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**Developers**



# Web▶M and the New VP9 Open Video Codec

*Building a Next-Generation, Open Source Video Codec*

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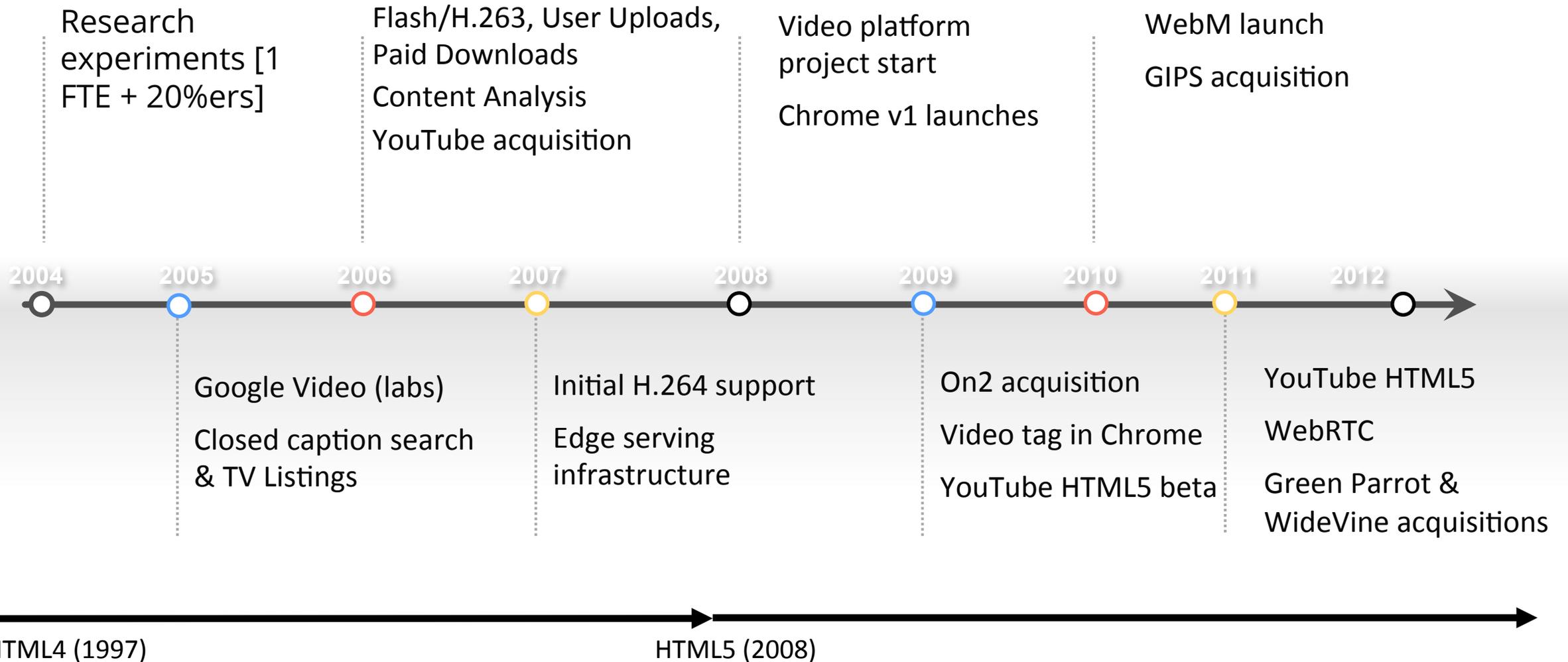
# A Quick Introductory Video





# 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

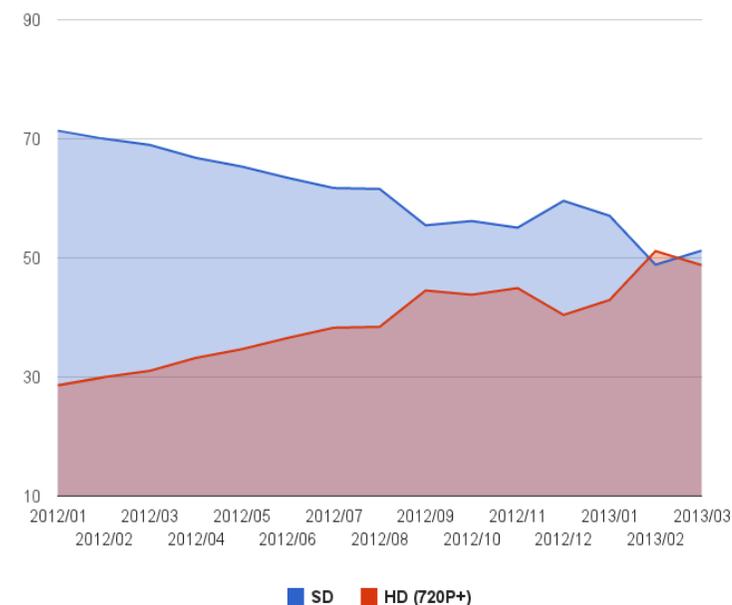
# YouTube Video Growth



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

Original Video Resolution of Content Encoded in YouTube



“ 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...

