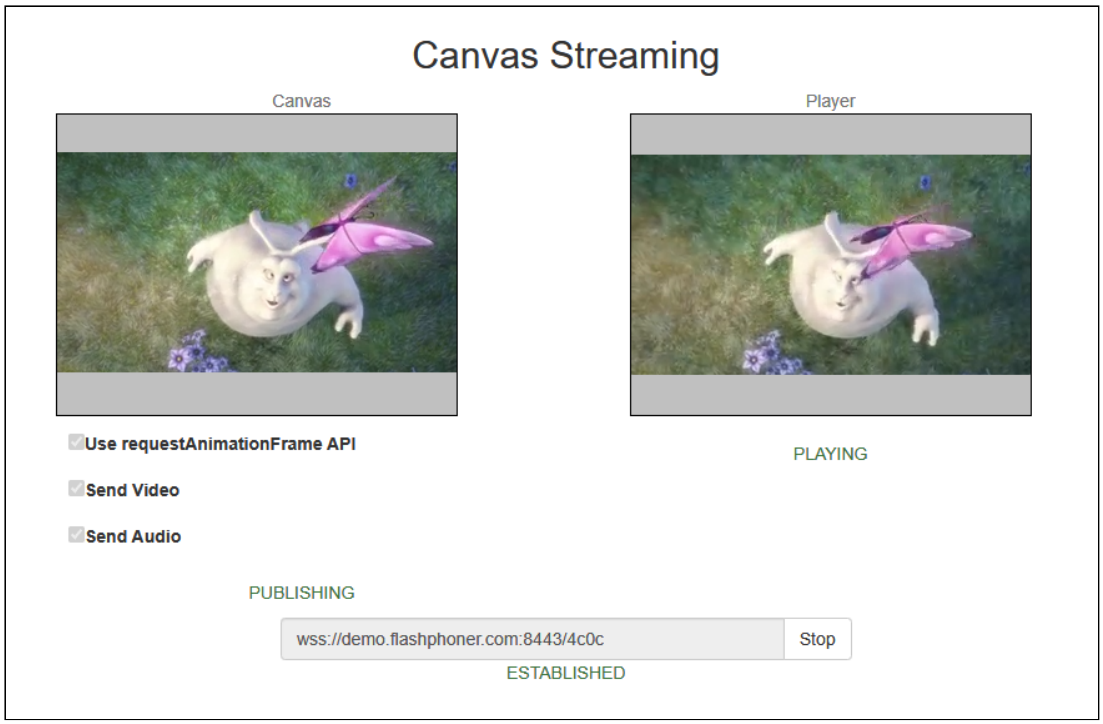
Operation flowchart



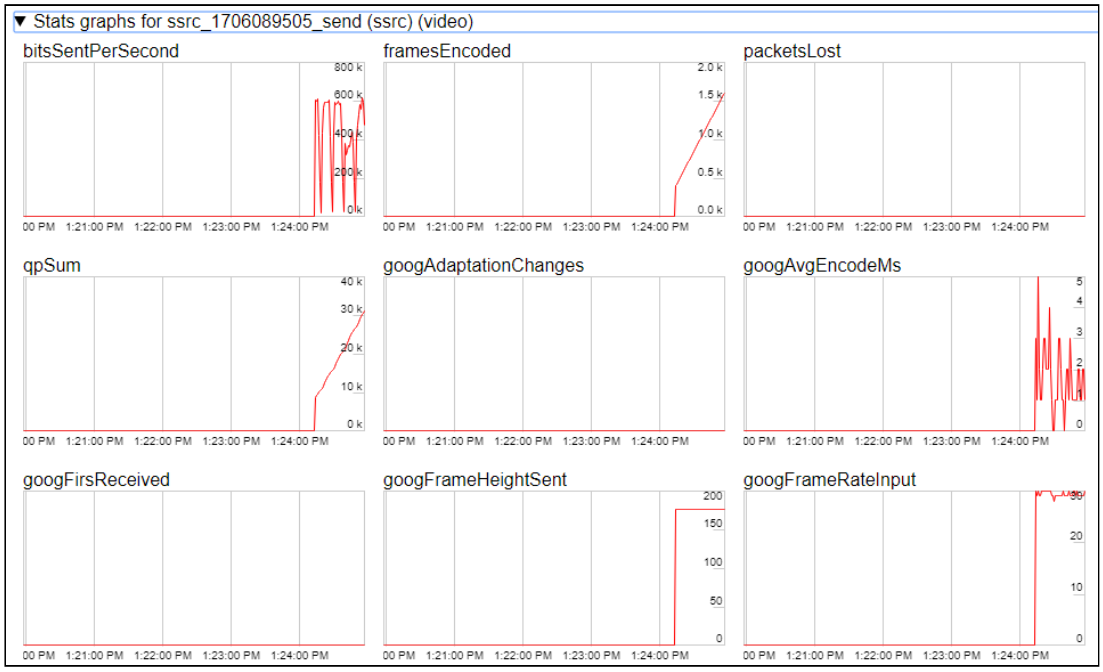
1. The browser establishes a connection to the server via the Websocket protocol and sends the `publishStream` command.
2. The browser captures the image of an HTML5 Canvas element and sends a WebRTC stream to the server.
3. The second browser establishes a connection also via Websokcet and sends the `playStream` command.
4. The second browser receives the WebRTC stream and plays the stream on the page.

