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| *Title:* | **JCT-VC AHG report: Screen content extensions software development (AHG 8)** | | |
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# Abstract

This report summarizes the activities of Ad Hoc Group 8 on screen content extensions software (SCM) development that have taken place between the JCT-VC 22nd meeting in Geneva, Switzerland, and the 23rd meeting in San Diego, USA.

# Mandates

The ad hoc group was mandated to:

* Coordinate development of the HM SCM software and its distribution.
* Prepare and deliver HM 16.x-SCM-6.0 software version and the reference configuration encodings according to JCTVC-U1015.
* Prepare and deliver additional "dot" version software releases and software branches as appropriate.
* Perform analysis and reconfirmation checks of the behavior of the draft design, and report the results of such analysis.
* Suggest configuration files for additional testing of tools.
* Coordinate with AHG7 to address any identified issues regarding text and software relationship.

# Software revisions

Multiple versions of the HM SCM software were produced and announced on the JCT-VC email reflector. The integration details and performance summary of these revisions are provided in the next subsections. The performance results of software revisions were observed to be consistent with the adopted techniques.

## HM-16.7\_SCM-6.0 releases

HM-16.7\_SCM-6.0 was announced on the email reflector on November 23rd 2015. The software was tagged as <https://hevc.hhi.fraunhofer.de/svn/svn_HEVCSoftware/tags/HM-16.7+SCM-6.0/> .

HM-16.7\_SCM-6.0 incorporates following adoptions/bug fixes:

* JCTVC-V0034: Palette encoder improvement for 4:2:0.
* JCTVC-V0040: Enable by default the method in U0095 on fast encoder for ACT and intra.
* JCTVC-V0041: Constrain the range of escape values.
* JCTVC-V0042: Allow zero size palette in PPS.
* JCTVC-V0043: Restriction for maximum palette predictor size.
* JCTVC-V0048: Relax 8x8 bi-bred restriction based on mv's and temporal referencing.
* JCTVC-V0049: Round merge MVs when ref picture is curr pic.
* JCTVC-V0056: Relax 8x8 bi-bred restriction based on the value of TwoVersionsOfCurrDecPicFlag.
* JCTVC-V0065: Modified formula for computing PaletteMaxRun including consideration of copy\_above\_indices\_for\_final\_run\_flag.
* JCTVC-V0066: Remove special treatments of IBC as different from inter in the case of CIP.
* Bug fix for delta QP for palette mode.

JCTVC-V0057/ JCTVC-U0181 (storage of unfiltered decoded picture in DPB) are disabled for now in the SCM and are planned to be enabled in the future releases after software issues involved are fixed. (These do not impact CTC).

The performance HM-16.7\_SCM-6.0 compared to HM-16.6\_SCM-5.2 was described according to the common test conditions in JCTVC-U1015. For the lossy 444 configuration, it is reported that this version provides BD-rate reduction of 0.0%, 0.2% and 0.3% for RGB 1080p & 720p text and graphics category in AI/RA/LB configurations respectively and BD-rate reduction of 0.0%, 0.1% and 0.2% for YUV 1080p & 720p text and graphics category in AI/RA/LB configuration, respectively.

For the lossy 420 configuration, it is reported that this version provides BD-rate reduction of 3.2%, 2.5% and 1.6% for YUV 1080p & 720p text and graphics category in AI/RA/LB configurations respectively.

Table 1 and Table 2 summarize BD-rate change for lossy 444 and lossy 420 configurations respectively.

Table 1. BD-Rate change in Lossy 444 configuration (SCM 6.0 Vs SCM 5.2)