[at&t](#) / [comcast](#) / [netflix](#)

## Which ISPs are capping your broadband, and why?

by [Stacey Higginbotham](#) OCT. 1, 2012 - 12:03 PM PDT

[67 Comments](#) [Twitter](#) [Facebook](#) [LinkedIn](#) [+1](#) [Email](#)

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**SUMMARY:** *More than 64 percent of broadband subscribers in the U.S. have a cap on their usage. Are you one of them? This story shows which ISPs are capping your broadband, the structure of those plans and explains why caps are a big business.*

[tweet this](#)



Broadband caps are spreading across the U.S., and even if Comcast did recently raise its cap of four years from 250 GB a month to 300 GB, the growth of usage based broadband is a [negative and insidious trend](#) that could hurt our ability to



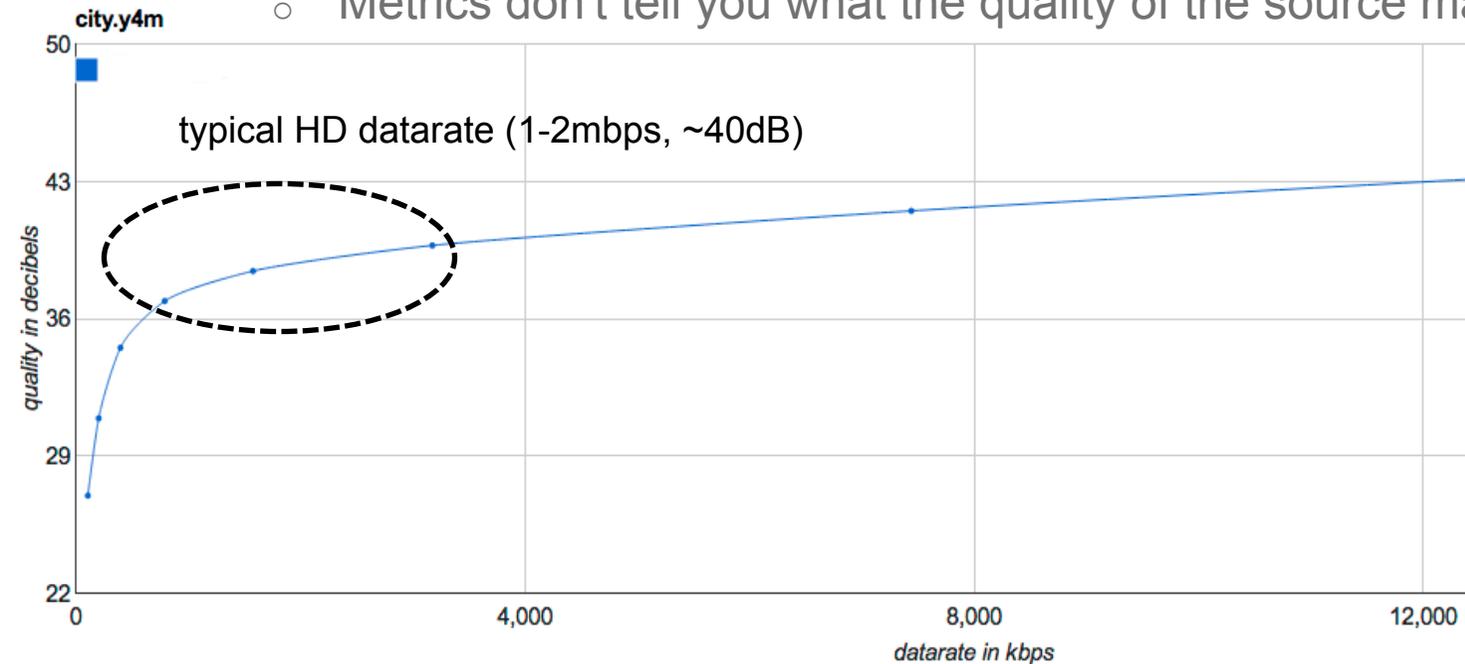


# VP9 Development

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 - 250kbps**

**H264 - 250kbps**

284.7

231.1

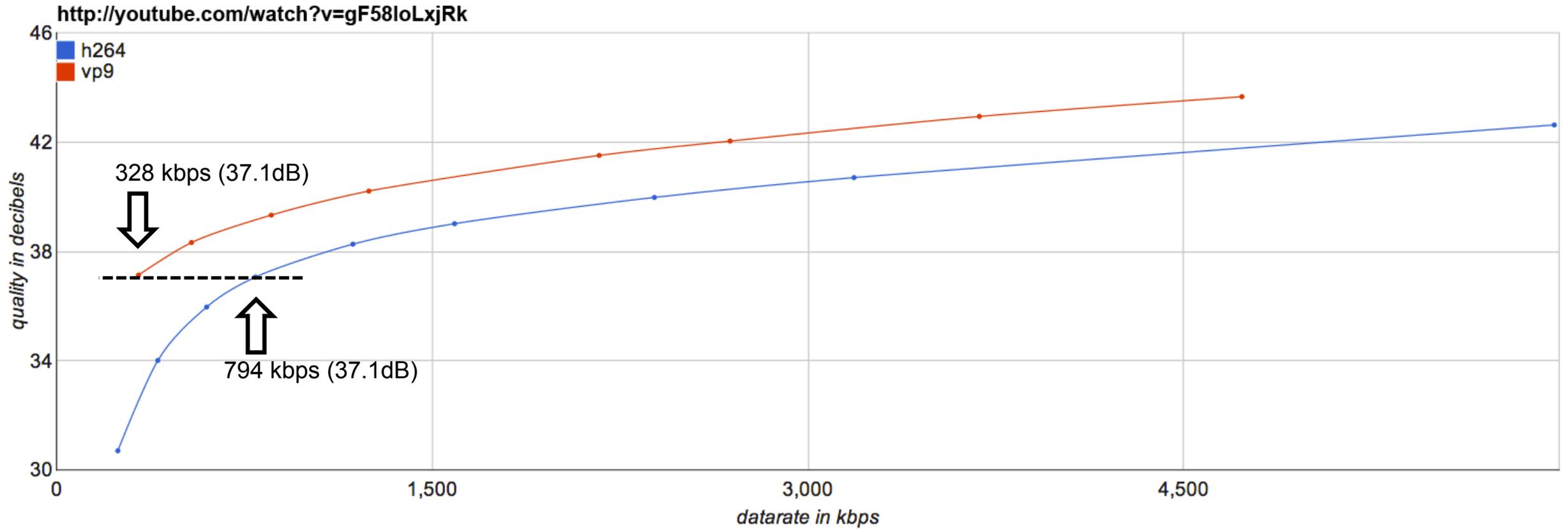
**VP9**

**H.264**

0:00



# VP9 quality/bitrate comparisons



# VP9 quality/bitrate comparisons

**VP9 - 200kbps**

**H264 - 200kbps**

160.3

**VP9**

273

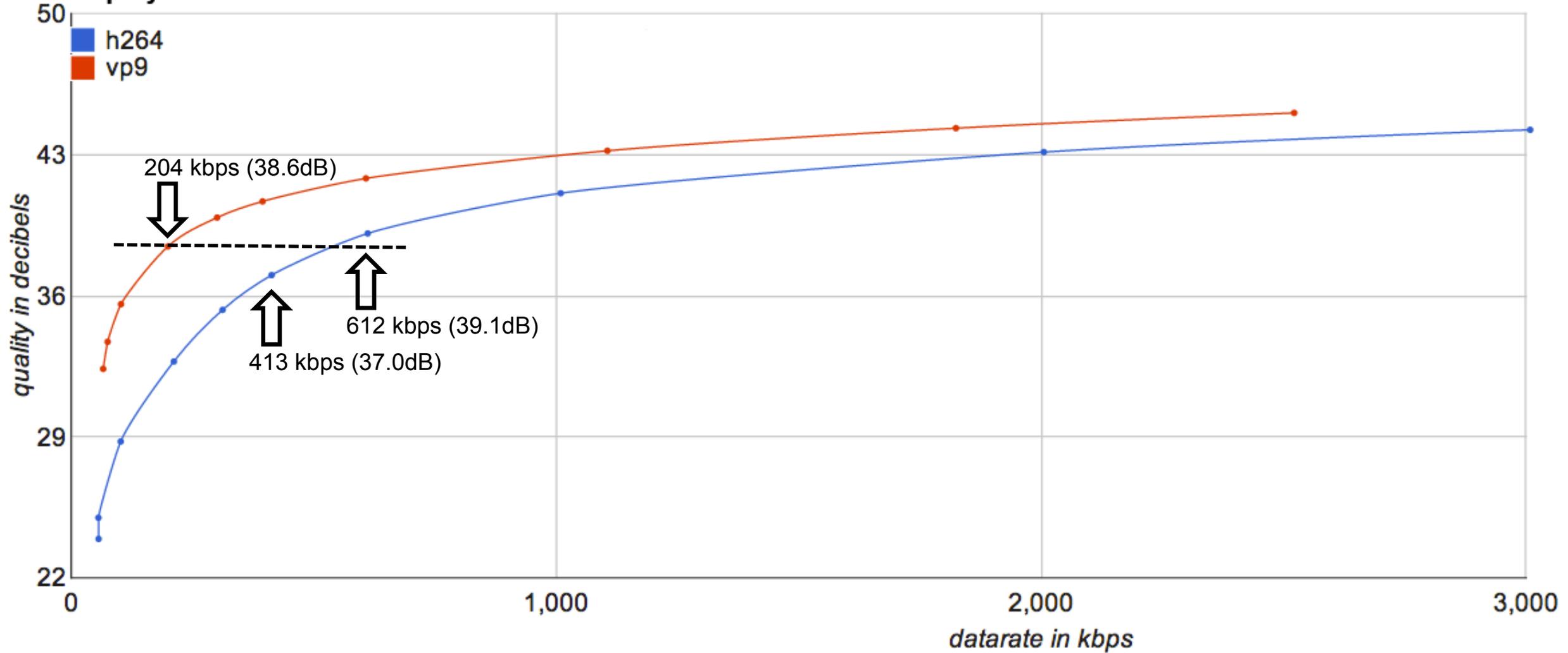