Quick manual on testing

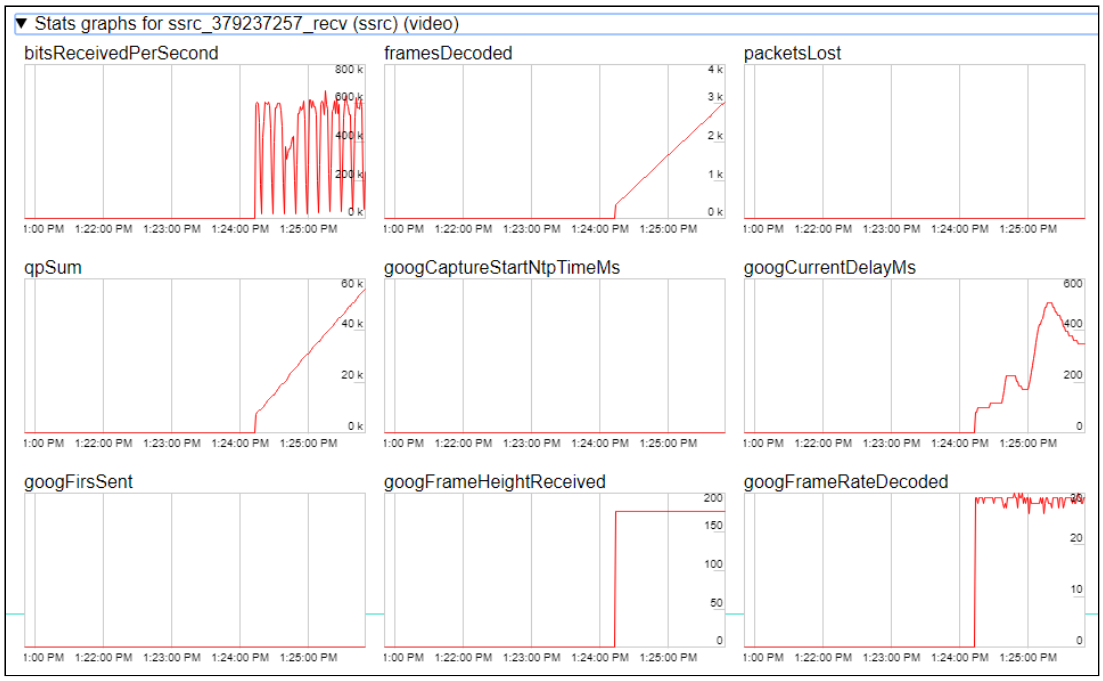
1. For test we use:
2. WCS server `demo.flashphoner.com`;
3. Canvas Streaming web application in Chrome browser
4. Press `Start`. This starts streaming from HTML5 Canvas on which test video fragment is played:



