H2B2VS
D4.1.1

Standardization Report

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EXECUTIVE SUMMARY

This deliverable provides a summary of all the contributions and all standardization activities produced or followed by the project partners in relation to the project related activities.

This report provides a list of the contributions with the relevant details and an abstract. Some summaries of the main contribution to standardization are available for free download on the project web site: http://h2b2vs.epfl.ch

The document will be periodically updated with the new publications produced during the project lifetime.

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1 DOCUMENT HISTORY AND ABBREVIATIONS

1.1 Document history

Version	Date	Description of the modifications
0.1	26/02/2014	First ToC
0.2	05/03/2014	Add contributions from TVN, TPT, INSA, EPFL
0.3	15/04/2014	Add contributions from MPEG Valencia meeting
0.4	17/04/2014	Review of contents

1.2 Abbreviations

RVC	Reconfigurable Video Coding
JCT-VC	Joint Collaborative Team Video Coding
DVB	Digital Video Broadcasting

2 INPUT / OUTPUT CONTRIBUTIONS SUMMARY

Standardization Body	Doc number	Title	Authors / Editors
JCT-VC MPEG 105	JCTVC-N0043 m29616	On software complexity: real time and parallel SHVC video decoder	W. Hamidouche, M. Raulet, O. Déforges
JCT-VC MPEG 106	JCTVC-O0115 m30856	Pipeline and parallel architecture for the SHVC decoder	W. Hamidouche, M. Raulet, O. Deforges
JCT-VC MPEG 107	m32099	Update of JCTVC-O0115 on a pipeline and parallel architecture of an SHVC decoder	W. Hamidouche, M. Raulet
JCT-VC MPEG 108	JCTVC-Q0046 m32722	Complexity analysis of an optimized SHVC decoder	W. Hamidouche, M. Raulet, O. Deforges
JCTVC-Q0050 m32726	JCTVC-Q0050 m32726	4K real time streaming with SHVC decoder and GPAC player	W. Hamidouche, M. Raulet, J. Le Feuvre
JCT-VC MPEG 107	JCTVC-P0127r2	AHG14: On a profile supporting Bit Depth and Color Gamut Scalability in HEVC Scalable extensions	Xavier Ducloux, Pierre Andrivon, Philippe Bordes, Edouard François, Yan Ye, Alberto Duenas, Andrew Segall, Kemal Ugur, Xiang Li, Elena Alshina
MPEG 104 Systems	m29227	Timeline Delivery for MPEG-2 TS enhancements	J. Le Feuvre, C. Concolato, R. Monnier, A-L. Mevel, P. Gendron, M. Mattavelli, C. Alberti, D. Renzi, F. Pescador, N. García, M. Raulet
MPEG 104 Systems	w13474	WD of ISO/IEC 13818-1:201X/AMD 6 Delivery of Timeline for External Data	Jean Le Feuvre, Sam Narasimhan
MPEG 105 Systems	m30300	Extensible Syntax and Extensions for TS Timeline	Jean Le Feuvre, Tran Min-Son, Pierre Sarda, Patrick Gendron, Raoul Monnier, Mickaël Raulet, Marco Mattavell
MPEG 105 Systems	w13661	WD 2.0 of ISO/IEC 13818-1 :201X/AMD 6 Delivery of Timeline for External Data	Jean Le Feuvre, Sam Narasimhan
MPEG 106 Systems	m31446	Input on WD2 of 13818-1 AMD8	Jean Le Feuvre, Patrick Gendron, Anne-Laure Mevel, Jean-François Travers, Pascal Dupain, Mickael Raulet
MPEG 106 Systems	m31397	a scalable HEVC demonstration within GPAC player	W. hamidouche, J. Le Feuvre, M. Raulet
MPEG 106 Systems	m31448	Follow up on Uniform Signaling for Timeline Alignment	Jean Le Feuvre
MPEG 106 Systems	w13951	Request for ISO/IEC 13818-1:2013/AMD 6 Delivery of Timeline for External Data	Jean Le Feuvre, Sam Narasimhan
MPEG 106 Systems	w13952	Text of ISO/IEC 13818-1:2013/PDAM 6 Delivery of Timeline for External Data	Jean Le Feuvre, Sam Narasimhan
MPEG 106 Systems	w14015	Proposed Exploration of “Uniform Signaling for Timeline Alignment”	Jean Le Feuvre, David Singer
MPEG 107 Systems	m32287	Update on 13818-1 DAM6	Jean Le Feuvre, Patrick Gendron

