Google
Developers

WebM and the New VP9 Open Video Codec

Building a Next-Generation, Open Source Video Codec

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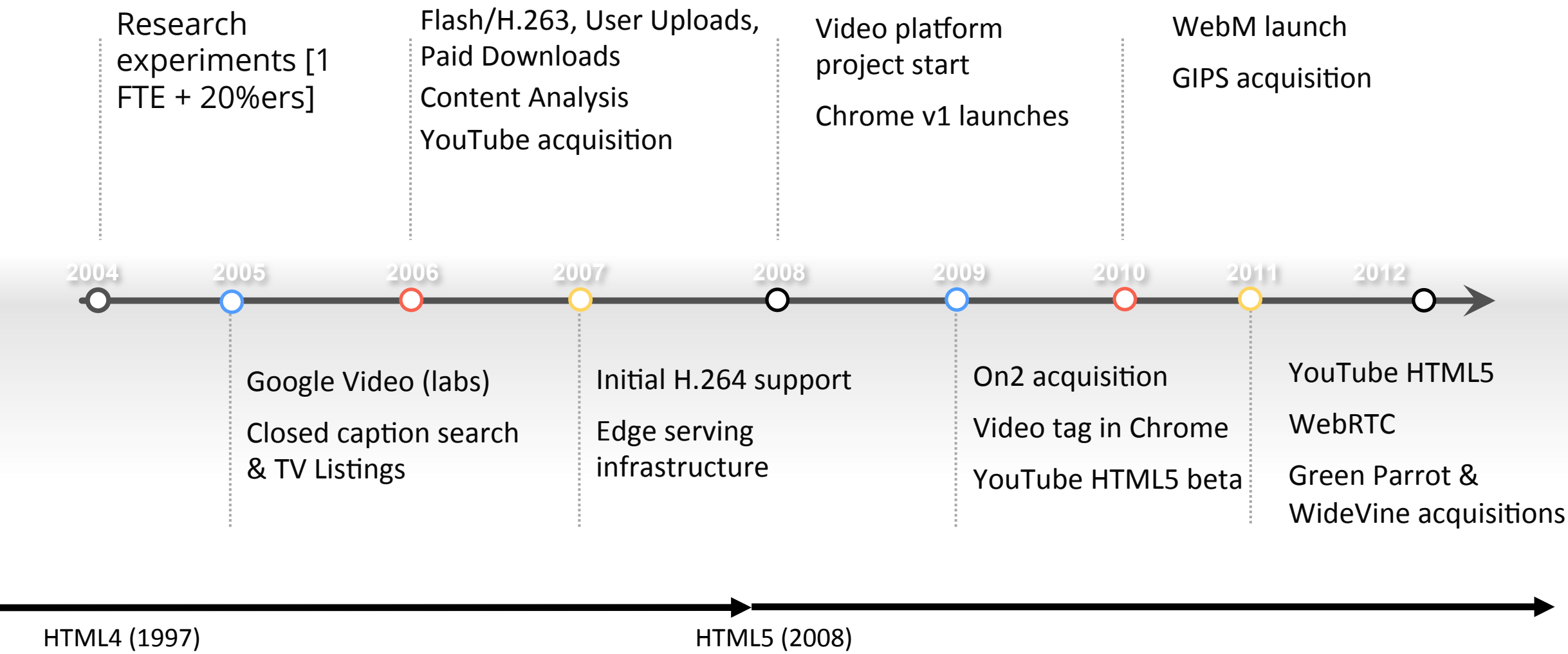
A Quick Introductory Video

Why Do We Care About Open Video?

History of Video Technology at Google



What is WebM?

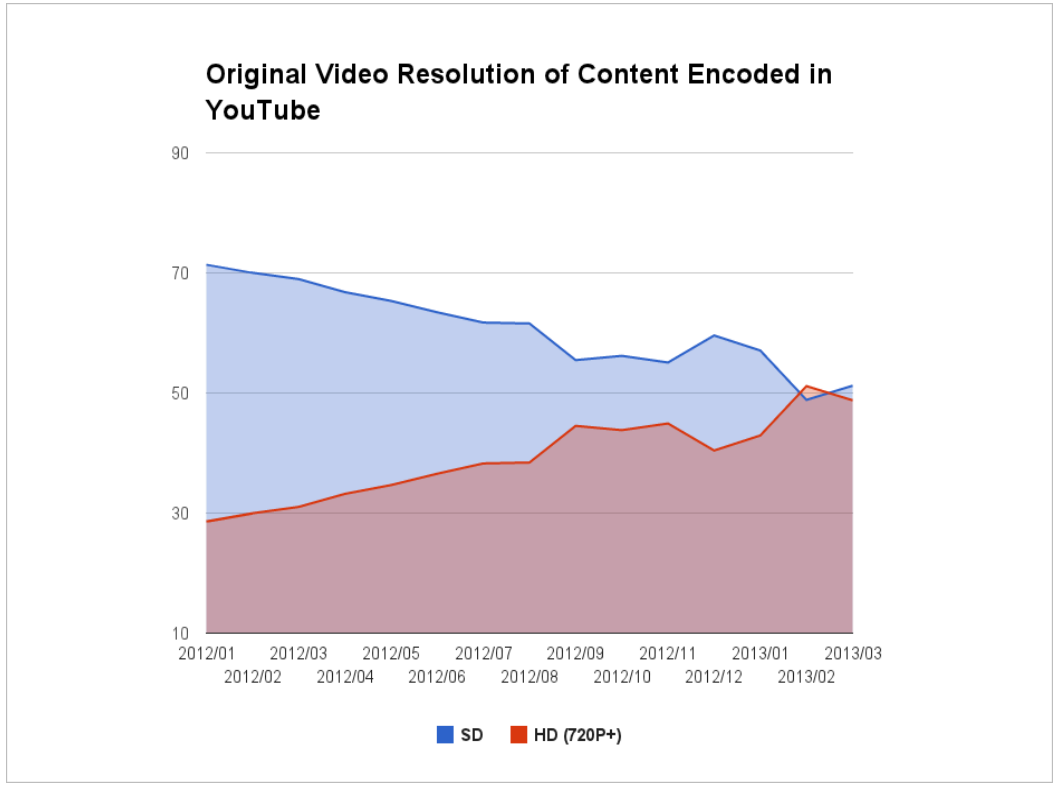
- High quality, open alternative for web video
  - VP8 video or VP9 video
  - Vorbis audio or Opus audio
  - Matroska-based container

