Exceeding the buffering quota

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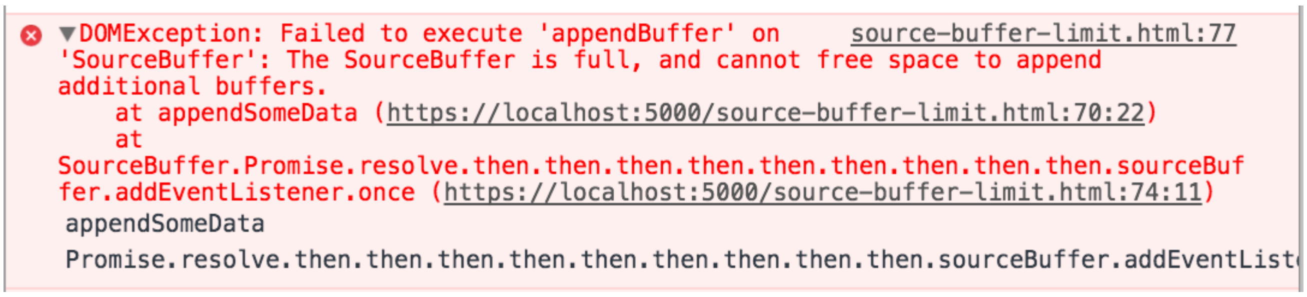
If you're working with Media Source Extensions (MSE), one thing you will eventually need to deal with is an over-full buffer. When this occurs, you'll get what's called a `QuotaExceededError`. In this article, I'll cover some of the ways to deal with it.

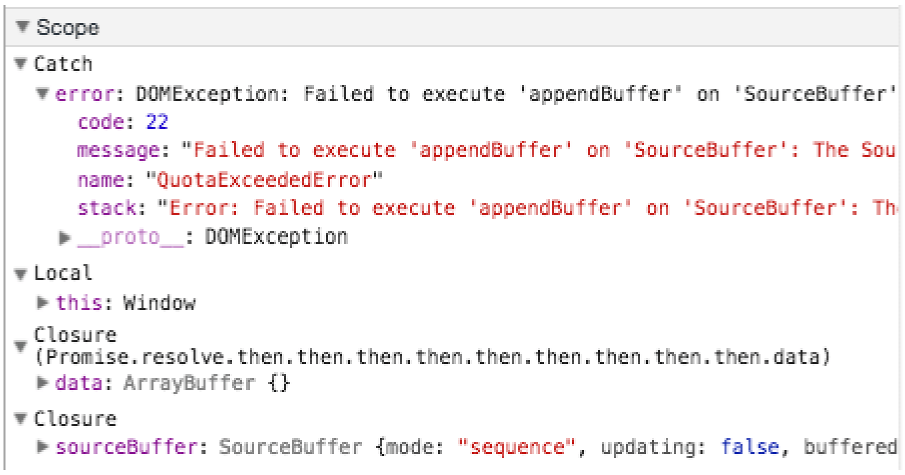
What is the QuotaExceededError?

Basically, `QuotaExceededError` is what you get if you try to add too much data to your `SourceBuffer` object. (Adding more `SourceBuffer` objects to a parent `MediaSource` element can also throw this error. That's outside the scope of this article.) If `SourceBuffer` has too much data in it, calling `SourceBuffer.appendBuffer()` will trigger the following message in the Chrome console window.



```
▼DOMException: Failed to execute 'appendBuffer' on      source-buffer-limit.html:77
'SourceBuffer': The SourceBuffer is full, and cannot free space to append
additional buffers.
    at appendSomeData (https://localhost:5000/source-buffer-limit.html:70:22)
    at
SourceBuffer.Promise.resolve.then.then.then.then.then.then.then.then.then.sourceBuf
fer.addEventListener.once (https://localhost:5000/source-buffer-limit.html:74:11)
 appendSomeData
 Promise.resolve.then.then.then.then.then.then.then.then.then.sourceBuffer.addEventList
```

There are a few things to note about this. First, notice that the name `QuotaExceededError` appears nowhere in the message. To see that, set a breakpoint at a location where you can catch the error and examine it in your watch or scope window. I've shown this below.



```
▼ Scope
▼ Catch
  ▼ error: DOMException: Failed to execute 'appendBuffer' on 'SourceBuffer'
      code: 22
      message: "Failed to execute 'appendBuffer' on 'SourceBuffer': The Sou
      name: "QuotaExceededError"
      stack: "Error: Failed to execute 'appendBuffer' on 'SourceBuffer': Th
    ▶ __proto__: DOMException
▼ Local
  ▶ this: Window
▼ Closure
  (Promise.resolve.then.then.then.then.then.then.then.then.then.data)
  ▶ data: ArrayBuffer {}
▼ Closure
  ▶ sourceBuffer: SourceBuffer {mode: "sequence", updating: false, buffered
```

Second, there's no definitive way to find out how much data the **`SourceBuffer`** can handle.

Behavior in other browsers

At the time of writing, Safari does not throw a **`QuotaExceededError`** in many of its builds. Instead it removes frames using a two step algorithm, stopping if there is enough room to handle the **`appendBuffer()`**. First, it frees frames from between 0 and 30 seconds before the current time in 30 second chunks. Next, it frees frames in 30 second chunks from duration backwards to as close as 30 seconds after **`currentTime`**. You can read more about this in a Webkit changeset from 2014.