5. To make shure that stream goes to server, open `chrome://webrtc-internals`:



6. Playback graphs on `chrome://webrtc-internals`:

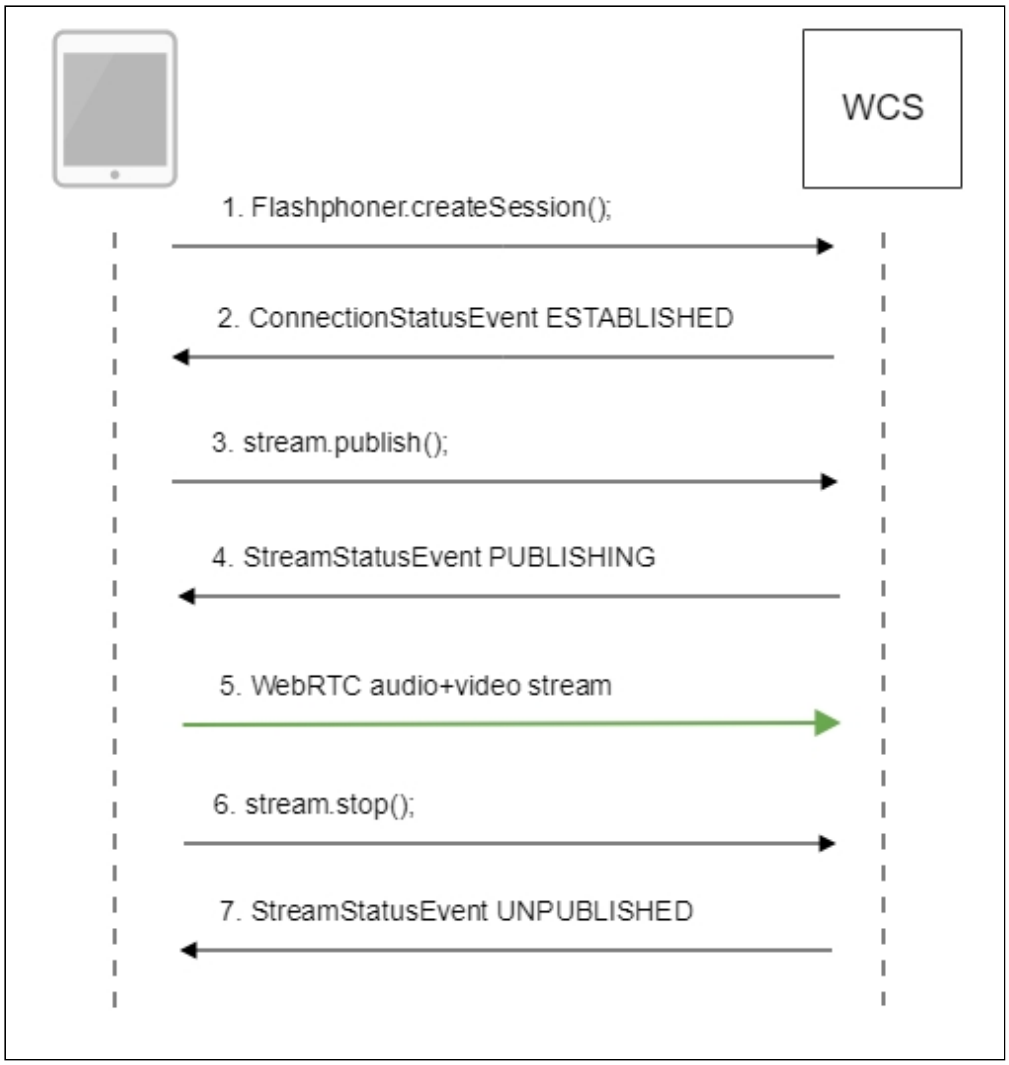


Call flow

Below is the call flow in the Canvas Streaming example

canvas_streaming.html

canvas_streaming.js



1. Establishing a connection to the server
   `Flashphoner.createSession()` code

```
Flashphoner.createSession({urlServer: url}).on(SESSION_STATUS.ESTABLISHED,
function(session){
  //session connected, start streaming
  startStreaming(session);
}).on(SESSION_STATUS.DISCONNECTED, function(){
  setStatus(SESSION_STATUS.DISCONNECTED);
  onStopped();
}).on(SESSION_STATUS.FAILED, function(){
  setStatus(SESSION_STATUS.FAILED);
  onStopped();
});
```