Web Video Continues To Grow

YouTube Video Growth

A global-scale video platform:

- 1B+ monthly users
- 4B+ video views per day
- 6B+ hours watched per month
- 72+ hours of video uploaded each minute
  - HD becoming dominant
- 25% mobile consumption



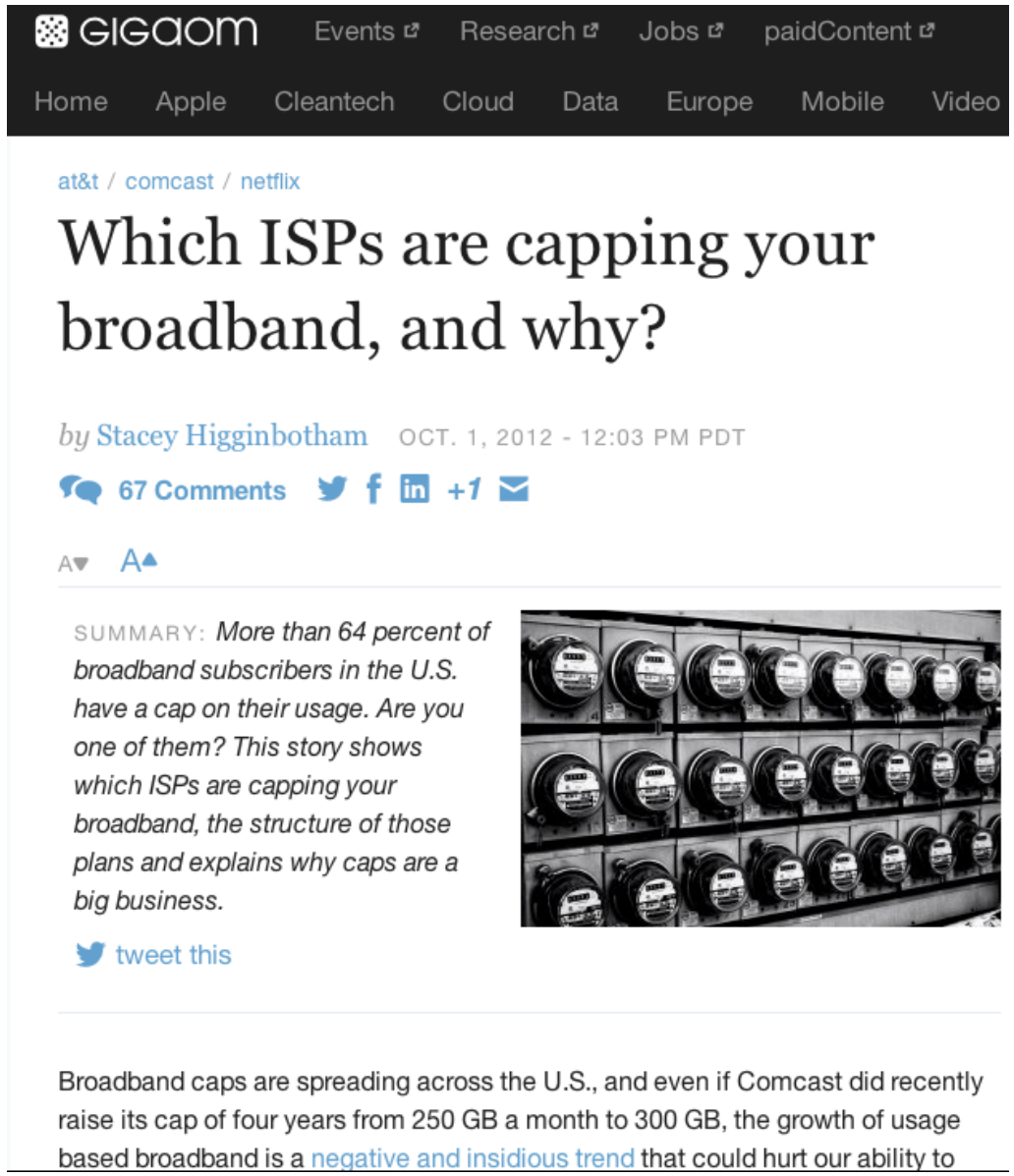
“ The sum of all forms of video…will be approximately 86 percent of global consumer traffic by 2016. ”

Cisco Visual Networking Index: Forecast and Methodology, 2011-2016

Cisco Systems, Inc.

Video Compression is Key

- We can effectively:
  - Significantly increase the size of the Internet;
  - Significantly increase the speed of the Internet;
- And then we have to do it again and again…and again…