MPEG 107 Systems	m32625	AHG on Timeline alignment	Youngkwon Lim, Jean Le Feuvre
MPEG 107 Systems	w14117	Study of ISO/IEC 13818-1:2013/PDAM 6 Delivery of Timeline for External Data	Jean Le Feuvre, Sam Narasimhan
MPEG 108 Systems	m33383	It's Hybrid Demo Time!	Jean Le Feuvre, Cyril Concolato, Mickael Raulet, Wassim Hamidouche
MPEG 103 RVC	m28171	Proposal of a Decoder Energy Management Scheme with RVC	Eduardo Juarez, Rong Ren, Jianguo Wei, Mickael Raulet, Matias Javier Garrido, Cesar Sanz, Fernando Pescador
MPEG 103 RVC	m28209	RVC description of an HEVC low delay decoder	M. Raulet, G. Cocherel, M. Mattavelli, D. De Saint Jorre, E. Juarez
MPEG 104 RVC	m29252	Update of WD1 of FU and FN descriptions for HEVC	M. Raulet, K. Jerbi, D. de Saint Jorre, M. Mattavelli, G. Cocherel
MPEG 104 RVC	m29253	RVC: HEVC decoder status on conformance test streams	M. Raulet, K. Jerbi, D. de Saint Jorre, M. Mattavelli, G. Cocherel
MPEG 105 RVC	m30336	Update on Text of ISO/IEC 23002-4:201x/PDAM2 FU and FN descriptions for HEVC	Khaled Jerbi, Mickaël Raulet, Damien De Saint Jorre, Marco Mattavelli, Daniele Renzi, Claudio Alberti
MPEG 105 RVC	m30337	Updates on HEVC decoder status on conformance test streams	Khaled Jerbi, Damien De Saint Jorre, Mickaël Raulet, Daniele Renzi, Marco Mattavelli, Claudio Alberti
MPEG 105 RVC	m30338	On using tiles for a parallel HEVC decoder description	Khaled Jerbi, Mickaël Raulet, Damien De Saint Jorre, Marco Mattavelli, Daniele Renzi, Claudio Alberti
MPEG 106 RVC	m30338	Performance Monitoring for Energy Estimation in RVC-CAL Descriptions	E. Juarez, R. Ren, M. Raulet, J. Wei, M. J. Garrido, C. Sanz, F. Pescador
MPEG 106 RVC	m31400	Linking SSE-optimized functions with a RVC-CAL program	Khaled Jerbi, Mickaël Raulet
MPEG 106 RVC	m31403	On using tiles for a parallel HEVC decoder description (post implementation)	Khaled Jerbi, Damien De Saint Jorre, Mickaël Raulet, Marco Mattavelli
MPEG 107 RVC	m32310	Updates on HEVC decoder status on conformance test streams	Khaled Jerbi, Damien De Saint Jorre, Mickaël Raulet, Marco Mattavelli, Daniele Renzi, Claudio Alberti
MPEG 108 RVC	m33115	Energy-Aware Reconfiguration Based on a Just-In-Time Adaptive Decoder Engine (JADE)	Rong Ren, Eduardo Juarez, Mickael Raulet, Jianguo Wei, Matias J. Garrido, Cesar Sanz, Fernando Pescador
MPEG 108 RVC	m33241	Updates on HEVC decoder status on conformance test streams	Khaled Jerbi, Damien De Saint Jorre, Mickaël Raulet, Marco Mattavelli, Daniele Renzi, Claudio Alberti
MPEG 108 RVC	m33242	Update on Text of ISO/IEC 23002-4:201x/PDAM2 FU and FN descriptions for HEVC	Khaled Jerbi, Damien De Saint Jorre, Mickaël Raulet, Marco Mattavelli, Daniele Renzi, Claudio Alberti

Table 1- Summary of the H2B2VS contributions

3 JOINT VIDEO COLLABORATIVE TEAM (JCT-VC)

3.1.1 105th meeting in Vienna, AU. August 2013.

3.1.1.1 JCTVC-N0043 On software complexity: real time and parallel SHVC video decoder

Source: INSA/IETR Rennes

This contribution provides an open source SHVC software decoder implementing the reference index based SHVC solution. The wave-front parallel processing approach is used to perform in parallel the video decoding of both the base layer and the enhancement one.
Experimental results carried out on a laptop fitted with a core Intel i7 processor show that the proposed software decoder achieves the decoding of 1280×720 base layer and 1920×1080 enhancement layer video sequences at 25 fps when using four concurrent threads.

3.1.2 106th MPEG meeting in Geneva, CH. October 2013.

3.1.2.1 JCTVC-O0115 Pipeline and parallel architecture for the SHVC decoder

Source: INSA/IETR Rennes

This contribution provides a complete implementation of the SHVC decoder under the *GPAC* player. The SHVC decoder is based on the open source software *OpenHEVC*, which implements a conforming HEVC decoder. The proposed pipeline and parallel SHVC decoder enables two levels of parallelism. The first level decodes the base layer and the enhancement layer frames in parallel. The second level of parallelism performs the decoding of both the base layer and the enhancement layer in parallel through the HEVC high-level parallel processing solutions (wave-front and tile).
Experimental results carried out on a computer fitted with an Intel Xeon processor running at 3.4 GHz showed that the pipeline SHVC decoder achieves the decoding of 1920x1080 base layer and 2560x1600 enhancement layer at 45 frames per second when using six concurrent threads.

