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VP8 as RTCWEB Mandatory to Implement
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Abstract

This document recommends that the RTCWEB working group choose the VP8 specification as a mandatory to implement video codec for RTCWEB implementations.

This document is not intended for publication as an RFC.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Introduction

As described in [I-D.ietf-rtcweb-overview], successful interoperable deployment of RTCWEB requires that implementations share a video codec. Not requiring a video codec will mean that this decision is left to processes outside the standards process, and risks the spectre of fragmented deployment.

This memo argues that VP8 should be that codec.

2. Requirements for an MTI codec

As outlined by the presentation given at the IETF meeting at IETF 84 in Vancouver, it is unclear what the hard requirements for a video codec are, but the items that it was suggested that proposals give information on were:

- Image quality - comparative data was sought, but without defining a baseline
- Performance - what resolutions / frame rates can be achieved in software on some common systems
- Power consumption of hardware and/or software implementations
- Hardware support
- IPR status

This document lays out the available information in each category.

3. Definition of VP8

VP8 is defined in [RFC6386], and its RTP payload is defined in

[I-D.ietf-payload-vp8] . There are no profiles; all decoders are able to decode all valid media streams.

4. Image quality evaluations

In tests carried out by Google on a set of ten sample video clips containing typical video-conference content, VP8 outperformed the x264 H.264 codec running the constrained baseline profile by on average 37.2%. That is, at the same quality, measured by PSNR, VP8 produced 37.2% fewer bits on average than H.264. VP8 outperformed H.264 on all ten of the test clips by between 19% and 64%. Both

codecs were configured in one-pass mode using settings conducive to real-time operation, and the ten clips varied in size between 640x360 pixels and 1280x720 pixels.

An independent evaluation by Christian Feller and Mohammed Raad, presented to ISO/IEC SC29 WG11 in July 2012, showed that VP8 performed better than the (H.264 baseline) anchors for the IVC project on a majority of the cases.

As part of the process of submitting VP8 for evaluation in ISO/IEC JTC1 SC29 WG11 (MPEG), Google is also commissioning an independent subjective quality evaluation effort.

5. Performance evaluation

5.1. Software

The current reference implementation is libvpx, developed in the WebM project.

The encoding speed in software depends on the quality setting. On a stock PC platform using an Intel Xeon CPU at 2.67 GHz, in a test using extremely difficult 720p material and encoding at a target data rate of 2 Mbit/sec, VP8's encoding speed varied from 48.4 fps (at the setting used in WebRTC today) to 96.2 fps (at the fastest setting), using a single thread. This variation in encode speed is achieved by changing the configuration of VP8 encoding tools in a deterministic way to trade-off encoding speed with output quality.

On a stock PC platform using an Intel Xeon CPU with 8 cores at 2.27GHz, tests using difficult 720p material encoded at 2 Mbit/sec show that using a single thread VP8 can decode at 200.50 fps (in comparison H.264, baseline profile, achieves 107.95 fps), using four threads VP8 decodes at 519.96 fps (H.264 achieves 363.73 fps), and using sixteen threads VP8 decodes at 1,076.49 fps (H.264 achieves 807.11 fps). .

5.2. Hardware support

To date, Google has licensed VP8 hardware accelerators to over 50 chip manufacturers, and VP8 hardware IP cores have also been made available by Imagination Technologies, Verisilicon and Chips & Media. Furthermore, Google is aware of several 3rd party implementations of VP8 decoders and encoders from the world's leading semiconductor companies.

At the time of this writing, more than a dozen of chip manufacturers

have announced chips with 1080p VP8 support, including Samsung (Exynos 5), NVIDIA (Tegra 3), Marvell (Armada 1500), Broadcom (BCM28150), Texas Instruments (OMAP54xx), Freescale (i.MX 6), ST-Ericsson (NovaThor L9540), LG Electronics, Hisilicon (K3v2), Rockchip (RK2918, RK3066), Nufront (NS115), Ziilabs (ZMS40) and Allwinner (A10). Google estimates that a clear majority of leading mobile chipsets in 2013 will contain VP8 hardware support.

The encoder chip produced by Quanta has allowed OEMs to integrate hardware HD VP8 encoding into their video camera hardware; this chip is available now. More suppliers have such a chip coming.

5.3. Hardware performance

Several of the aforementioned hardware implementations are based on the WebM video hardware designs described at http://www.webmproject.org/hardware/. Performance figures include:

- Decode of 1080p video at 30 fps at less than 100 MHz clock frequency
- Decoding more than ten simultaneous SD video streams on a single

chip

- Less than 25 milliwatts of power for 1080p decoding
- Encoding 1080p video at 30 fps at less than 220 MHz clock frequency
- Less than 80 milliwatts of power for HD video encoding

Based on the Hantro G1 multiformat decoder implementation, the VP8 hardware decoder is 45% smaller in silicon area than the H.264 High Profile decoder. VP8 also requires 18% less DRAM bandwidth than H.264 as it does not use bidirectional inter prediction, allowing significant reductions in the overall decoding system power consumption.

6. IPR status

Google has made its position clear with respect to Google-owned IPR in its licensing terms, http://www.webmproject.org/license/additional/.

As of this moment (October 5, 2012), Google's royalty-free license commitment is the only IPR statement filed against RFC 6386 in the IETF disclosures database.

Google has also submitted VP8 for consideration in ISO/IEC JTC1 SC29 WG11 (MPEG), in the IVC project (which aims for a royalty-free codec), and expects ISO to execute its ordinary process for resolution of IPR issues.

7. IANA Considerations

This document makes no request of IANA.

Note to RFC Editor: this section may be removed on publication as an RFC.

8. Security Considerations

Codec definitions do not in themselves comprise security risks, as long as there is no means of embedding active content in their datastream. VP8 does not contain such active content.

Codec implementations have frequently been the cause of security concerns. The reference implementation of VP8 has been extensively tested by Google security experts, and is believed to be free from exploitable vulnerabilities. There is a continuous program in place to ensure that any vulnerabilities identified are repaired as quickly as possible.

9. Acknowledgements

Several members of the Google VP8 team contributed to this memo.

10. References

10.1. Normative References

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Guide", RFC 6386, November 2011.

10.2. Informative References

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Alvestrand, H., "Overview: Real Time Protocols for Brower-based Applications", draft-ietf-rtcweb-overview-05 (work in progress), December 2012.

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