

译 HEVC与VP9编码效率对比

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HEVC(High EfficiencyVideo Coding,高效率视频编码)是一种视频压缩标准,H.264/MPEG-4 AVC的继任者。目前正在由ISO/IEC MPEG和ITU-T VCEG开发中。为此目的MPEG与VCEG联合成立了一个JCT-VC (JointCollaborative Team on Video Coding) 作为共同开发HEVC的团队。HEVC被认为不仅提升图像质量, 同时也能达到H.264/MPEG-4 AVC两倍之压缩率 (等同于同样画面质量下比特率减少了50%) , 可支持4K分辨率甚至到超画质电视, 最高分辨率可达到8192×4320 (8K分辨率) 。第一版的HEVC/H.265视频压缩标准在2013年4月13日被接受为国际电信联盟 (ITU-T) 的正式标准。

VP9是一个由Google开发的开放的视频压缩标准。VP9将是VP8的后继者。VP9的开发始于2011。VP9的目标之一是相同质量下相对于VP8可以减少50%的比特率。而另一个目标就是争取能在压缩效率上高于HEVC。2013年2月21日, 第一个支持VP9解码技术的Google Chrome网页浏览器发布了。

HEVC和VP9都是下一代视频编码技术, 到底孰优孰劣呢? DOOM9论坛上x00y00z0o对此进行了研究。

在这个测试中, HEVC和VP9的GOP长度是匹配的。

vp9 编码器 参数是 WebM Guide中的“best quality”, 但是改变了 kf-max-dist 以匹配 GOP并且增加了 tune=psnr。

x264设置为 veryslow, psnr|ssim,matched keyint, open-gop, and crf.

以下是他的测试结果：

| | HM 9.0 RA Main | | | | | | | VP9-exp (c94e55) 2pass Best | | | | | | |
|-----------------|----------------|--------|--------|--------|-------|--------|------|-----------------------------|--------|--------|--------|-------|--------|------|
| | kbps | Y psnr | U psnr | V psnr | YUV | NR-HVS | SSIM | kbps | Y psnr | U psnr | V psnr | YUV | NR-HVS | SSIM |
| Kimono | 4781.26 | 41.61 | 43.46 | 45.26 | 42.29 | 42.35 | 0.96 | 4696.31 | 40.70 | 42.83 | 44.32 | 41.42 | 40.42 | 0.95 |
| 1920x1080p24 | 2184.72 | 39.75 | 42.11 | 43.42 | 40.50 | 38.37 | 0.94 | 2145.93 | 38.58 | 41.45 | 42.66 | 39.45 | 36.39 | 0.93 |
| | 1068.55 | 37.45 | 40.90 | 42.06 | 38.46 | 34.46 | 0.93 | 1047.69 | 36.15 | 40.12 | 41.30 | 37.29 | 32.63 | 0.91 |
| 24 GOP | 542.55 | 35.07 | 40.06 | 41.27 | 36.47 | 31.08 | 0.90 | 531.95 | 33.77 | 38.94 | 40.30 | 35.23 | 29.54 | 0.88 |
| ParkScene | 7670.38 | 40.07 | 42.38 | 43.79 | 40.82 | 42.85 | 0.96 | 7524.95 | 38.68 | 41.26 | 42.36 | 39.46 | 40.80 | 0.94 |
| 1920x1080p24 | 3331.20 | 37.55 | 40.50 | 41.55 | 38.42 | 38.33 | 0.93 | 3246.80 | 35.91 | 39.21 | 40.32 | 36.87 | 35.92 | 0.91 |
| | 1535.94 | 34.95 | 38.90 | 39.99 | 36.07 | 33.97 | 0.90 | 1502.53 | 33.37 | 37.52 | 39.00 | 34.59 | 31.67 | 0.86 |
| 24 GOP | 717.38 | 32.44 | 37.72 | 39.09 | 33.93 | 30.05 | 0.84 | 700.92 | 31.05 | 36.22 | 38.08 | 32.58 | 28.02 | 0.80 |
| BasketballDrill | 3453.62 | 40.46 | 43.04 | 43.60 | 41.17 | 43.70 | 0.96 | 3437.04 | 39.73 | 42.39 | 42.73 | 40.44 | 42.68 | 0.96 |
| 832x480p50 | 1663.04 | 37.36 | 40.68 | 40.87 | 38.21 | 38.30 | 0.93 | 1655.02 | 36.63 | 39.90 | 39.80 | 37.44 | 37.30 | 0.92 |
| | 814.86 | 34.43 | 38.61 | 38.57 | 35.47 | 33.56 | 0.89 | 815.10 | 33.69 | 37.59 | 37.21 | 34.62 | 32.54 | 0.88 |
| 48 GOP | 431.59 | 31.93 | 37.16 | 36.95 | 33.21 | 29.85 | 0.84 | 432.22 | 31.27 | 35.65 | 35.01 | 32.28 | 28.90 | 0.83 |