3.1.3 107th MPEG meeting in San José, USA. January 2014

3.1.3.1 JCTVC-P0169 Update of JCTVC-O0115 on a pipeline and parallel architecture of an SHVC decoder

Source: INSA/IETR Rennes

This contribution provides an update of contribution JCTVC-O0115 that provides a complete implementation of the SHVC decoder under the *GPAC* player. The SHVC decoder is based on the open source software *OpenHEVC*, which implements a conforming HEVC decoder. A parallel processing architecture is proposed to reduce both the decoding time and the latency of the SHVC decoder. The proposed solution combines the high level parallel processing solutions defined in the HEVC standard with an extension of the frame-based parallelism. The latter solution enables the decoding of several spatial and temporal SHVC frames in parallel to enhance both decoding frame rate and latency. The wavefront parallel processing solution is used for more coarse level of granularity.
The proposed hybrid parallel processing approach achieves a near optimal speedup and provides a good trade-off between decoding time, latency and memory usage. On a 6 cores Xeon processor, the parallel SHVC decoder performs a real time decoding of 1600p60 video resolution.

3.1.3.2 JCTVC- AHG14: On a profile supporting Bit Depth and Color Gamut Scalability in HEVC Scalable extensions

Source: Thomson Video Networks

This contribution requests to define a profile for the HEVC scalable extension supporting Color Gamut and Bit-depth Scalability (CGS). Such a scalability technology may be considered in applications standardization committees such as DVB CM-AVC/CM-UHDTV or ATSC3.0. Considering

the foreseeable evolution of capture and display device capabilities and use cases, CGS appears to be one major feature to be supported in upcoming mainstream applications. Finally, this contribution also suggests establishing a Liaison Statement on Colour Gamut Scalability requirements and performance between DVB CM-AVC/CM-UHDTV, SC 29/WG 11 and SG 16.

3.1.4 108th MPEG meeting in Valencia, Spain. April 2014

3.1.4.1 JCTVC-Q0046 Complexity analysis of an optimized SHVC decoder

Source: INSA/IETR Rennes

This contribution provides a complexity assessment of an optimized Scalable High efficiency Video Coding (SHVC) decoder. The SHVC decoder is based on a real time and parallel HEVC decoder developed under the open source *OpenHEVC* project. The main time-consuming operations introduced in the SHVC standard including the up-sampling of the lower layer picture and the up-scaling of its Motion Vectors (MVs) are optimized in Single Instruction Multiple Data (SIMD) operations.

The optimized SHVC decoder archives a real time decoding of 1080p50 enhancement layer on single core of an Intel i7 processor running at 2.6 GHz (Macbook Pro Retina, end 2013, turbo boost 3.4GHz). The SHVC decoder decoding two layers introduces in average 50%-80% extra complexity in respect to the single layer HEVC decoder. Moreover, the up-sampling and up-scaling operations, in the case of spatial scalability and inter coding configuration, represent around 16% of the whole decoding time. Finally, the low level optimizations jointly with a hybrid parallelism approach enable the decoding of 1600p enhancement layer at 88 frames per second on a 4 cores i7 processor.

3.1.4.2 JCTVC-Q0050 4K real time streaming with SHVC decoder and GPAC player

Source: INSA, Telecom ParisTech

This contribution provides a 4K end-to-end video streaming demonstration with using an optimized SHVC decoder under the openHEVC/FFmpeg library (openHEVC project) and the GPAC player. On the one hand, the optimized and parallel SHVC decoder enables a real time decoding 2160p30 video sequence associated with low frame latency. The SHVC decoder was integrated in the openHEVC/FFmpeg library enabling this open source library to support the decoding of a conforming SHVC bitstream. On the other hand, the GPAC player implements tools to encapsulate the conforming SHVC bitstream into the mp4 file format.

At the server side, the GPAC player broadcasts the mp4 content in MPEG2-TS. At the receiver side, the GPAC player feeds the openHEVC/FFmpeg SHVC decoder with the received video packets. The FFmpeg library through the SHVC decoder decodes the requested SHVC video layers and pushes YUV pictures corresponding to the highest decoded layer for rendering by the GPAC layer. This demonstration also provides at the receiver side an interactive interface to switch between the decoded SHVC layers: HD and 4K for x2 spatial scalability.

4 MPEG (TPT, EPFL)

4.1 MPEG Reconfigurable Video Coding (EPFL)

Reconfigurable Video Coding (RVC) provides a framework to efficiently support multiple codec specifications and implementations by combining functional blocks, the so-called functional units (FU), from a collection of libraries. Two MPEG standards apply in this context: 1) MPEG-B part 4, that generally defines the framework and the standard languages used to describe the components of the framework and 2) MPEG-C part 4, that defines a library of video coding tools employed in existing MPEG standards.

This section lists the project's contributions to MPEG related to Reconfigurable Video Coding and summarizes their impact on output documents.