**H.264**

0:00



# VP9 quality/bitrate comparisons

<http://youtube.com/watch?v=Y6OhVwxEFHI>



# Save ~50% bandwidth

by distributing your videos using VP9 instead of H.264

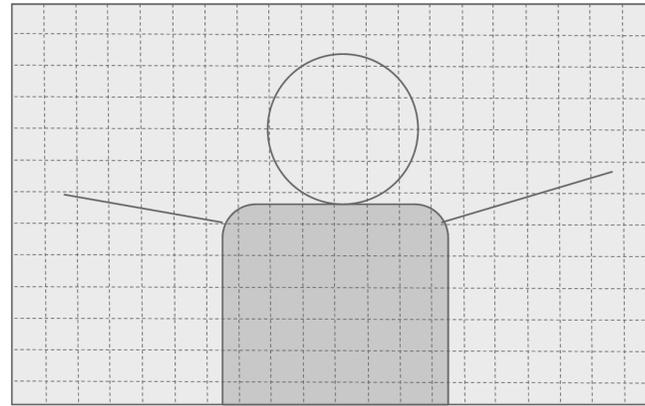




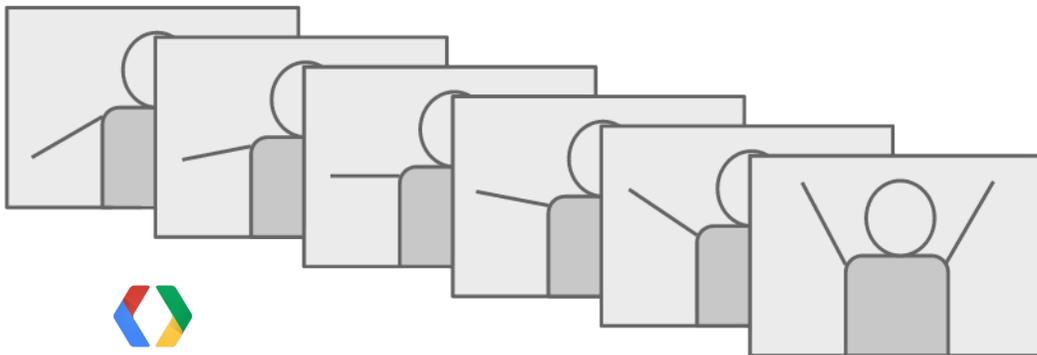
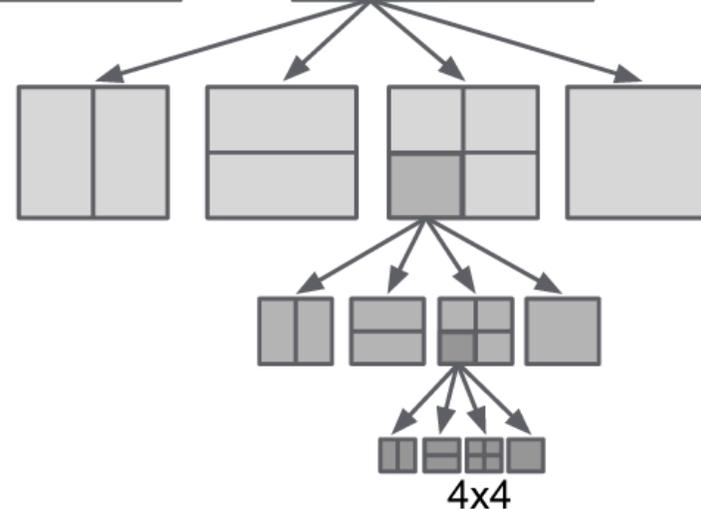
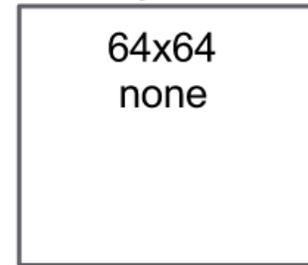
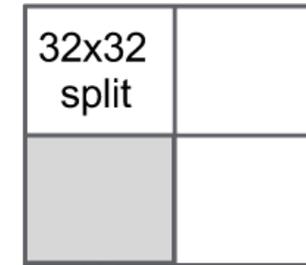
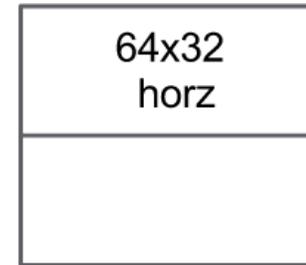
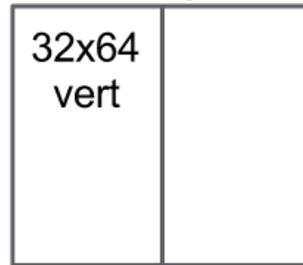
# A Look Under the Hood

# 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)



64x64  
"superblock"