| | x264 PSNR | | | | | | | VP9-exp (c94e55) 2pass Best | | | | | | |
|-----------------|-----------|--------|--------|--------|-------|--------|------|-----------------------------|--------|--------|--------|-------|--------|------|
| | kbps | Y psnr | U psnr | V psnr | YUV | NR-HVS | SSIM | kbps | Y psnr | U psnr | V psnr | YUV | NR-HVS | SSIM |
| Kimono | 5731.14 | 40.92 | 43.03 | 44.57 | 41.64 | 40.96 | 0.95 | 4696.31 | 40.70 | 42.83 | 44.32 | 41.42 | 40.42 | 0.95 |
| 1920x1080p24 | 2913.94 | 39.04 | 41.89 | 43.09 | 39.90 | 37.25 | 0.94 | 2145.93 | 38.58 | 41.45 | 42.66 | 39.45 | 36.39 | 0.93 |
| | 1537.34 | 36.71 | 40.72 | 41.75 | 37.84 | 33.53 | 0.92 | 1047.69 | 36.15 | 40.12 | 41.30 | 37.29 | 32.63 | 0.91 |
| 24 GOP | 852.79 | 34.15 | 39.67 | 40.76 | 35.67 | 30.05 | 0.89 | 531.95 | 33.77 | 38.94 | 40.30 | 35.23 | 29.54 | 0.88 |
| ParkScene | 8663.20 | 39.58 | 41.73 | 43.00 | 40.28 | 41.68 | 0.95 | 7524.95 | 38.68 | 41.26 | 42.36 | 39.46 | 40.80 | 0.94 |
| 1920x1080p24 | 4231.89 | 37.33 | 40.14 | 41.34 | 38.18 | 37.82 | 0.93 | 3246.80 | 35.91 | 39.21 | 40.32 | 36.87 | 35.92 | 0.91 |
| | 2130.36 | 34.83 | 38.66 | 39.93 | 35.94 | 33.68 | 0.89 | 1502.53 | 33.37 | 37.52 | 39.00 | 34.59 | 31.67 | 0.86 |
| 24 GOP | 1089.33 | 32.26 | 37.48 | 38.95 | 33.75 | 29.74 | 0.84 | 700.92 | 31.05 | 36.22 | 38.08 | 32.58 | 28.02 | 0.80 |
| BasketballDrill | 2808.20 | 38.21 | 41.51 | 41.81 | 39.07 | 39.76 | 0.94 | 3437.04 | 39.73 | 42.39 | 42.73 | 40.44 | 42.68 | 0.96 |
| 832x480p50 | 1470.00 | 35.45 | 39.42 | 39.37 | 36.43 | 35.20 | 0.90 | 1655.02 | 36.63 | 39.90 | 39.80 | 37.44 | 37.30 | 0.92 |
| | 789.67 | 32.88 | 37.35 | 37.09 | 33.96 | 31.24 | 0.86 | 815.10 | 33.69 | 37.59 | 37.21 | 34.62 | 32.54 | 0.88 |
| 48 GOP | 442.45 | 30.35 | 35.68 | 35.17 | 31.62 | 27.63 | 0.81 | 432.22 | 31.27 | 35.65 | 35.01 | 32.28 | 28.90 | 0.83 |