4.1.1 103rd MPEG meeting in Geneva, CH. January 2013

4.1.1.1 m28171 Proposal of a Decoder Energy Management Scheme with RVC

Source: UPM, INSA/IETR Rennes

This document presents a proposal for a decoder energy management scheme based on RVC.
The structure of the contribution is as follows. Section 2 details why RVC constitutes an opportunity to manage the energy usage of a decoder and describes the proposal of an energy management scheme based on the RVC framework and energy estimates. Section 3 presents energy estimation results for an RVC-CAL Constrain Baseline profile AVC decoder that can be employed within the previous scheme. At last, in Section 4, the conclusions are drawn.

4.1.1.2 m28209 RVC description of an HEVC low delay decoder

Source: INSA/IETR Rennes, EPFL, UPM

This contribution presents the development status of a low delay HEVC decoder and extends the contributions submitted to the 101st and 102ng Mpeg meetings in Stockholm and Shanghai respectively. The HEVC RVC decoder has been tested on HM9.0 bitstreams available at ftp://ftp.kw.bbc.co.uk/hevc/hm-9.0-anchors/. It supports i_main, lp_main and ld_main bitstreams. The current version of the XDF decoder does not include inloop filters but they have already been written in CAL and tested over the same bitstreams. It supports decoding of 8 bit only bitstreams.

4.1.2 104th MPEG meeting in Incheon, KR. April 2013

4.1.2.1 m29252 Update of WD1 of FU and FN descriptions for HEVC

Source: INSA/IETR Rennes, EPFL

Compared to the previous WD, the reference sw is attached to this contribution. It adds different HM10 capabilities: CABAC parsing, SAO and DBF filterings (in track changes, the difference on the WD1) and MD5 checking.

4.1.2.2 m29253 RVC: HEVC decoder status on conformance test streams

Source: INSA/IETR Rennes, EPFL

This contribution extends the previous 4 contributions by updating the HEVC RVC decoder to HM.10. The decoder supports now the DBF and SAO filters. It supports also the streams with disabled TMVP. In this contribution, the authors added also an MD5 check. All these updates are detailed in an annexed Excel document.

The design was successfully tested on Anchor streams (i_main, ld_main, lp_main and ra_main). Concerning the JCTVC conformance streams, the results are summarized in an xls file joint to the submission where we added 3 new columns "pass", "Uflag" and "MD5": pass error means that the simulation is blocked, Uflag error means that the stream contains unsupported cases such as weightedPred !=0 and MD5 error means that the stream is supported but the displayed video is not correct.

4.1.3 105th meeting in Vienna, AU. August 2013.

4.1.3.1 m30336 Update on Text of ISO/IEC 23002-4:201x/PDAM2 FU and FN descriptions for HEVC

Source: IETR/INSA Rennes, EPFL

This document provides a paragraph to be added to Clause 2 of the mentioned document and an entire new clause (Clause 9) to be added. Clause 9 describes FUs for building the HEVC Main Profile decoder.

4.1.3.2 m30337 Updates on HEVC decoder status on conformance test streams

Source: INSA/IETR Rennes, EPFL

This document provides an update on the ongoing conformance tests of the RVC HEVC decoder. It is accompanied by an Excel sheet summarizing the status with respect to the set of conformance bitstreams.

4.1.3.3 m30338 On using tiles for a parallel HEVC decoder description

Source: INSA/IETR Rennes, EPFL

The HEVC codec was conceived to manage huge sizes of image such as 4K videos. To take profit of the existing multi-core platforms and the parallel hardware architectures, the standard introduced the notion of Tiles. Indeed, a tile is a completely independent part of an image that can be decoded separately from other tiles.
In this contribution, the authors focus on the decoding part and they explain how the parser generates the required information for each tile. Then, the authors detail a perspective of parallelizing the process using dynamic reconfiguration to generate the required number of parsing units for each tile.

4.1.4 106th MPEG meeting in Geneva, CH. October 2013.

4.1.4.1 m30338 Performance Monitoring for Energy Estimation in RVC-CAL Descriptions

Source: UPM, INSA/IETR Rennes

This contribution proposes a set of procedure primitives to monitor performance events in RVC-CAL descriptions. In addition, a model which relates event occurrence to energy is presented. At last, the results obtained applying the model to a PHP AVC and HEVC RVC-CAL decoder descriptions are discussed. This work extends contribution m28171 presented at the 103rd meeting in Geneva.

4.1.4.2 m31400 Linking SSE-optimized functions with a RVC-CAL program

Source: INSA/IETR Rennes, EPFL

This document describes how it is possible to increase the performance of a decoder with the optimization of some recurrent functions on a specific platform. In ffmpeg/libav some functions were optimized for x86 architectures using SSE. In this contribution, the authors show how they tried to rewrite some highly repeated functions analogically to the way they were developed in the SSE optimized version. The authors linked the projects generated with the c-back-end of Orcc to the optimized functions and they noticed a gain of 14% for a 480p sequence.

4.1.4.3 m31403 On using tiles for a parallel HEVC decoder description (post implementation)

Source: INSA/IETR Rennes, EPFL

This contribution is a continuity of m30336 presented in Vienna: “FU and FN descriptions for HEVC (ISO/IEC 23002-4) document presented in the last meeting”. The authors present the final architecture of the parallelized design and provide some implementation results.