2. Receiving from the server an event confirming successful connection
   `SESSION_STATUS.ESTABLISHED` code

```
Flashphoner.createSession({urlServer: url}).on(SESSION_STATUS.ESTABLISHED,
function(session){
    //session connected, start streaming
```

```
    startStreaming(session);
    ...
});
```

3. 2.1. Set up and start HTML5 Canvas capturing
   `getConstraints()` code

```
function getConstraints() {
    var constraints;
    var stream = createCanvasStream();
    constraints = {
        audio: false,
        video: false,
        customStream: stream
    };
    return constraints;
}
```

4. 2.2. Set up video capturing from Canvas
   `createCanvasStream()` code

```
function createCanvasStream() {
   var canvasContext = canvas.getContext("2d");
   var canvasStream = canvas.captureStream(30);
   mockVideoElement = document.createElement("video");
   mockVideoElement.setAttribute("playsinline", "");
   mockVideoElement.setAttribute("webkit-playsinline", "");
   mockVideoElement.src = '../../dependencies/media/test_movie.mp4';
   mockVideoElement.loop = true;
   mockVideoElement.muted = true;
   ...
   return canvasStream;
}
```

5. 2.3. Draw on Canvas using `requestAnimationFrame()` or `setTimeout()`
   code

```
function createCanvasStream() {
   ...
   var useRequestAnimationFrame = $("#usedAnimFrame").is(':checked');
   mockVideoElement.addEventListener("play", function () {
       var $this = this;
       (function loop() {
           if (!$this.paused && !$this.ended) {
               canvasContext.drawImage($this, 0, 0);
               if (useRequestAnimationFrame) {
                   requestAnimationFrame(loop);
               } else {
                   setTimeout(loop, 1000 / 30); // drawing at 30fps
               }
           }
       })();
   }, 0);
   ...
```

```
    return canvasStream;
}
```

6. 2.4. Play test video fragment on Canvas
   code

```
function createCanvasStream() {
    ...
    mockVideoElement.play();
    ...
    return canvasStream;
}
```

7. 2.5. Set up audio capturing from Canvas
   code

```
if ($("#sendAudio").is(':checked')) {
    mockVideoElement.muted = false;
    try {
        var audioContext = new (window.AudioContext ||
window.webkitAudioContext)();
    } catch (e) {
        console.warn("Failed to create audio context");
    }
    var source = audioContext.createMediaElementSource(mockVideoElement);
    var destination = audioContext.createMediaStreamDestination();
    source.connect(destination);
    canvasStream.addTrack(destination.stream.getAudioTracks()[0]);
}
```

8. Publishing the stream
   `Stream.publish()` code

```
session.createStream({
  name: streamName,
  display: localVideo,
  cacheLocalResources: true,
  constraints: constraints
}).on(STREAM_STATUS.PUBLISHING, function (stream) {
  ...
}).on(STREAM_STATUS.UNPUBLISHED, function () {
  ...
}).on(STREAM_STATUS.FAILED, function () {
  ...
}).publish();
```

9. Receiving from the server an event confirming successful publishing of the stream
   `STREAM_STATUS.PUBLISHING` code

```
session.createStream({
  ...
}).on(STREAM_STATUS.PUBLISHING, function (stream) {
```

```
  setStatus("#publishStatus", STREAM_STATUS.PUBLISHING);
  playStream();
  onPublishing(stream);
}).on(STREAM_STATUS.UNPUBLISHED, function () {
  ...
}).on(STREAM_STATUS.FAILED, function () {
  ...
}).publish();
```

10. Sending the audio-video stream via WebRTC
11. Stopping publishing the stream
    `Stream.stop()` code

```
function stopStreaming() {
    ...
    if (publishStream != null && publishStream.published()) {
        publishStream.stop();
    }
    stopCanvasStream();
}
```

`stopCanvasStream()` code

```
function stopCanvasStream() {
    if(mockVideoElement) {
        mockVideoElement.pause();
        mockVideoElement.removeEventListener('play', null);
        mockVideoElement = null;
    }
}
```

12. Receiving from the server an event confirming successful unpublishing of the stream
    `STREAM_STATUS.UNPUBLISHED` code

```
session.createStream({
  ...
}).on(STREAM_STATUS.PUBLISHING, function (stream) {
  ...
}).on(STREAM_STATUS.UNPUBLISHED, function () {
  setStatus("#publishStatus", STREAM_STATUS.UNPUBLISHED);
  disconnect();
}).on(STREAM_STATUS.FAILED, function () {
  ...
}).publish();
```

To developer

Capability to capture video stream from an HTML5 Canvas element is available in WebSDK since this version of JavaScript API. The source code of the example is located in

`examples/demo/streaming/canvas_streaming/`.