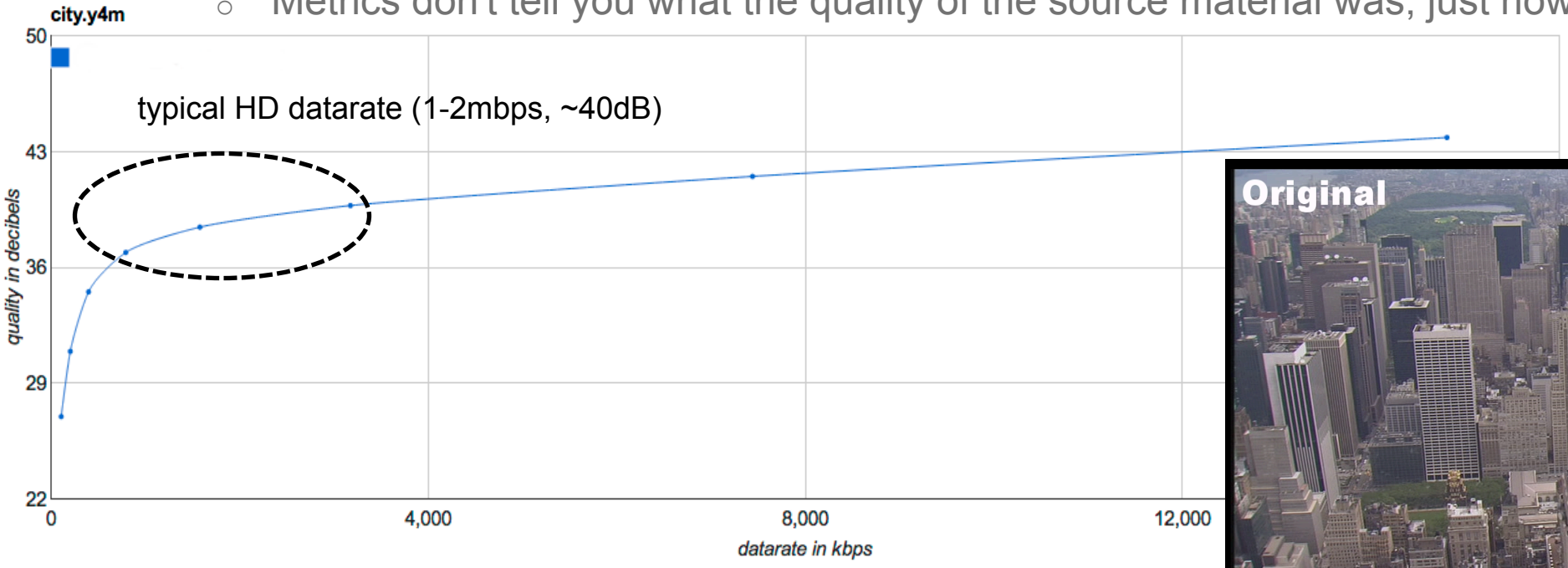


VP9 Development

Developing a Cutting-Edge Codec

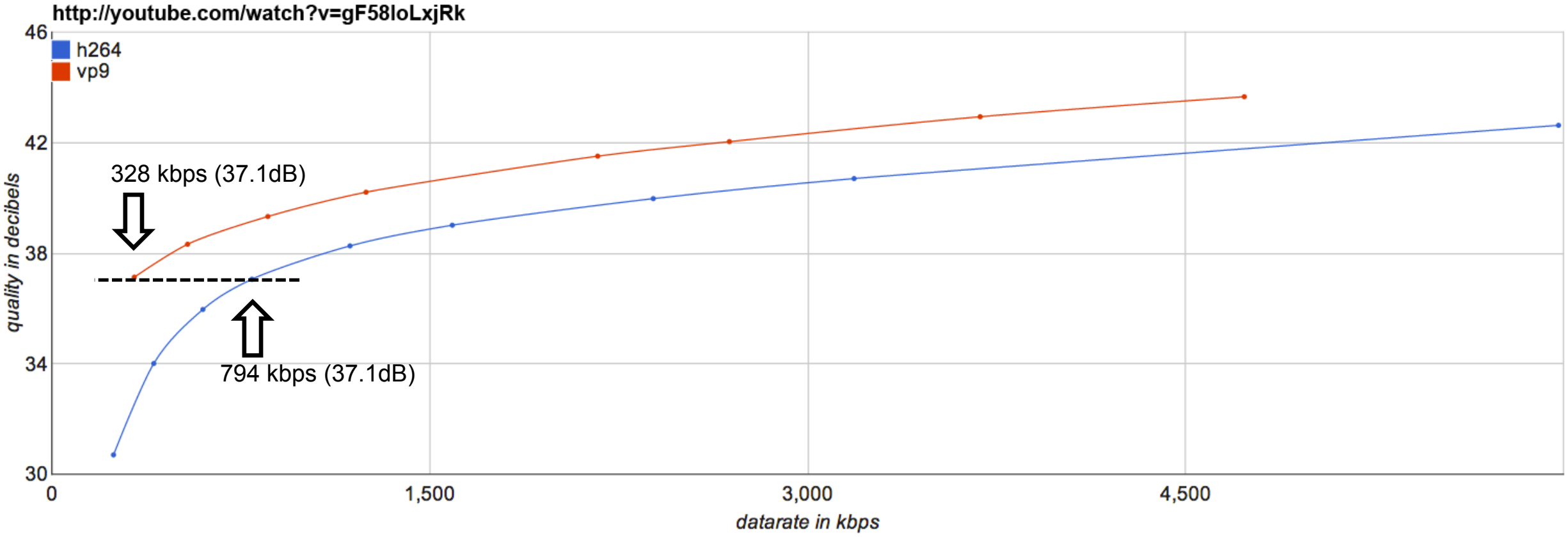
Assessing video quality

- Assess visually, and use metrics
  - Typical metric for video quality is PSNR (although others exist, e.g. SSIM and VQM)
- How does visual quality correspond to typical metric (PSNR) values?
  - PSNR is a metric - it can be cheated, so always primarily trust visual results
  - Metrics don't tell you what the quality of the source material was, just how well it was represented



