|  |  |
| --- | --- |
| **Joint Collaborative Team on 3D Video Coding Extension**  **of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11**  13th Meeting: Geneva, CH, 17 – 21 Oct 2015 | Document: JCT3V-M0003 |

|  |  |  |  |
| --- | --- | --- | --- |
| *Title:* | **JCT-3V AHG Report: MV-HEVC and 3D-HEVC Software Integration (AHG3)** | | |
| *Status:* | AHG report input to JCT-3V | | |
| *Purpose:* | AHG report | | |
| *Author(s) or Contact(s):* | Gerhard Tech (Fraunhofer HHI) Hongbin Liu Yi-Wen Chen (Mediatek) | Email: | [gerhard.tech@hhi.fraunhofer.de](mailto:gerhard.tech@hhi.fraunhofer.de) [liuhongbinhit@qq.com](mailto:liuhongbinhit@qq.com) [yiwen.chen@mediatek.com](mailto:yiwen.chen@mediatek.com) |
| *Source:* | AHG | | |

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Abstract

This report summarizes the activities of the AhG on MV-HEVC and 3D-HEVC Software Integration that have taken place between the 12th JCT-3V meeting in Warsaw and the 13thJCT-3V meeting in Geneva. Activities focused on the update of HTM to HM-16.5, the integration of missing items to HTM, the release of the MV-HEVC Software Draft 4, the release of the 3D-HEVC Software Draft 2.

# Mandates

|  |  |  |
| --- | --- | --- |
| **Title** | **Chairs** | **Mtg** |
| **MV-HEVC / 3D-HEVC Software Integration (AHG4)**  ([jct-3v@lists.rwth-aachen.de](mailto:jct-3v@lists.rwth-aachen.de))   * Coordinate development of the HTM software and its distribution to JCT-3V members, and finalize the work plan within one week. * Produce documentation of software usage for distribution with the software. * Prepare and deliver HTM-15.0 software version and the reference configuration encodings according to JCT3V-G1100 (expected within six weeks after the meeting). * Start integrating HTM-15.1 for additional missing parts (related to HL syntax, SEI messages) * Prepare and deliver the Draft 4 of MV-HEVC software JCT3V-L1009 and Draft 2 of 3D-HEVC software JCT3V-L1012. * Coordinate with 3D-HEVC Draft and MV-HEVC / 3D-HEVC Test Model editing to identify any mismatches between software and text. | G. Tech  H. Liu  Y. W. Chen  (co-chairs) | N |

# HTM tool integration

Development of the software was coordinated with the parties needing to integrate changes.

The distribution of the software was announced on the JCT-3V e-mail reflector and the software was made available through the SVN server:

[https://hevc.hhi.fraunhofer.de/svn/svn\_3DVCSoftware/tags/](https://hevc.hhi.fraunhofer.de/svn/svn_3DVCSoftware/tags/HTM-4.0)

Anchor bitstreams have been created and uploaded to:

[ftp.hhi.fraunhofer.de](ftp://ftp.hhi.fraunhofer.de); login: mpeg3dv\_guest; path: /MPEG-3DV/HTM-Anchors/

**Note that the password changed**. To obtain the new password, please send a mail to gerhard.tech@hhi.fraunhofer.de.

Two versions of the HTM software were produced and announced on the JCT-3V email reflector. A third version will be released during the meeting. The following sections give a brief summary of the integrated tools and achieved coding gains.

## Version HTM-15.0 (Update to HM-16.6)

HTM-15.0 was developed from HTM-14.1 and HM-16.6. Development of HTM-15.0 started already before the Warsaw meeting and was conducted in several parallel and non-parallel tracks supervised by different software coordinator.

### Integrated items

All 3D- and MV-HEVC related code has been merged from HTM-14.1 to the new version based on HM-16.6. Several bug fixes have been applied.