Fortunately, along with Chrome, Edge and Firefox do throw this error. If you're using another browser, you'll need to do your own testing. Though probably not what you'd build for a real-life media player, François Beaufort's source buffer limit test at least lets you observe the behavior.

How much data can I append?

The exact number varies from browser to browser. Since you can't query for the amount currently appended data, you'll have to keep track of how much you're appending yourself. As for what to watch, here's the best data I can gather at the time of writing. For Chrome these numbers are upper limits meaning they can be smaller when the system encounters memory pressure.

	Chrome	Chromecast*	Firefox	Safari	Edge
Video	150MB	30MB	100MB	290MB	Unknown

	Chrome	Chromecast*	Firefox	Safari	Edge
Audio	12MB	2MB	15MB	14MB	Unknown

- Or other limited memory Chrome device.

So what do I do?

Since the amount of supported data varies so widely and you can't find the amount of data in a `SourceBuffer`, you must get it indirectly by handling the `QuotaExceededError`. Now let's look at a few ways to do that.

There are several approaches to dealing with `QuotaExceededError`. In reality a combination of one or more approaches is best. Your approach should be to base the work on how much you're fetching and attempting to append beyond `HTMLMediaElement.currentTime` and adjusting that size based on the `QuotaExceededError`. Also using a manifest of some kind such as an mpd file (MPEG-DASH) or an m3u8 file (HLS) can help you keep track of the data you're appending to the buffer.

Now, let's look at several approaches to dealing with the `QuotaExceededError`.

- Remove unneeded data and re-append.
- Append smaller fragments.
- Lower the playback resolution.

Though they can be used in combination, I'll cover them one at a time.

Remove unneeded data and re-append

Really this one should be called, "Remove least-likely-to-be-used-soon data, and then retry append of data likely-to-be-used-soon." That was too long of a title. You'll just need to remember what I really mean.

Removing recent data is not as simple as calling `SourceBuffer.remove()`. To remove data from the `SourceBuffer`, it's updating flag must be false. If it is not, call `SourceBuffer.abort()` before removing any data.

There are a few things to keep in mind when calling `SourceBuffer.remove()`.

- **This could have a negative impact on playback.** For example, if you want the video to replay or loop soon, you may not want to remove the beginning of the video. Likewise, if you or the user seeks to a part of the video where you've removed data, you'll have to append that data again to satisfy that seek.
- **Remove as conservatively as you can.** Beware of removing the currently playing group of frames beginning at the keyframe at or before `currentTime` because doing so could cause playback stall. Such information may need to be parsed out of the bytestream by the web app if it is not available in the manifest. A media manifest or app knowledge of keyframe intervals in the media can help guide your app's choice of removal ranges to prevent removing the currently playing media. Whatever you remove, don't remove the currently playing group of pictures or even the first few beyond that. Generally, don't remove beyond the current time unless you're certain that the media is not needed any longer. If you remove close to the playhead you may cause a stall.
- **Safari 9 and Safari 10 do not correctly implement `SourceBuffer.abort()`**. In fact, they throw errors that will halt playback. Fortunately there are open bug trackers here and here. In the meantime, you'll have to work around this somehow. Shaka Player does it by stubbing out an empty `abort()` function on those versions of Safari.

Append smaller fragments

I've shown the procedure below. This may not work in every case, but it has the advantage that the size of the smaller chunks can be adjusted to suit your needs. It also doesn't require going back to the network which might incur additional data costs for some users.

```
const pieces = new Uint8Array([data]);
(function appendFragments(pieces) {
  if (sourceBuffer.updating) {
    return;
  }
  pieces.forEach(piece => {
    try {
      sourceBuffer.appendBuffer(piece);
    }
    catch e {
      if (e.name !== 'QuotaExceededError') {
        throw e;
      }

      // Reduction schedule: 80%, 60%, 40%, 20%, 16%, 12%, 8%, 4%, fail.
      const reduction = pieces[0].byteLength * 0.8;
      if (reduction / data.byteLength < 0.04) {
        throw new Error('MediaSource threw QuotaExceededError too many times');
      }
      const newPieces = [
        pieces[0].slice(0, reduction),
        pieces[0].slice(reduction, pieces[0].byteLength)
      ];
      pieces.splice(0, 1, newPieces[0], newPieces[1]);
      appendBuffer(pieces);
    }
  });
})(pieces);
```

Lower the playback resolution

This is similar to removing recent data and re-appending. In fact, the two may be done together, though the example below only shows lowering the resolution.

There are a few things to keep in mind when using this technique:

- **You must append a new initialization segment.** You must do this any time you change representations. The new initialization segment must be for the media segments that follow.
- **The presentation timestamp of the appended media should match the timestamp of the data in the buffer as closely as possible, but not jump ahead.** Overlapping the buffered data may cause a stutter or brief stall, depending on the browser. Regardless of what you append, don't overlap the playhead as this will throw errors.
- **Seeking may interrupt playback.** You may be tempted to seek to a specific location and resume playback from there. Be aware that this will cause playback interruption until the seek is completed.