VP9 quality/bitrate comparisons

VP9 quality/bitrate comparisons



VP9 quality/bitrate comparisons

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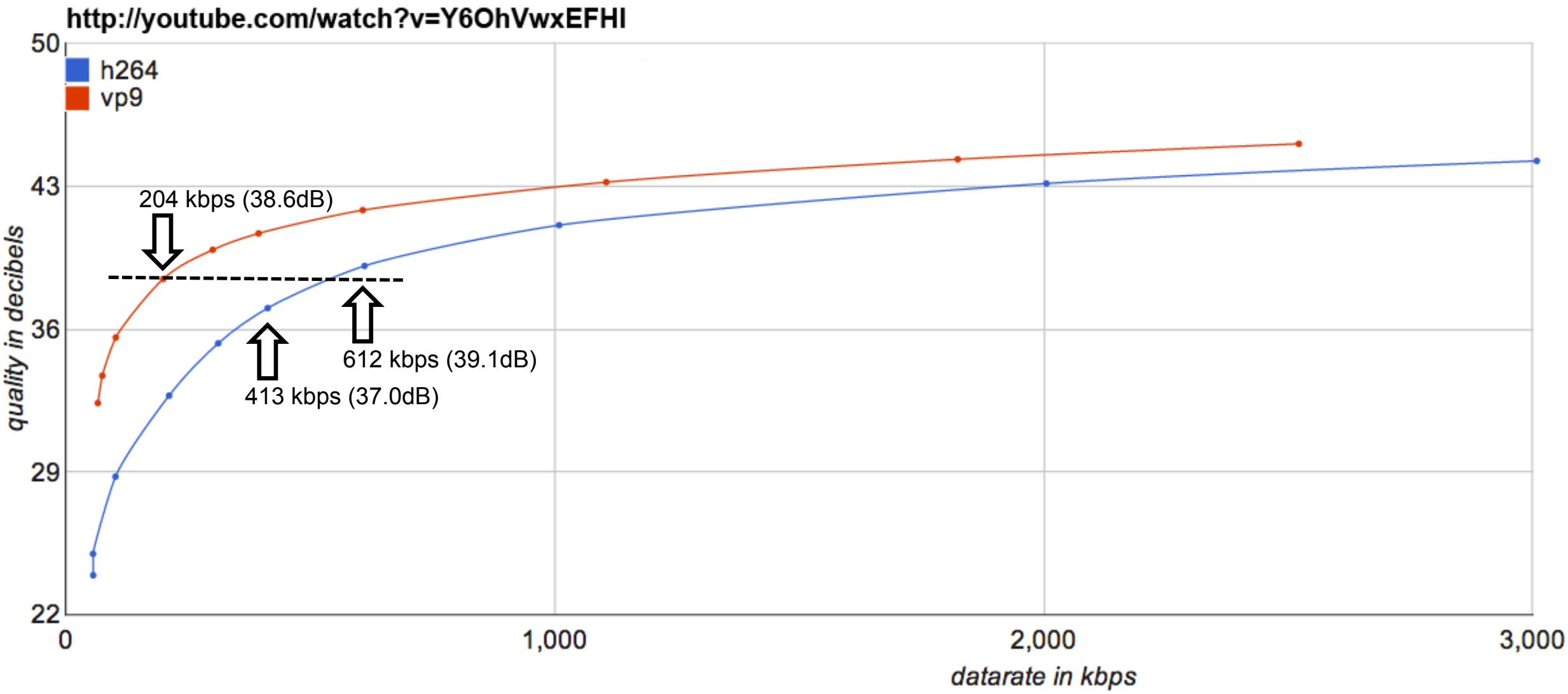


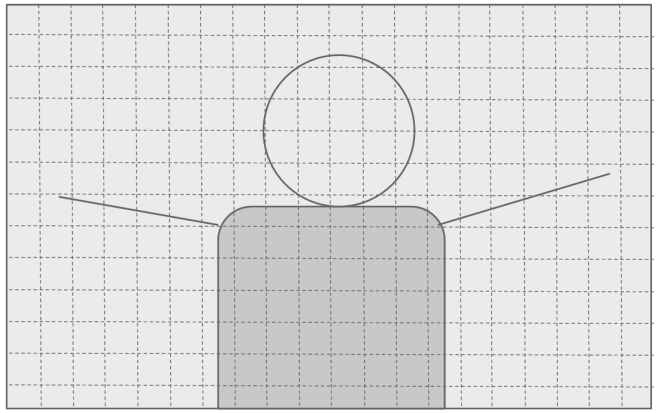
Save ~50% bandwidth

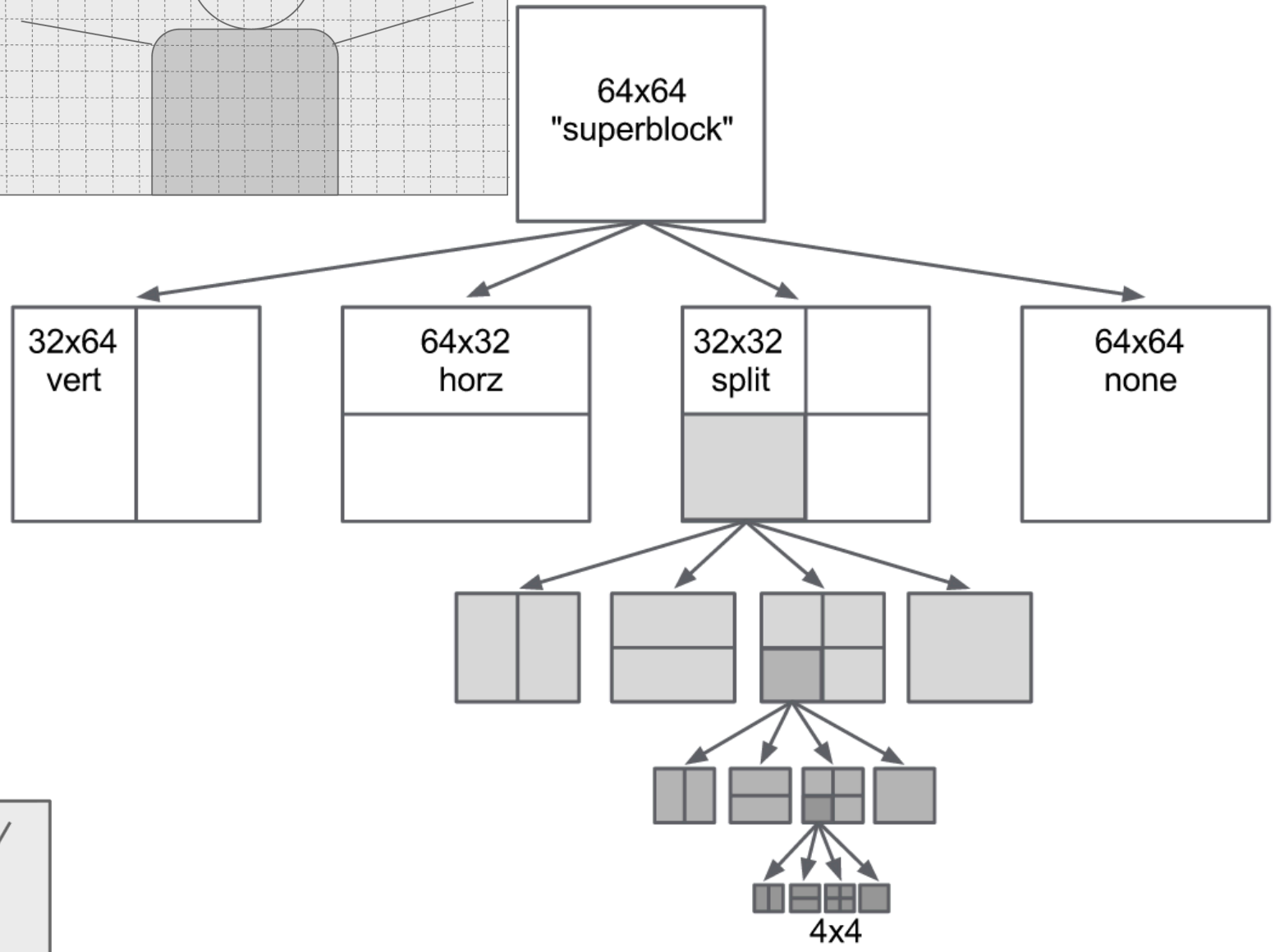
by distributing your videos using VP9 instead of H.264