**Quick Recap.....**

# Advantages of VP9

# 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

# VP9

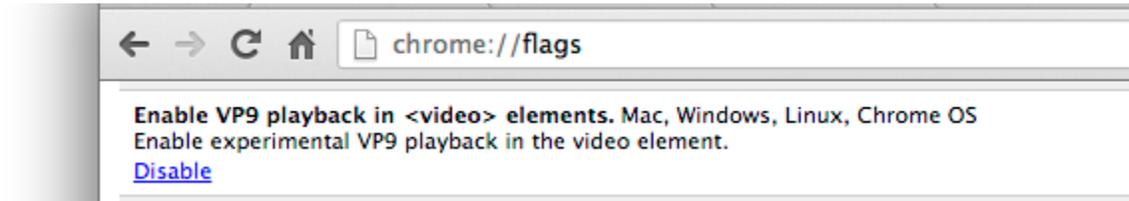
- Bitstream in beta (semi-freeze) since May 3
- 45-day period "Call for Comments"
- Bitstream final on June 17

```
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 }
```

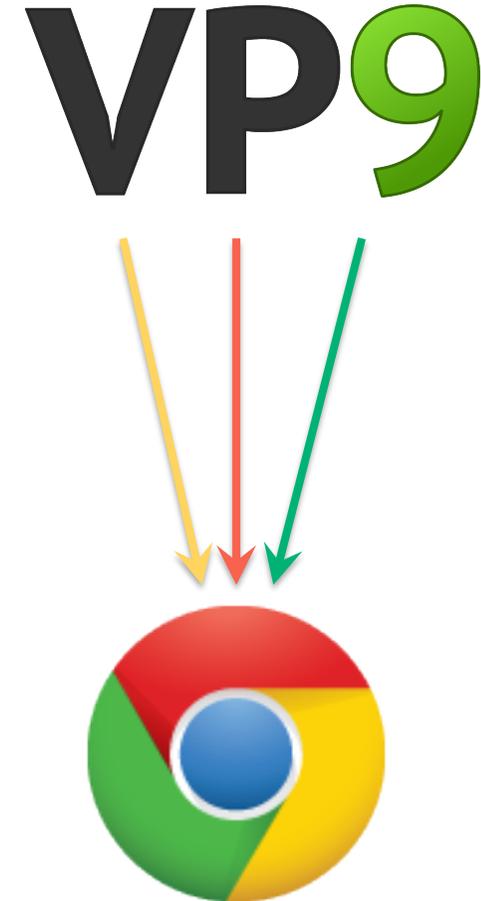


# VP9 in Chrome

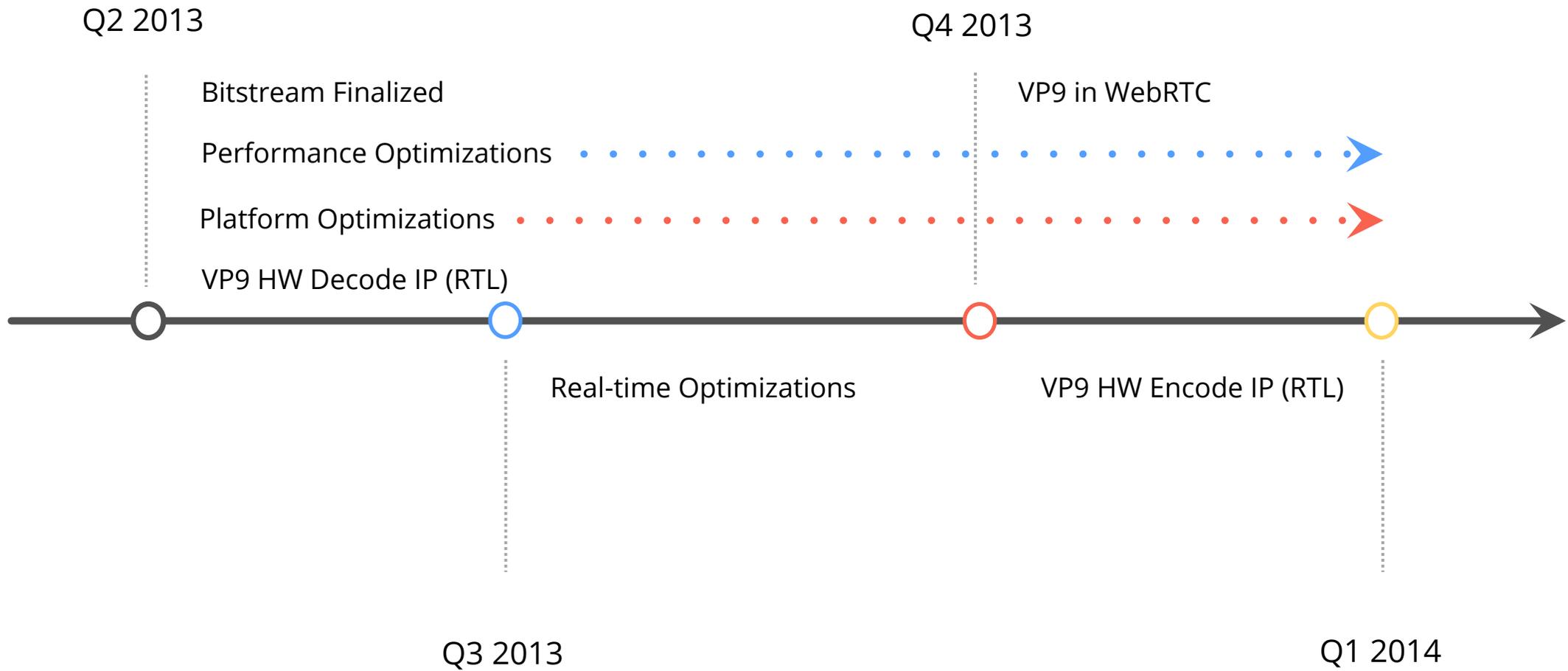
- Beta VP9
  - Chrome 28 Dev: behind flag (May 5)