4.1.5 107th MPEG meeting in San José, USA. January 2014

4.1.5.1 m32310 Updates on HEVC decoder status on conformance test streams

Source: INSA/IETR Rennes, EPFL

In this document, the authors summarize the newly supported streams in the JCTVC conformance database.
This database contains 130 conformance streams. 121 streams are coded in 8 bits and 9 streams are coded in 10 bits but not yet supported in the RVC dataflow design. Among the 121 8-bits streams the RVC design supports 56.

4.1.6 108th MPEG meeting in Valencia, Spain. April 2014

4.1.6.1 m33115 Energy-Aware Reconfiguration Based on a Just-In-Time Adaptive Decoder Engine (JADE)

Source: UPM, INSA

This contribution proposes an implementation of a new set of primitives to include within the scenario specification of the Just-In-Time Adaptive Decoder Engine (JADE). JADE is an open source tool which implements the Reconfigurable Vide Coding (RVC) framework. The goal of the proposal is to provide a mechanism to reconfigure a decoder based on energy consumption criteria. An energy-aware manager has been implemented in JADE to select a decoder description (DD) among those available at the decoder side.

4.1.6.2 m33241 Updates on HEVC decoder status on conformance test streams

Source: EPFL, INSA

In this document, we summarize the newly supported streams in the JCTVC conformance database. This database contains 141 conformance streams. 132 streams are coded in 8 bits and 9 streams are coded in 10 bits but not yet supported in the RVC dataflow design. Among the 132 8-bits streams the RVC design supports 78 ones. An excel sheet is attached.

4.1.6.3 m33242 Update on Text of ISO/IEC 23002-4:201x/PDAM2 FU and FN descriptions for HEVC

Source: EPFL, INSA

Some additional ports for the functional units are added.

4.1.7 RVC Core experiments

Since the 103rd MPEG meeting held in Geneva in January 2013 MPEG has conducted Core Experiments on RVC.

The reference output documents are: w13338, w13568, w13761, w13930, w14224
The goal of the experiments is to specify FUs composing the HEVC decoder in such a way that it can be split in order to provide more parallelism.

The HEVC toolbox has been written in a compact number of FU. The goal of these CEs is to provide a finer HEVC description to provide more flexibility and parallelism.

The work plan is the following:

1. to identify bottlenecks of the decoder description
2. to split FU when possible
3. to provide more parallelism
4. to re-write such FUs

4.2 Timeline and Hybrid Delivery (TPT)

4.2.1 104th MPEG meeting in Incheon, KR. April 2013

4.2.1.1 m29227 Timeline Delivery for MPEG-2 TS enhancements

Source: Telecom ParisTech, Thomson Video Networks, EPFL, UPM, INSA

The work presented in this contribution focuses on enhancing broadcast MPEG-2 Transport streams with broadband media. Various use cases for possible enhancements exist, and can be classified as follows:

- Enhancement with no synchronization or loose synchronization: in these cases, existing tools from already deployed TSs are sufficient to estimate the current time of the broadcast service with little accuracy, typically up to a few seconds or more;
- Enhancement requiring subjective synchronization: in these use cases, timing has to be computed with the same precision as regular inter-media synchronization (A/V sync, Text/Video sync …), which is usually a few tens of milliseconds up to a few hundreds;
- Enhancement requiring frame accurate: in these cases, timing has to be perfectly reconstructed (synchronization error tolerance is zero), otherwise either the decoding or the presentation of one media fails.

In this contribution, we mainly focus on the last type of use cases, as solutions covering this type also cover the use cases requiring subjective synchronization. However, examples of both subjective synchronization and frame accurate synchronization use cases are given in order to better understand the differences and constraints.

4.2.1.2 w13474 WD of ISO/IEC 13818-1:201X/AMD 6 Delivery of Timeline for External Data

Source: Telecom ParisTech, Arris

The systems group reviewed the contributions m29227 on timeline streaming for synchronized external enhancements of TS services, follow-up of the contributions m26903 and m28136 presented during the 102nd and 103rd MPEG Meetings.
The group agreed to enable transport of a media timeline in an MPEG-2 TS program, in order to provide a stable media time not sensitive to PCR discontinuities, and to signal the location of current and potentially upcoming external media enhancements.
The group agrees to follow a generic design independent of the media enhancement type; the technologies included in this AMD can be used to locate and synchronize external content with an MPEG-2 TS program, regardless of the external content packaging or coding types. The group agrees that in order to suppress potential PCR discontinuities that typically occur in an MPEG- 2 TS network, and provide frame-accurate timeline alignments, the mapping between the embedded timeline and PCR clock should be achieved through PES PTS values, hence implying a PES stream for the timeline transport.

The following provides the text under consideration for signaling of all these agreements based on the contributions cited above. MPEG welcomes comments on this document and further contributions. This working draft is expected to progress to a proposed draft amendment (PDAM 6) to ISO/IEC 13818-1:2012 for the 105th MPEG meeting.