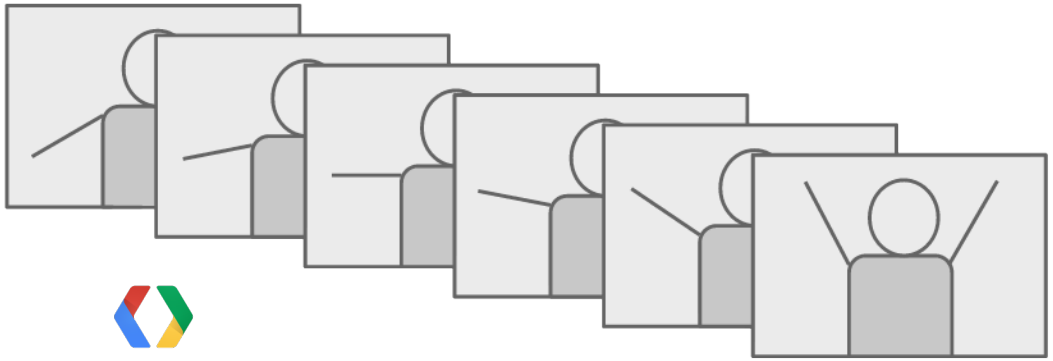
A Look Under the Hood

VP9 techniques

- recursive variable block size support (64x64 to 4x4, square and rectangular)
- finer motion vector precision (16th-pel) and adaptive motion filters (sharp, lowpass, regular)
  - multi-level past and future reference (alt-ref) frames
- larger dct transforms (32x32, 16x16, 8x8, 4x4) and adst transforms (16x16, 8x8, 4x4)







Quick Recap.....

Advantages of VP9

- ~50% better than the very best H.264;
- Currently available in Chrome/libvpx for testing;
- Open source;
- Royalty-free;

Putting VP9 in Your Hands

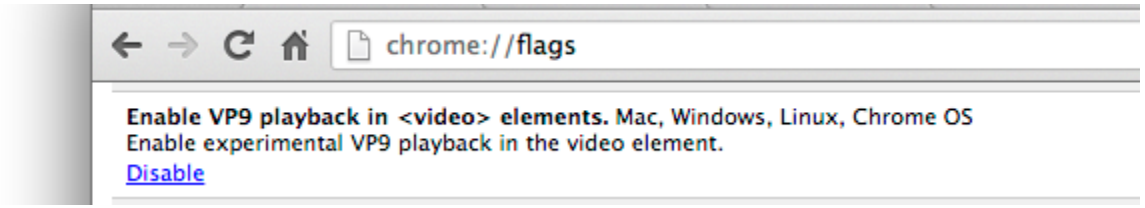
Finalizing VP9

- Bitstream in beta (semi-freeze) since May 3
- 45-day period "Call for Comments”
- Bitstream final on June 17

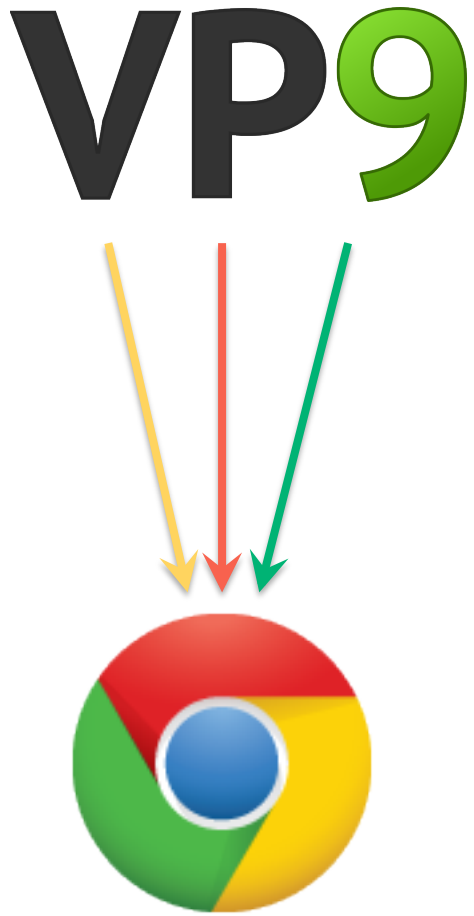
```
1252 void vp9_short_idct32x32_c(int16_t *input, int16_t *output, int pitch) {
1253   int16_t out[32 * 32];
1254   int16_t *outptr = out;
1255   const int half_pitch = pitch >> 1;
1256   int i, j;
1257   int16_t temp_in[32], temp_out[32];
1258
1259   // Rows
1260   for (i = 0; i < 32; ++i) {
1261     idct32_1d(input, outptr);
1262     input += 32;
1263     outptr += 32;
1264   }
1265
1266   // Columns
1267   for (i = 0; i < 32; ++i) {
1268     for (j = 0; j < 32; ++j)
1269       temp_in[j] = out[j * 32 + i];
1270     idct32_1d(temp_in, temp_out);
1271     for (j = 0; j < 32; ++j)
1272       output[j * half_pitch + i] = ROUND_POWER_OF_TWO(temp_out[j], 6);
1273   }
1274 }
```