### Coding performance

***MV-HEVC: HTM-15.0 vs. HTM-14.1 (CTC, three view configuration)***

|  |  |  |  |
| --- | --- | --- | --- |
|  | video  total rate | enc time | dec time |
| Balloons | -0,2% | 93,9% | 99,1% |
| Kendo | -0,2% | 93,3% | 99,3% |
| Newspaper\_CC | -0,3% | 94,0% | 97,9% |
| GT\_Fly | -0,5% | 93,2% | 99,1% |
| Poznan\_Hall2 | -0,3% | 99,5% | 102,4% |
| Poznan\_Street | -0,5% | 98,0% | 105,9% |
| Undo\_Dancer | -0,2% | 96,5% | 98,2% |
| Shark | -0,3% | 91,7% | 98,7% |
| 1024x768 | -0,2% | 93,7% | 98,8% |
| 1920x1088 | -0,3% | 95,8% | 100,9% |
| **average** | **-0,3%** | **95,0%** | **100,1%** |

***3D-HEVC: HTM-15.0 vs. HTM-14.1 (CTC, three view configuration)***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | video  video rate | video  total rate | synth  total rate | enc time | dec time | ren time |
| Balloons | -0,1% | -0,3% | -0,1% | 93,5% | 92,1% | 99,9% |
| Kendo | -0,2% | -0,5% | 0,0% | 91,9% | 94,1% | 100,2% |
| Newspaper\_CC | -0,3% | -0,5% | -0,3% | 95,5% | 88,2% | 97,7% |
| GT\_Fly | -0,3% | -0,5% | -0,4% | 91,9% | 86,6% | 101,2% |
| Poznan\_Hall2 | -0,1% | -0,3% | 0,2% | 95,2% | 86,3% | 97,5% |
| Poznan\_Street | -0,4% | -0,4% | -0,4% | 97,1% | 86,3% | 96,6% |
| Undo\_Dancer | 0,0% | -0,1% | 0,2% | 94,2% | 90,8% | 99,4% |
| Shark | -0,2% | -0,4% | -0,1% | 93,2% | 89,7% | 100,6% |
| 1024x768 | -0,2% | -0,4% | -0,1% | 93,6% | 91,4% | 99,3% |
| 1920x1088 | -0,2% | -0,3% | -0,1% | 94,3% | 87,9% | 99,1% |
| **average** | -0,2% | -0,4% | -0,1% | 94,1% | 89,3% | 99,2% |

## Version HTM-15.1

Starting point for development of HTM-15.1 was HTM-15.0. Development of HTM-15.1 was conducted in a single track by the software coordinators.

### Integrated items

* Major clean-up of MV-HEVC related decoding processes. The structure of code and naming for variables are now close to the specification text.
* Fixes to POC reset, layer-wise startup, DPB management.
* Several other bugs have been fixed.

### Coding performance

The coding performance for MV-HEVC is identical to HTM-15.0. For 3D-HEVC, there is a minor bit rate increase due to a fix for the presence of camera parameters.

## Version HTM-15.2 (SEI messages)

Starting point for development of HTM-15.2 was HTM-15.1. Development of HTM-15.2 was conducted in a single track. HTM-15.2 will probably be released during the meeting.

### Integrated items

* General SEI changes, (new interface to specify SEIs for different layers)
* Multiview view position SEI
* Multiview acquisition information SEI
* Multiview scene information SEI
* Inter-layer constrained tile sets SEI
* Layers not present SEI
* Alpha channel information SEI
* 3D reference displays information SEI
* Depth representation information SEI
* Overlay information SEI
* Alternative Depth Information SEI (warp map part).
* Alternative Depth Information SEI (GVD part, not finalized yet)

### Coding performance

The coding performance is identical to HTM-15.1.

# MV-HEVC Software Draft 4

The MV-HEVC software draft 4 (JCT3V-L1009) has been released. The software has been generated by removing 3D-HEVC related source code and configuration files from HTM-15.1. The software can also be accessed using the svn:

https://hevc.hhi.fraunhofer.de/svn/svn\_3DVCSoftware/branches/HTM-15.1-MV-draft-4

The related document has been submitted to the MPEG secretariat as DAM study text.

# 3D-HEVC Software Draft 2

The 3D-HEVC software draft 2 (JCT3V-L1012) has been released. The software corresponds to HTM-15.0. The software can also be accessed using the svn:

https://hevc.hhi.fraunhofer.de/svn/svn\_3DVCSoftware/tags/HTM-15.0

The related document has been submitted to the MPEG secretariat for DAM ballot.

# Open issues

* Hybrid scalability has not been integrated yet.
* Other minor issues in the bug tracking system.
* Integration of GVD part of alternative depth information SEI message needs to be continued.

# Recommendations

The recommendations of the MV-HEVC and 3D-HEVC Software Integration AHG are:

* Continue development of HTM.
* Continue to identify bugs and discrepancies with text and address them.