4.2.2 105th meeting in Vienna, AU. August 2013.

4.2.2.1 m30300 Extensible Syntax and Extensions for TS Timeline

Source: Telecom ParisTech, Nagra France, Nagra Vision, Thomson Video Network, INSA/IETR Rennes, EPFL

In 104th MPEG Meeting in Incheon, a proposed working draft was issued to allow carriage of synchronization information for external media add-ons, in N13474. The current syntax in the working draft is compact in order to fit in a single TS packet, but is not extensible for other metadata. In this contribution, we propose to provide an extended syntax for the WD. We also propose new tools to be included in the WD.
In this proposal, we suggest to define the payload syntax of the timeline extension as a set of descriptors, similar to other descriptors used in the general MPEG-2 Transport Stream part. We also propose to have an optional CRC32 check at the end of the TEMI payload.

4.2.2.2 w13661 WD 2.0 of ISO/IEC 13818-1:201X/AMD 6 Delivery of Timeline for External Data

Source: Telecom ParisTech, Arris

The systems group reviewed the contributions m29227 and m30300 on timeline streaming for synchronized external enhancements of TS services, follow-up of the contributions m26903 and m28136 presented during the 102nd and 103rd MPEG Meetings.
The group agreed to enable transport of a media timeline in an MPEG-2 TS program, in order to provide a stable media time not sensitive to PCR discontinuities, and to signal the location of current and potentially upcoming external media enhancements.
The group agrees to follow a generic design independent of the media enhancement type; the technologies included in this AMD can be used to locate and synchronize external content with an MPEG-2 TS program, regardless of the external content packaging or coding types. The group agrees that in order to suppress potential PCR discontinuities that typically occur in an MPEG- 2 TS network, and provide frame-accurate timeline alignments, the mapping between the embedded timeline and PCR clock should be achieved through PES PTS values, hence implying a PES stream for the timeline transport.

The following provides the text under consideration for signaling of all these agreements based on the contributions cited above. MPEG welcomes comments on this document and further contributions. This working draft is expected to progress to a proposed draft amendment (PDAM 6) to ISO/IEC 13818-1:2013 for the 106th MPEG meeting.

4.2.3 106th MPEG meeting in Geneva, CH. October 2013.

4.2.3.1 m31446 Input on WD2 of 13818-1 AMD8

Source: Telecom ParisTech, TDF, Thomson Video Networks, INSA

In 105th MPEG Meeting in Incheon, a stable syntax for carriage of media timeline and external resource location has been proposed in W13661. Following the meeting, a number of discussions on the topic have taken place in the H2B2VS and other standard organizations such as DVB or HbbTV, and some companies have raised interest on the general topic and concerns on bandwidth overhead. This contribution reviews the bandwidth overhead introduced by TEMI and proposes an alternate transmission mode of timing. This contribution also proposes fixes and improvements to the working draft.

4.2.3.2 m31397 a scalable HEVC demonstration within GPAC player

Source: INSA, Telecom ParisTech

This contribution describes the different steps for playing SHVC contents with GPAC and an opnsource decoder based on OpenHEVC. GPAC encapsulates SHVC (SHM2.0 compatible bitstream) into ISOBMFF. The SHVC decoder is based on the open source software *OpenHEVC (build upon ffmpeg/libav)*, which implements a conforming HEVC decoder. The SHVC decoder, pipeline and parallel, enables two levels of parallelism.

The GPAC player allows the user to smoothly switch between layers. As the decoder is multiple loop base layer can be obtained instantaneously whereas Enhancement layer has to be delayed until an IRAP is encountered.

4.2.3.3 m31448 Follow up on Uniform Signaling for Timeline Alignment

Source: Telecom ParisTech

This contribution is the logical continuation of long online, offline or face-2-face discussions on the topic of “hybrid delivery” aver the last year, and the author lost count of all participants in the debates- let them be thanked. The author would like to address special thanks to the experts that patiently reviewed this contribution, especially David Singer and Ali C. Begen.

In Incheon meeting an exploration on Uniform Signaling for Timeline Alignment was started, in order to investigate the required tools at the systems level to allow a media presentation packaged and delivered in one format over one network type to be “augmented” by another media presentation, possibly using different packaging and/or delivery means. More specifically, the exploration welcomes feedback on the topics of:

- timeline alignment of media packaged in different containers and delivered over different networks
- Discovery of the add-on media enhancing an existing presentation
- Tools allowing event signaling related to the add-on or enabling pre-fetch of add-on media

MPEG has a key role to play in this area, and should propose guidelines and technologies in a well-identified manner in order to ensure interoperability in the connected media CE market. Other standard bodies such as HbbTV (ETSI) are currently looking for solutions to recommend in their products for what they usually refer to as “Hybrid Delivery”, and plan to release their new technologies before mid 2014.

In this regard, this contribution reviews existing MPEG and IETF technologies that can be used to achieve the goal listed in the exploration activity for all the topics previously stated.