VP9 in Chrome

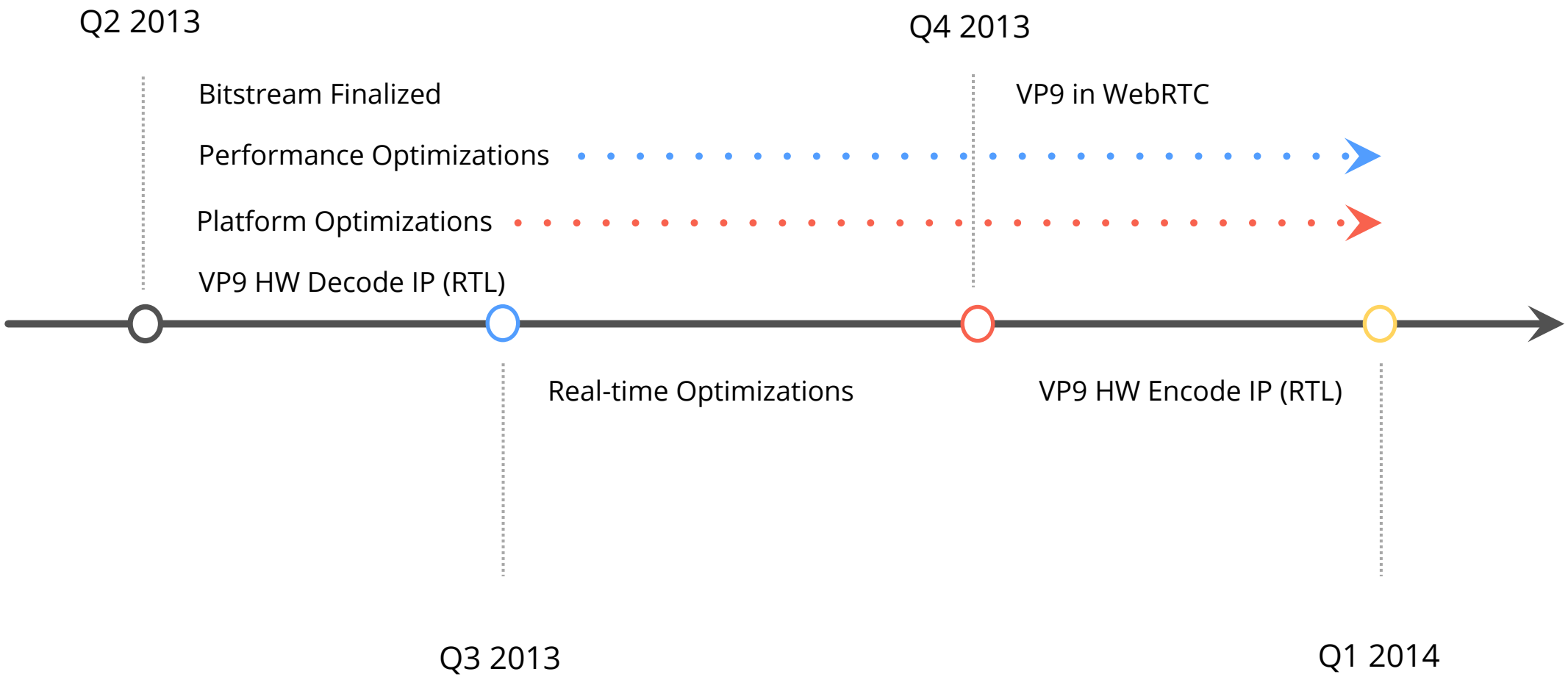
- Beta VP9
  - Chrome 28 Dev: behind flag (May 5)



- **Final** VP9 (flag removed)
  - Chrome 29 Dev: June 24
  - Chrome 29 Beta: July 11
  - Chrome 29 Stable: August 20

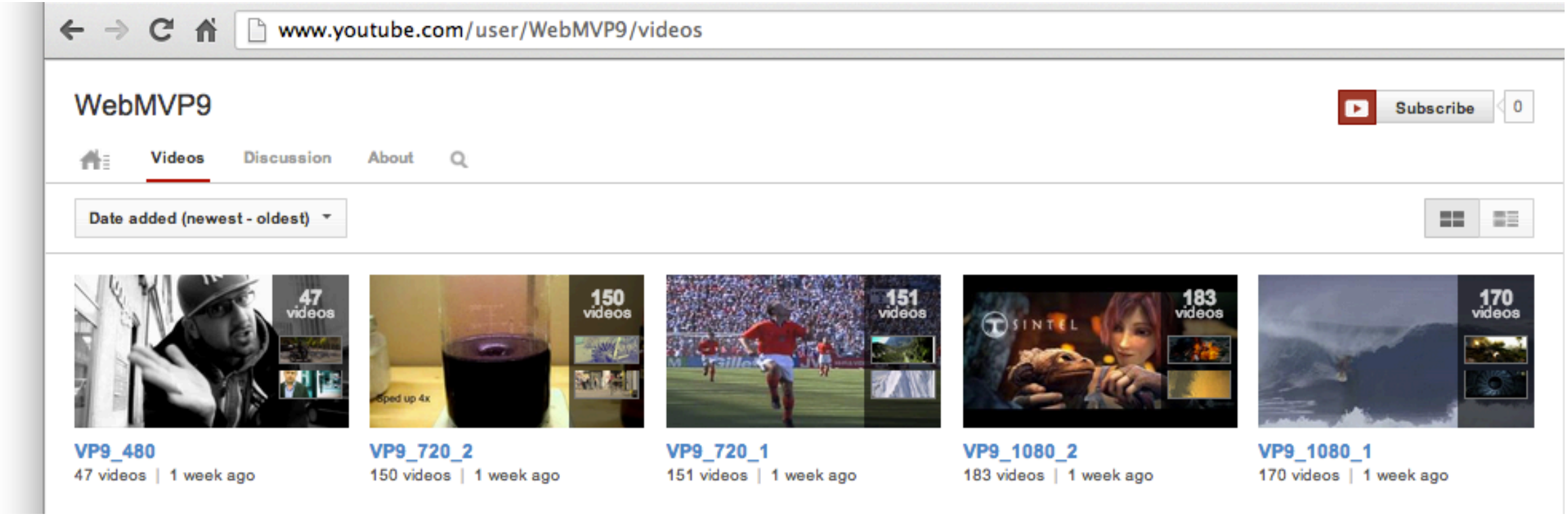


VP9 Rollout


Q2 2013
Q4 2013
Bitstream Finalized
VP9 in WebRTC
Performance Optimizations
Platform Optimizations
VP9 HW Decode IP (RTL)
Real-time Optimizations
VP9 HW Encode IP (RTL)
Q3 2013
Q1 2014