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  | **All Intra** | | |
|  | G/Y | B/U | R/V |
| RGB, text & graphics with motion, 1080p & 720p | 0.0% | 0.0% | 0.0% |
| RGB, mixed content, 1440p & 1080p | 0.0% | 0.0% | 0.0% |
| RGB, Animation, 720p | 0.0% | 0.0% | 0.0% |
| RGB, camera captured, 1080p | 0.0% | 0.0% | 0.0% |
| YUV, text & graphics with motion, 1080p & 720p | 0.0% | 0.0% | 0.0% |
| YUV, mixed content, 1440p & 1080p | 0.0% | -0.1% | 0.0% |
| YUV, Animation, 720p | 0.0% | 0.0% | 0.0% |
| YUV, camera captured, 1080p | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 98% | | |
| Dec Time[%] | 114% | | |
|  |  |  |  |
|  | **Random Access** | | |
|  | G/Y | B/U | R/V |
| RGB, text & graphics with motion, 1080p & 720p | -0.2% | -0.2% | -0.2% |
| RGB, mixed content, 1440p & 1080p | -0.2% | -0.2% | -0.2% |
| RGB, Animation, 720p | -0.5% | -0.7% | -0.6% |
| RGB, camera captured, 1080p | -0.1% | -0.3% | -0.1% |
| YUV, text & graphics with motion, 1080p & 720p | -0.1% | -0.1% | -0.1% |
| YUV, mixed content, 1440p & 1080p | -0.2% | -0.2% | -0.3% |
| YUV, Animation, 720p | -0.2% | -0.2% | -0.3% |
| YUV, camera captured, 1080p | -0.2% | -0.2% | -0.2% |
| Enc Time[%] | 99% | | |
| Dec Time[%] | 108% | | |
|  |  |  |  |
|  | **Low delay B** | | |
|  | G/Y | B/U | R/V |
| RGB, text & graphics with motion, 1080p & 720p | -0.3% | -0.2% | -0.3% |
| RGB, mixed content, 1440p & 1080p | -0.5% | -0.5% | -0.3% |
| RGB, Animation, 720p | -0.6% | -0.6% | -0.7% |
| RGB, camera captured, 1080p | -0.3% | -0.3% | -0.3% |
| YUV, text & graphics with motion, 1080p & 720p | -0.2% | -0.1% | -0.1% |
| YUV, mixed content, 1440p & 1080p | -0.3% | -0.8% | -0.8% |
| YUV, Animation, 720p | -0.5% | -0.5% | -0.5% |
| YUV, camera captured, 1080p | -0.1% | 0.1% | -0.1% |
| Enc Time[%] | 101% | | |
| Dec Time[%] | 106% | | |
|  |  |  |  |

Table 2. BD-Rate change in Lossy 420 configuration (SCM 6.0 Vs SCM 5.2)

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  | **All Intra** | | |
|  | G/Y | B/U | R/V |
| YUV, text & graphics with motion, 1080p & 720p | -3.2% | -1.6% | -1.2% |
| YUV, mixed content, 1440p & 1080p | -1.1% | -0.7% | -0.9% |
| YUV, Animation, 720p & 768p | -1.1% | -0.1% | -0.2% |
| Enc Time[%] | 106% | | |
| Dec Time[%] | 117% | | |
|  |  |  |  |
|  | **Random Access** | | |
|  | G/Y | B/U | R/V |
| YUV, text & graphics with motion, 1080p & 720p | -2.5% | -1.3% | -1.6% |
| YUV, mixed content, 1440p & 1080p | -1.3% | -1.1% | -1.9% |
| YUV, Animation, 720p | -0.7% | -0.1% | -0.6% |
| Enc Time[%] | 97% | | |
| Dec Time[%] | 114% | | |
|  |  |  |  |
|  | **Low delay B** | | |
|  | G/Y | B/U | R/V |
| YUV, text & graphics with motion, 1080p & 720p | -1.6% | -1.4% | -1.6% |
| YUV, mixed content, 1440p & 1080p | -1.0% | -0.8% | -1.0% |
| YUV, Animation, 720p | -0.6% | 0.2% | 0.0% |
| Enc Time[%] | 97% | | |
| Dec Time[%] | 104% | | |
|  |  |  |  |

## HM-16.6\_SCM-5.x and HM-16.7\_SCM-5.4 releases

HM-16.6\_SCM-5.3, HM-16.6\_SCM-5.4 were tagged on HHI Server on November 02nd, 2015 and can be downloaded at <https://hevc.hhi.fraunhofer.de/svn/svn_HEVCSoftware/tags/>

The changes over HM-16.6\_SCM5.2 are

* Following tickets were fixed: #1411, #1417, #1418, #1419, #1420, #1421, #1422.
* Macro Removals related to SCM 5.2
* Merge to HM 16.7
* Misc. Cleanups/ fixes for memory leaks

It is observed that there was no noticeable change in performance under common test configuration due to above integrations.

## Bug tracker

The JCT-VC issue tracker at <https://hevc.hhi.fraunhofer.de/trac/hevc/> has been updated to allow bug reports to be entered for SCM, currently under milestone HM+SCC-7.0, version SCC-6.0 (HM16.7).

Following tickets were closed during the meeting cycle: #1411, #1417, #1418, #1419, #1420, #1421, and #1422. . Currently there are no open tickets.

# Recommendations

* Continue to develop reference software based on HM16.7\_SCM6.0 and improve its quality.
* Remove macros introduced in previous versions before starting integration towards SCM-6.x/SCM-7.0 such as to make the software more readable.
* Continue merging with later HM versions.