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

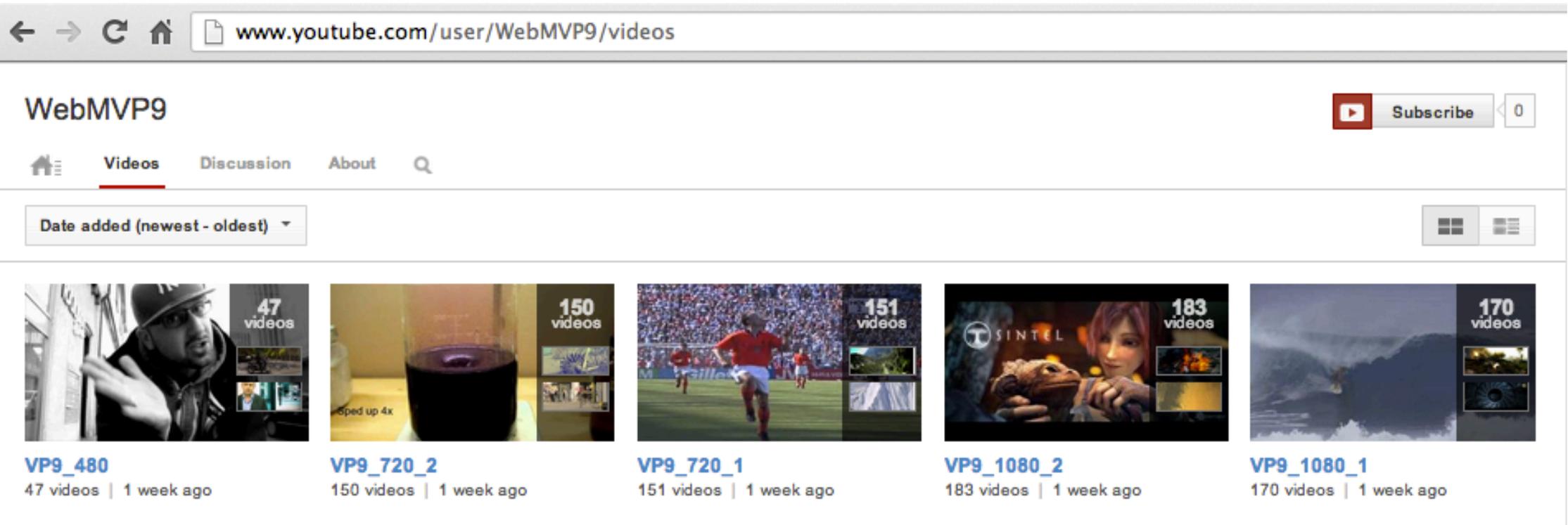


# VP9 Rollout



# VP9 in YouTube

- VP9 already available on YouTube
- See for yourself at [www.youtube.com/user/WebMVP9/videos](http://www.youtube.com/user/WebMVP9/videos)



The screenshot shows a web browser window displaying the YouTube channel page for 'WebMVP9'. The address bar shows the URL 'www.youtube.com/user/WebMVP9/videos'. The channel name 'WebMVP9' is at the top left, with a 'Subscribe' button and '0' subscribers to the right. Below the channel name are navigation tabs for 'Videos', 'Discussion', and 'About'. A dropdown menu shows 'Date added (newest - oldest)'. The main content area displays five video thumbnails, each with a VP9 label and video count:

Video ID	Video Count	Upload Time
VP9_480	47 videos	1 week ago
VP9_720_2	150 videos	1 week ago
VP9_720_1	151 videos	1 week ago
VP9_1080_2	183 videos	1 week ago
VP9_1080_1	170 videos	1 week ago

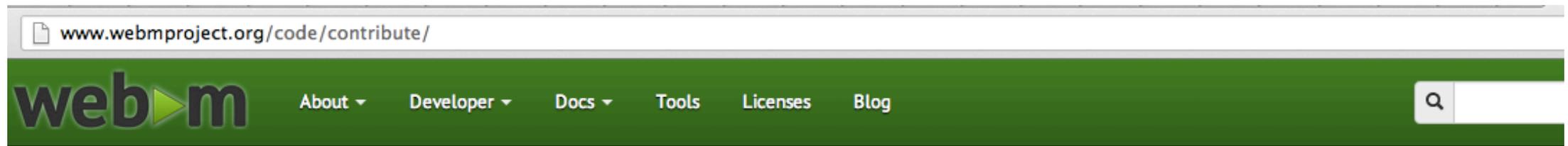




**What Should I Be Doing?**

# What Should I Be Doing?

- Contribute



[Home](#) > [Code](#) > [Contribute](#)

## Information for Contributors

Regardless of your expertise, there are many ways that you can contribute to the WebM Project. You don't have to be a codec expert, and some tasks don't even involve writing code.