VP9 in YouTube

- VP9 already available on YouTube
- See for yourself at www.youtube.com/user/WebMVP9/videos



What Should I Be Doing?

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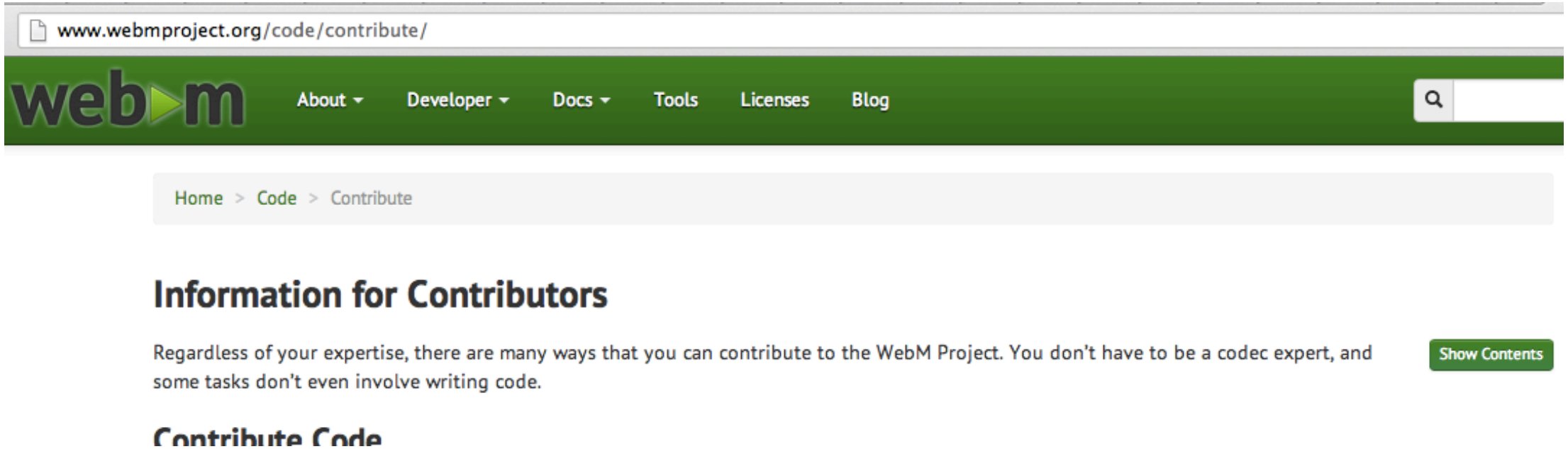
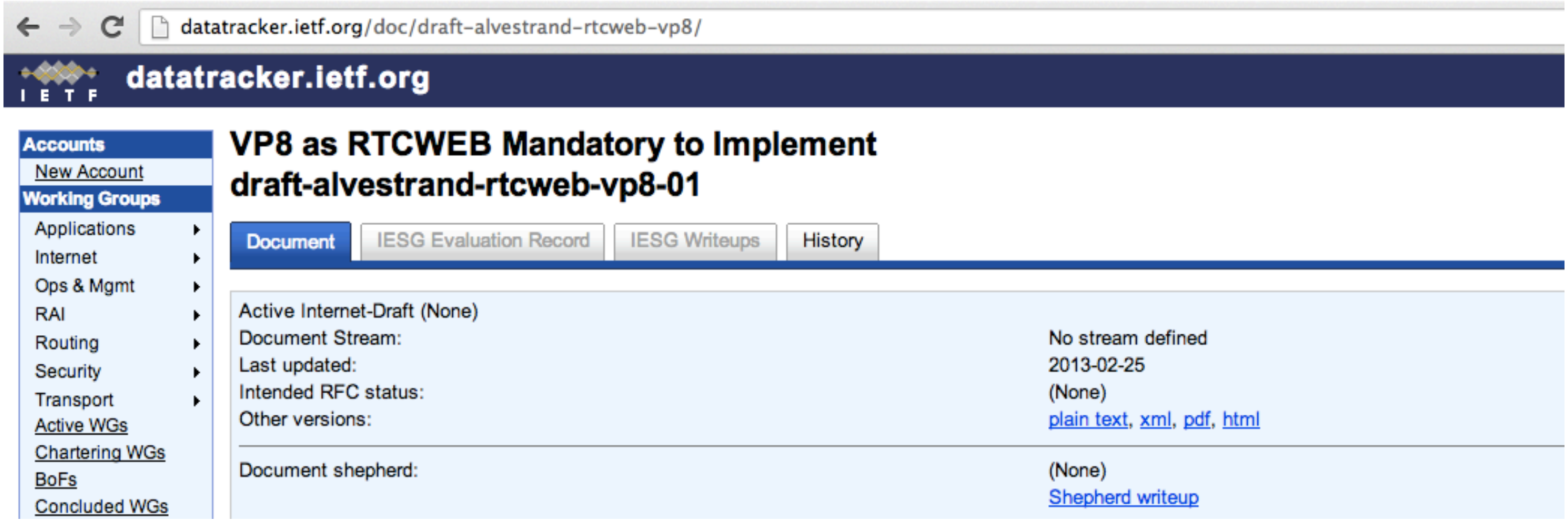
- Contribute



What Should I Be Doing?

