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1. Introduction

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[1] and OpenHEVC [2].
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.

2. Reproducing the demonstration

This demonstration is powered by open-source tools. It can be reproduced using the revision 5184 of the GPAC project, and the latest version of the openHEVC decoder in its shvc4.0 branch.

Assuming demo.shvc is a two-layered SHVC encoded bitstream, compatible with SHM4.0 and stored in annex B format, the following content preparation is required:

1- Import the video stream in a ISOBMF file, with one track per layer and no extractors

```
MP4Box –add demo.shvc:svcmode=splitnox –new demo_split.mp4
```

2- Create the ISOBMF files continaing the base layer and the enhancement layers

```
MP4Box –add demo_split.mp4#1 –new demo_base.mp4
MP4Box –add demo_split.mp4#2 –new demo_scal.mp4
```

3- Create the DASH session for the scalable stream

This step is only needed if you want to use dash.

```
MP4Box –dash 2000 –profile live –out demo_scal.mpd
```

In this example, 2000 is the GOP duration in milliseconds of the scalable stream

Copy the resulting MPD and segments to your favorite web server (or use them locally).

4- Start the multicast stream

```
MP42TS –single-au –prog=demo_base.mp4 –dst-udp=224.0.0.1:1234 –
temi=http://myserver.org/demo_scal.mpd
```

If running on different machines of a local network, you may want to increase the multicast TTL using `–ttl=N` option.
The URL passed in the –temi option can be either local or remote (http), and point either to an ISOBMF file or an MPD/DASH session.

5- Start the playback

```
MP4Client mpegts-udp://224.0.0.1:1234
```

The scalable addon will automatically be enabled.
The buffering may take some time depending on the downlink speed from server to the machine.

The same content can be played without the addon:

```
MP4Client –no-addon mpegts-udp://224.0.0.1:1234
```

A set of sequences has been made available at the following address:
http://download.tsi.telecom-paristech.fr/gpac/SHVC/

3. Conclusion

Telecom ParisTech and INSA/IETR are proud to show and share the first TEMI/SHVC enabled prototype with the research community, and welcome any feedback on this demonstration and associated software.

References

[1] GPAC, http://gpac.io, DOI http://dx.doi.org/10.1145/1291233.1291452
[2] openHEVC, https://github.com/OpenHEVC