You can use this capability to capture your own video stream rendered in the browser, for example:

```
var audioStream = new window.MediaStream();
var videoStream = videoElement.captureStream(30);
var audioTrack = videoStream.getAudioTracks()[0];
audioStream.addTrack(audioTrack);
publishStream = session.createStream({
    name: streamName,
    display: localVideo,
    constraints: {
        customStream: audioStream
    },
});
publishStream.publish();
```

Capturing from a `video` element works in Chrome:

```
constraints.customStream = videoElement.captureStream(30);
```

Capturing from a `canvas` element works since Chrome 66, Firefox 59 and Mac OS Safari 11.1:

```
constraints.customStream = canvas.captureStream(30);
```

Note that `cacheLocalResources` parameter is ignored and local resources are not cached while `customStream` is used.

Using requestAnimationFrame API

Since WebSDK build 2.0.200 the following example is added to use `requestAnimationFrame` API to draw image on HTML5 Canvas:

```
function createCanvasStream() {
    ...
    var useRequestAnimationFrame = $("#usedAnimFrame").is(':checked');
    mockVideoElement.addEventListener("play", function () {
        var $this = this;
        (function loop() {
            if (!$this.paused && !$this.ended) {
                canvasContext.drawImage($this, 0, 0);
                if (useRequestAnimationFrame) {
                    requestAnimationFrame(loop);
                } else {
                    setTimeout(loop, 1000 / 30); // drawing at 30fps
                }
            }
        })();
    }, 0);
```

```
    ...
    return canvasStream;
}
```

This is modern method comparing to drawing by timer, but this requires a browser tab to be active while canvas stream is capturing. If user switches to another browser tab or minimizes browser window to background, requestAnimationFrame API will stop. Drawing by timer does not stop in this case excluding mobile browsers.

Known issues

1. Capturing from an HTML5 Video element does not work in Firefox on certain platforms and in old Safari versions.

Symptoms

There is no video in a stream published from a canvas, but there is audio only, streaming fails with `Failed by Video RTP activity`

Solution

Use this capability only in the browsers supporting it

2. There are some browser specific issues capturing a canvas content

Symptoms

When performing HTML5 Canvas capturing: - in Firefox, the local video does not display what is rendered; - in Chrome, the local video does not display black background.

Solution

Take browser specific behavior into account during development

3. If the web app is inside an iframe element, publishing of the video stream may fail.

Symptoms

IceServer errors in the browser console

Solution

Put the app out of iframe to an individual page

4. Bitrate problems are possible when publishing a stream under Windows 10 or Windows 8 with hardware acceleration enabled in a browser

Symptoms

Low quality of the video, muddy picture, bitrate shown in `chrome://webrtc-internals` is less than 100 kbps.

Solution

Turn off hardware acceleration in the browser by setting the flag `chrome://flags/#disable-accelerated-video-encode` to `Disable` or set up the browser or the server to use the VP8 codec for publishing

5. In some Chromium based browsers video is not publishing from canvas when hardware encoding acceleration is enabled

Symptoms

There is no video in a stream published from a canvas, but there is audio only, streaming fails with `Failed by Video RTP activity` error

Solution

Disable hardware encoding acceleration in browser by setting the flag `chrome://flags/#disable-accelerated-video-encode` to `Disable`, set up the browser or the server to use the VP8 codec for publishing or use other browser

6. Canvas capturing may stop while switching to another browser tab or minimizing browser window

Symptoms

Canvas stream is freezing while playing it, player does not receive video and audio packets

Solution

Hold the browser tab in foreground while capturing canvas from it

7. Stream publishing resolution cannot exceed the canvas size

Symptoms

Stream publishing picture size is equal or less than HTML5 Canvas element on the page size (width x height)

Solution

a) use HTML5 Canvas of appropriate size on the page to publish a desired resolution

b) transcode the stream picture to the desired size at server side