- Contribute
- Advocate



What Should I Be Doing?

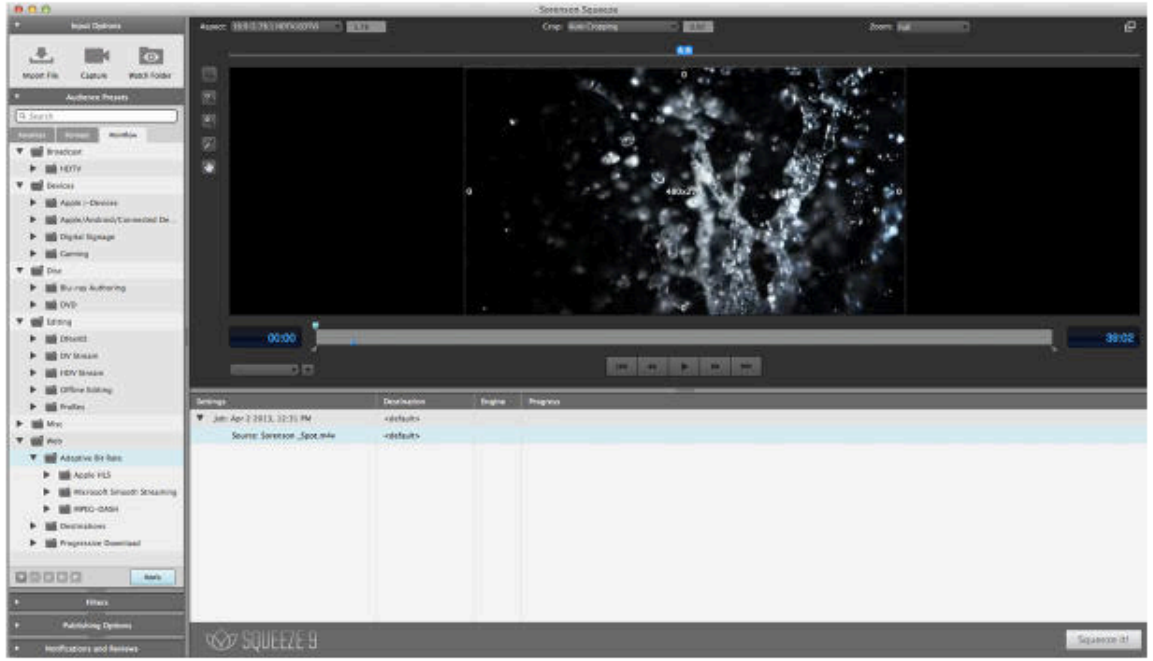
- Contribute
- Advocate
- But most of all...use it!!!

Sorenson embraces Web video with Squeeze 9

A new version of the video compression software is designed to ease use of Web video, producing HTML code for both H.264 and VP8.

by Stephen Shankland | April 8, 2013 5:02 AM PDT

Follow



Sorenson Squeeze 9 makes life easier for high-end video producers.
(Credit: Sorenson Media)

Higher-end video producers anxious to adapt to the new realities of online video will be pleased

Other I/O Sessions About Open Video

- Tools -- *see* **Demystifying Video Encoding: WebM/VP8 for the Rest of Us**
- Real-Time Communication – *see* **Real-time communication with WebRTC**

<Thank You!>

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Matt Frost (mfrost@google.com)

www.webmproject.org
http://www.webmproject.org/code/

Google
Developers

Extra Slides – Not Going to Be Displayed

Color Palette

Flat Color

67
135
253

244
74
63

255
209
77

13
168
97

Secondary

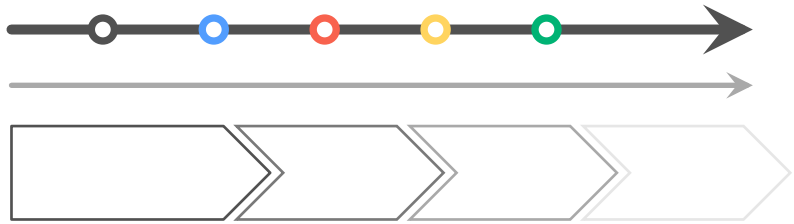
Gradient

Grays

Graphic Element Styles and Arrows

Rounded Boxes

Code
Boxes



Arrows

Content Container Boxes

Pie Chart Example

Subtitle Placeholder

Chart Title

source: place source info here

Column Chart Example

Subtitle Placeholder

source: place source info here

Line Chart Example

Subtitle Placeholder

source: place source info here

Table Option A

Subtitle Placeholder

	Column 1	Column 2	Column 3	Column 4
Row 1	placeholder	placeholder	placeholder	placeholder
Row 2	placeholder	placeholder	placeholder	placeholder
Row 3	placeholder	placeholder	placeholder	placeholder
Row 4	placeholder	placeholder	placeholder	placeholder
Row 5	placeholder	placeholder	placeholder	placeholder
Row 6	placeholder	placeholder	placeholder	placeholder
Row 7	placeholder	placeholder	placeholder	placeholder

Table Option B

Subtitle Placeholder

Header 1	placeholder	placeholder	placeholder
Header 2	placeholder	placeholder	placeholder
Header 3	placeholder	placeholder	placeholder
Header 4	placeholder	placeholder	placeholder
Header 5	placeholder	placeholder	placeholder

Segue Slide

Subtitle Placeholder

“ This is an example of quote text. ”

Name
Company

<Thank You!>

Lorem ipsum dolor sit amet, consectetur adipiscing elit. In eget pretium augue.

Jon@website.com
#Jon
+Jon

Code Slide With Subtitle Placeholder

Subtitle Placeholder

HTML

```
<script type='text/javascript'>  // Say hello world until the user starts questioning
  // the meaningfulness of their existence.
  function helloWorld(world) {
    for (var i = 42;--i >= 0;) {
      alert ('Hello' + String(world));
  }
}</script>
<style>p { color: pink }
p { color: blue }
u { color: 'umber' }</style>
```

What Tools Are Available?

- Widely-deployed player in Chrome;
- Source code;
- Bitstream specification;
- Hardware reference designs (RTL)