| | x264 SSIM | | | | | | | VP9-exp (c94e55) 2pass Best | | | | | | |
|-----------------|-----------|--------|--------|--------|-------|--------|------|-----------------------------|--------|--------|--------|-------|--------|------|
| | kbps | Y psnr | U psnr | V psnr | YUV | NR-HVS | SSIM | kbps | Y psnr | U psnr | V psnr | YUV | NR-HVS | SSIM |
| Kimono | 6026.42 | 40.84 | 43.00 | 44.36 | 41.55 | 41.19 | 0.95 | 4696.31 | 40.70 | 42.83 | 44.32 | 41.42 | 40.42 | 0.95 |
| 1920x1080p24 | 2902.04 | 38.91 | 41.84 | 42.91 | 39.78 | 37.27 | 0.94 | 2145.93 | 38.58 | 41.45 | 42.66 | 39.45 | 36.39 | 0.93 |
| | 1508.39 | 36.52 | 40.70 | 41.70 | 37.69 | 33.38 | 0.92 | 1047.69 | 36.15 | 40.12 | 41.30 | 37.29 | 32.63 | 0.91 |
| 24 GOP | 813.78 | 33.90 | 39.65 | 40.70 | 35.47 | 29.77 | 0.89 | 531.95 | 33.77 | 38.94 | 40.30 | 35.23 | 29.54 | 0.88 |
| ParkScene | 7747.79 | 39.05 | 41.19 | 42.39 | 39.74 | 41.35 | 0.95 | 7524.95 | 38.68 | 41.26 | 42.36 | 39.46 | 40.80 | 0.94 |
| 1920x1080p24 | 3634.06 | 36.66 | 39.64 | 40.83 | 37.55 | 37.02 | 0.93 | 3246.80 | 35.91 | 39.21 | 40.32 | 36.87 | 35.92 | 0.91 |
| | 1779.38 | 34.01 | 38.27 | 39.61 | 35.24 | 32.59 | 0.89 | 1502.53 | 33.37 | 37.52 | 39.00 | 34.59 | 31.67 | 0.86 |
| 24 GOP | 883.52 | 31.35 | 37.19 | 38.74 | 33.00 | 28.49 | 0.82 | 700.92 | 31.05 | 36.22 | 38.08 | 32.58 | 28.02 | 0.80 |
| BasketballDrill | 2247.74 | 37.36 | 40.40 | 40.50 | 38.13 | 38.95 | 0.94 | 3437.04 | 39.73 | 42.39 | 42.73 | 40.44 | 42.68 | 0.96 |
| 832x480p50 | 1147.26 | 34.40 | 38.27 | 38.13 | 35.35 | 34.02 | 0.90 | 1655.02 | 36.63 | 39.90 | 39.80 | 37.44 | 37.30 | 0.92 |
| | 599.05 | 31.56 | 36.46 | 36.17 | 32.75 | 29.64 | 0.85 | 815.10 | 33.69 | 37.59 | 37.21 | 34.62 | 32.54 | 0.88 |
| 48 GOP | 337.64 | 28.83 | 35.01 | 34.36 | 30.29 | 25.76 | 0.79 | 432.22 | 31.27 | 35.65 | 35.01 | 32.28 | 28.90 | 0.83 |

总结的实验结果如图所示

| | A | B | T | X | Y | Z | |
|----|----------------------------|-----------------|-----|---------------------------|------------|--------|--|
| 1 | Delta bitrate of | | | BD-rate (piecewise cubic) | | | |
| 2 | "VP9-exps Best 2pass" over | | | YUV PSNR | PSNR-HVS-M | SSIM | |
| 7 | HM9.0 RA-Main | Kimono | | 45.3% | 41.6% | 53.3% | |
| 11 | | ParkScene | | 62.5% | 49.2% | 70.1% | |
| 15 | | BasketballDrill | | 22.9% | 16.0% | 15.2% | |
| 20 | | | Avg | 43.6% | 35.6% | 46.2% | |
| 21 | | | | | | | |
| 28 | x264 r2245 veryslow PSNR | Kimono | | -17.4% | -17.1% | -14.2% | |
| 32 | | ParkScene | | 12.7% | 2.9% | 15.8% | |
| 36 | | BasketballDrill | | -12.8% | -17.1% | -22.0% | |
| 41 | | | Avg | -5.8% | -10.5% | -6.8% | |
| 42 | | | | | | | |
| 49 | x264 r2245 veryslow SSIM | Kimono | | -20.4% | -17.5% | -11.0% | |
| 53 | | ParkScene | | 6.6% | 2.5% | 25.8% | |
| 57 | | BasketballDrill | | -14.8% | -11.5% | -2.9% | |
| 62 | | | Avg | -9.5% | -8.8% | 4.0% | |
| 68 | | | | | | | |
| 69 | | | | | | | |

从测试结果来看：VP9的编码效率在H.264之上，但是在HEVC之下
原帖地址：<http://forum.doom9.org/showthread.php?t=165839&page=3>

=====补充=====

HEVC测试序列合集：<http://download.csdn.net/detail/leixiaohua1020/6843803>
VP9测试序列合集：<http://download.csdn.net/detail/leixiaohua1020/6843921>

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