4.2.3.4 w13951 Request for ISO/IEC 13818-1:2013/AMD 6 Delivery of Timeline for External Data

Source: Telecom ParisTech, Arris

Delivery of additional media to enhance MPEG-2 transport stream programs is being deployed in many markets, from broadcast to IPTV delivery. Current deployments rely on proprietary solutions and loose (i.e. not frame-accurate) synchronization of media. This amendment to ISO/IEC 13818-1 | ITU-T Recommendation H.222.0 provides a simple framework to allow signaling, pre-fetching and splicing of additional media enabled frame-accurate services including deployment of upcoming SHVC standard. The amendment introduces a new stream type for PES carriage of timing and signaling descriptors, and an extension mechanism in the adaptation field for in-band insertion of descriptors for low bit-rates environments.

Target Dates:

PDAM	2013-11
FPDAM	2014-04
FDAM	2014-10

4.2.3.5 w13952 Text of ISO/IEC 13818-1:2013/PDAM 6 Delivery of Timeline for External Data

Source: Telecom ParisTech, Arris

This amendment to ISO/IEC 13818-1:2013 enables signaling and synchronization of external enhancements of programs carried over MPEG-2 Transport Stream. Specifically, it enables transport of a media timeline in an MPEG-2 TS program, in order to provide a stable media timeline not sensitive to PCR discontinuities, and signaling of the location of current and potentially upcoming external media enhancements. The technologies included in this AMD can be used to locate and synchronize external content with an MPEG-2 TS program, regardless of the external content packaging or coding types; to accommodate the different application use cases, the signaling information and the timing information may be sent at different frequencies.

In order to provide frame-accurate timeline alignments despite potential PCR discontinuities that typically occur in an MPEG- 2 TS network, different types of time codes can be inserted into the TS. The information can be sent in a dedicated PES stream identified in the program’s PMT, for cases where bandwidth requirements are not too constrained, or can be inserted in the adaptation field of the media PID when the overhead of sending one TS packet per time code would be too high; for example, the typical bitrates for time code signaling for each frame of a 60 Hz video is around 90 kbps using PES only carriage and between 4 and 7 kbps using adaptation field scheme.

4.2.3.6 w14015 Proposed Exploration of “Uniform Signaling for Timeline Alignment”

Source: Telecom ParisTech, Apple

In a number of scenarios, ancillary timed content can be made available that enhances the experience of consuming some primary content. Examples include not only accessibility optional sub-titling or captions, but also content that enhances the user’s experience in other ways.

It is desirable that the availability and alignment of this ancillary media for the primary media be signaled using standard techniques and terms, in a uniform way, with only the manner in which it is stored in the formats varying.

Delivery of multimedia services using a combination of different transport protocols and formats is currently being investigated by many broadcasters (for example as part of HbbTV 2.0 requirements), and has been under discussion at MPEG during the 102nd (see contribution m26903) and the 103rd (m28136) MPEG meetings.

This exploration proposes to investigate this signaling, and how it may be embedded in a number of common formats, particularly those under MPEG control. The document integrates some ideas from contribution m31448.

4.2.4 107th MPEG meeting in San José, USA. January 2014

4.2.4.1 m32287 Update on 13818-1 DAM6

Source: Telecom ParisTech, Thomson Video Networks

WG11 has sent a liaison letter to DVB informing of the on-going work on timeline signaling in MPEG-2 TS, 13818-1:2013 DAM6.

Some fruitful discussions happened in DVB CSS group, including some members of the H2B2VS project, and a liaison letter was sent back to MPEG (m31817). This contribution addresses the technical questions in this liaison.

4.2.4.2 w14117 Study of ISO/IEC 13818-1:2013/PDAM 6 Delivery of Timeline for External Data

Source: Telecom ParisTech, Arris

This amendment to ISO/IEC 13818-1:2013 enables signaling and synchronization of external enhancements of programs carried over MPEG-2 Transport Stream. Specifically, it enables transport of a media timeline in an MPEG-2 TS program, in order to provide a stable media timeline not sensitive to PCR discontinuities; it also enables signaling of the location of current and potentially upcoming external media enhancements. The technologies included in this AMD can be used to locate and synchronize external content with an MPEG-2 TS program, regardless of the external content packaging or coding types; to accommodate the different application use cases, the signaling information and the timing information may be sent at different frequencies.

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108th MPEG meeting in Valencia, Spain. April 2014

4.2.4.3 m33383 It's Hybrid Demo Time !

Source: IETR/INSA, Telecom ParisTech

With the parallel development of scalable extensions for HEVC (SHVC, MV-HEVC) and timeline and external media information carriage in MPEG-2 TS (TEMI), MPEG is creating the foundation of future services for the broadcast industry: flexibility and extensibility in media coding, carried over using heterogeneous networks, including broadcast and broadband networks.

As part of the H2B2VS project, Telecom ParisTech and INSA/IETR have been working on a tight integration of scalable coding and transport layers through their respective open-source projects GPAC and OpenHEVC.