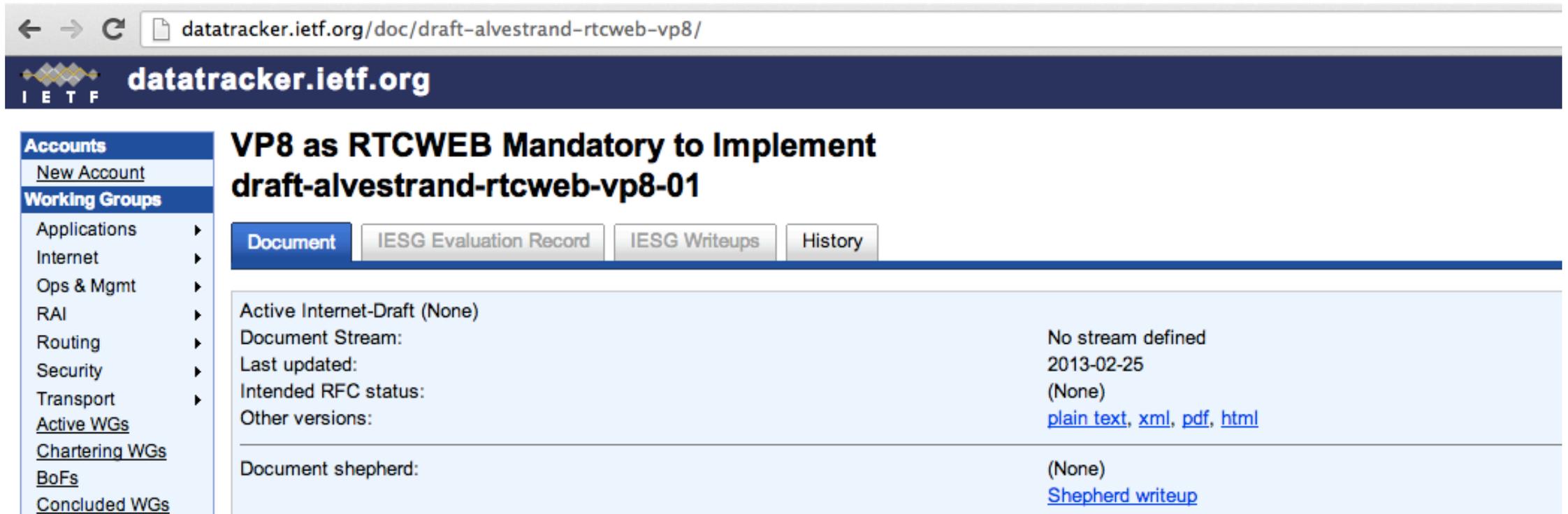
[Show Contents](#)

### Contribute Code



# What Should I Be Doing?

- Contribute
- Advocate



The screenshot shows a web browser window with the URL `datatracker.ietf.org/doc/draft-alvestrand-rtcweb-vp8/`. The page title is "VP8 as RTCWEB Mandatory to Implement draft-alvestrand-rtcweb-vp8-01". The left sidebar contains a navigation menu with categories: Accounts, Working Groups, Applications, Internet, Ops & Mgmt, RAI, Routing, Security, Transport, Active WGs, Chartering WGs, BoFs, and Concluded WGs. The main content area has tabs for "Document", "IESG Evaluation Record", "IESG Writeups", and "History". The "Document" tab is active, displaying the following information:

Active Internet-Draft (None)	
Document Stream:	No stream defined
Last updated:	2013-02-25
Intended RFC status:	(None)
Other versions:	<a href="#">plain text</a> , <a href="#">xml</a> , <a href="#">pdf</a> , <a href="#">html</a>
Document shepherd:	(None)
	<a href="#">Shepherd writeup</a>