This contribution demonstrates the combined usage of HEVC/SHVC, multicast MPEG-2 Transport Stream and on-demand MPEG-DASH in a prototype demonstration. The components of the demonstration are:

- a two layered SHVC video, using WPP for optimal parallelism processing; the video (and the SHVC video decoder)follows the SHM4 syntax,
- a multicast MPEG-2 Transport Stream simulating the broadcast channel. The transport stream only carries the base HEVC layer. The transport stream carries TEMI information to signal:
    - the location of an add-on for this program (URL sent at 1hz rate)
    - the media timeline used by this add-on (media timestamp information injected at each video frame)
- The TEMI descriptors are embedded in the adaptation field of the video PES, to keep the signaling overhead low.
- An MPEG-DASH presentation used to carry the scalable enhancement layer; the encapsulation is done in ISO Base Media File Format using the latest version of the WD of part 15 for SHVC carriage.

The scalable layer can also be played from file rather than from DASH. The use of DASH allows simpler seeking in the media presentation by requesting the closest segment to the live point, rather than downloading and seeking the file containing the enhancement layer.

5 DVB

End 2012, DVB, based on work starting in its commercial module (DVB-COS group) decided to set up a Study Mission to study Companion Streams and Screens. The main objective of the TM-SM-CSS was an initial comparative technical evaluation of relevant technologies and existing standards that can be used to provide enhancement of the overall viewing experience through the use of personal devices (i.e. companion screens) and through the use of additional streams (i.e. companion streams).

Based in the result of the Study Mission, it was decided to move forward with some specific actions regarding key technical areas for which the initial Study Mission had identified some missing answers. Synchronisation of the broadcast/broadband streams was one of these technical areas and a work was started in H1/2013 to issue a call for technologies on synchronisation mechanisms.

Even if the target of the TM-CSS is to define proper mechanism to synchronize streams carried by different networks (broadcast/broadband) and displayed on separate devices (the main TV set and a tablet for example), the requested mechanism can be also relevant to synchronise two streams received by a single device (eg a connected TV receiving both broadcast and broadband streams). Those streams can be further combined and displayed on a single device.

As a basis of the discussion on synchronisation mechanism, TM-CSS defined different classes based on the required accuracy:

- **None:** No synchronisation is expected or attempted.
- **Best effort**: there is no explicit synchronisation, but playback is usually started approximately co-timed in the hope the presentation of the elements retains synchronisation.
- **Loose:** there is explicit synchronisation, but permits errors in synchronisation of up to a defined tolerance (perhaps a fraction of a second to a few seconds)
- **Tight:** there is explicit synchronisation, and it is aimed at supporting lipsync levels of synchronisation (a few tens of milliseconds maximum).
- **Video Frame accurate:** there is explicit synchronisation that guarantees all frames are presented at the same time, for current and expected frame rates. This is probably close or identical to Tight synchronisation.
- **Very Tight:** supporting multi-channel audio where each stream is to one device that supports a single channel, yet results in a coherent sound stage.

Depending on the required accuracy, different protocols/methods could be used. Nevertheless for video frame accuracy, among existing technologies, only DVB SAD and PCR/PTS based solutions could be used.

Both previously mentioned technologies have drawback either in term of Bandwidth efficiency (DVB SAD) or robustness on the whole delivery network (PCR/PTS based mechanism).

The TM-CSS group is currently drafting a recommendation (TS_102_CSS_Companion-Screens-and-Streams) with the target to finalize it in H1 2014. The synchronization mechanism is one of the important topics of this recommendation.

Collaborative work has been established between MPEG and DVB in order to be in a position to select the MPEG TEMI mechanism currently in the ISO standardization process. At the technical level, the MPEG TEMI solution has been modified to better cope with the DVB requirements. This was made via several formal liaison letters or informal exchanges between H2B2VS members having some delegates on both standardization organizations. As DVB cannot be 100% sure that the ISO/MPEG track will deliver on time an appropriate amendment of the Transport stream specification, DVB has been working on an alternative mechanism to carry the Timeline. This mechanism called TSAP (stands for Transport Stream Adaptation Private data) tsap_timeline is a coding of data fields in the private data bytes of a Transport Stream packet adaptation field. It conveys timeline data describing the flow of a timeline for an audio or video service. The coding used here conforms to the specification for coding of data in private data bytes of the adaptation field in Blue book 101 154 [TS 101-154].

On the other side, Adaption field descriptors for Timed External Media Information (TEMI) is a draft amendment (DAM) to the MPEG Systems specification ISO/IEC 13818-1 that defines a mechanism for carriage of a timeline in the adaptation field of a transport stream packet that contains a PES stream with PTS declared in the PES header.

As of today, both options are included in the draft DVB specification, being technically very closed but as DVB cannot use reserved byte to define its own mechanism, the information are not located exactly in the same places as TEMI does.

One important point to consider is also the very tight timing as DVB wants to deliver a specification by mid-2014 at the latest whereas the ISO process should be finalized for MPEG TEMI end of 2014. A formal request to ISO has therefore been issued to ensure having a technically stable and publicly available ISO/MPEG Preliminary standard that DVB could refer to by mid-2014.