# What Should I Be Doing?

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

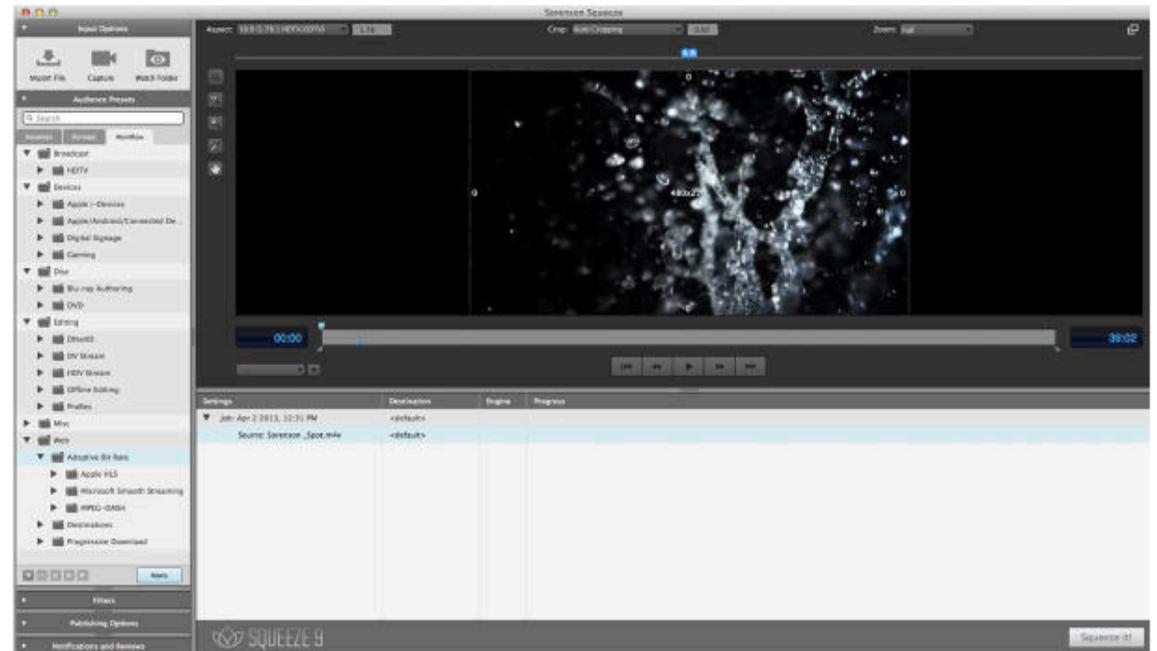
## Sorenson embraces Web video with Squeeze 9

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!>

Ronald S. Bultje (rbultje@google.com)

Matt Frost (mfrost@google.com)

[www.webmproject.org](http://www.webmproject.org)

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





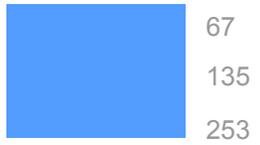
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**Extra Slides – Not Going to Be  
Displayed**

# Color Palette

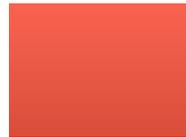
Flat Color



Secondary



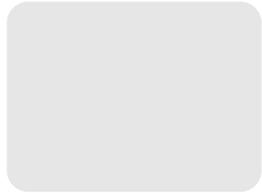
Gradient



Grays



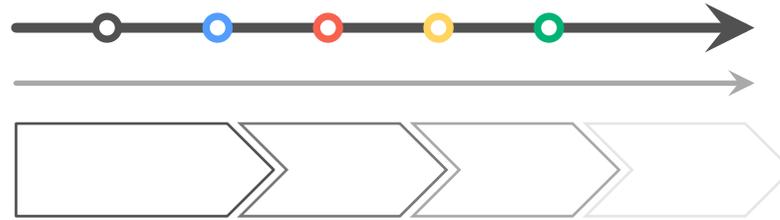
# Graphic Element Styles and Arrows



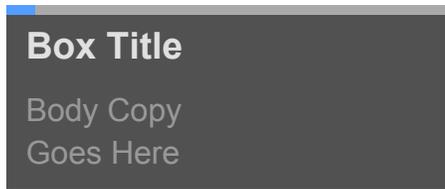
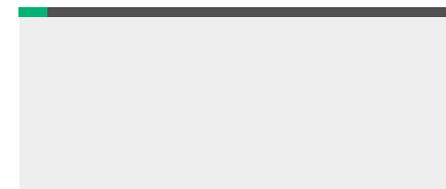
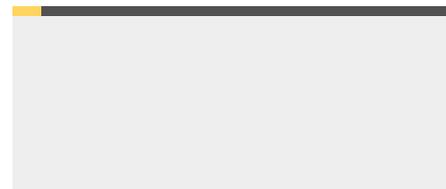
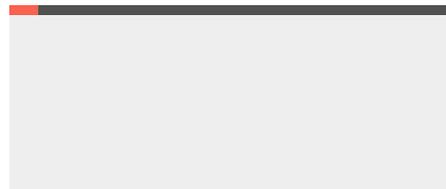
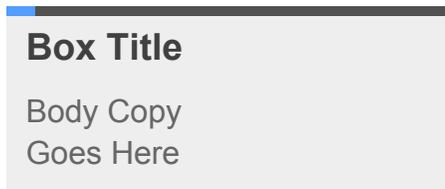
Rounded Boxes



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

<b>Header 1</b>	placeholder	placeholder	placeholder
<b>Header 2</b>	placeholder	placeholder	placeholder
<b>Header 3</b>	placeholder	placeholder	placeholder
<b>Header 4</b>	placeholder	placeholder	placeholder
<b>Header 5</b>	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

```
<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>
```

HTML



# What Tools Are Available?

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

