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Title   **On Hybrid Delivery**
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1   Introduction

In m26903 presented during the 102nd MPEG Meeting, we presented a solution to enable carriage of DASH timeline values in MPEG-2 TS in order to unambiguously recover MPD media time in the current period, regardless of time discontinuities introduced at the MPEG-2 TS network level.

This contribution is a generalization of the solution, with a particular focus on MPEG-2 and RTP.

2   Proposal for Hybrid Delivery in DASH

As identified in w13082, there are many use cases for which hybrid delivery of DASH and non-DASH content can be useful. The solution proposed in m26903 can be summarized as follows:

- allow referencing of streamed, non segmented media in the MPD (part of GTS-CE goals);
- allow linking from the streamed non-segmented media to the target MPD file
- define a stream in the source session (non-segmented one) carrying the MPD timeline of the media in a transport-resilient way, i.e. resistant to restamping that can occur on the network; optionally, period announcement can be used to warn the DASH client that period switching may occur.

2.1   Identifying the URL of the source stream in the MPD

We propose to identify non-segmented streams in the MPD as follows:

"Non-segmented representations describe media streams for which no segment or subsegment description, are available. These representations shall not use any of the SegmentBase, SegmentList or SegmentTemplate or BaseURL elements. These streams do not provide segment or subsegment alignment, but may be declared in an AdaptationSet where segmentAlignment or subsegmentAlignment is set to true; in this case, the alignment apply to all representation but non-segmented ones. Non-segmented representations are identified by the use of one or several *<StreamURI>* child elements, describing the media stream source."

The *<StreamURI>* element contains two attributes, @*value* and @*scheme,* used to identify the semantics of @*value*. The following schemes are defined

@scheme	@value
urn:mpeg:dash:stream:m2ts:2013 *Note: shall only be used if this MPD location was given in an MPDDescriptor in MPEG-2 TS*	Value of the PID carrying the stream in the source MPEG-2 TS
urn:mpeg:dash:stream:dvb:2013	Value is formatted as "ONID,TSID,SID,PID" quadruplet, where ONID is the DVB original network ID, TSID is ID of the source TS, SID is the service ID of the program in the source TS, and PID is the value of the PID carrying the media stream
urn:mpeg:dash:stream:rtpv4:2013	Value is formatted as address:port, where address is an IPv4 address and port is the port number of the RTP stream.
urn:mpeg:dash:stream:rtpv6:2013	Value is formatted as address:port, where address is an IPv6 address and port is the port number of the RTP stream.
urn:mpeg:dash:stream:sdp:2013	Value is the media formatted as address:mid, where address is the SDP location and mid is the media ID of the RTP stream, as identified by the a=mid: attribute defined in RFC 5583

2.2 Identifying the URL of the source stream in the MPD

For MPEG-2 TS, the MPD_Descriptor proposed in m26903 is used:

Syntax	No. of bits	Format

```MPD_descriptor{```
 ```   descriptor_tag```
 ```   descriptor_length```
 ```   for (i = 0; i < N; i++){```
 ```   mpd_url```
 ```   }```
 ```}```
	
	 8
	 8
	
	 8
		
		 uimsbf
		 uimsbf
		
		 bslbf

For RTP, we define a new attribute in the SDP:
a=mpdurl:URL

where URL is the location of the MPD describing the hybrid session.

2.3 DASH MPD Timeline Streaming

The DASH timeline payload format proposed in m26903 is used, with the addition of MPD update flag:

Syntax	No. of bits	Format
`DASHTime_PES_Payload {`		
`    mpd_force_update`	1	uimsbf
`    period_switch_timer`	31	
`    presentation_time`	64	uimsbf
`    for (i = 0; i < N; i++){`		
`     period_id`	8	bslbf
`    }`		
`}`		

Mpd_force_reload: indicates the associated MPD shall be updated before attempting to align timing information given in this packet.

period_switch_timer: indicates the estimated time in milliseconds until the period identified by *period_id* occurs. If not 0, the indicated period is not active but content from this period can be prefetched. If 0, the stream timeline is in the indicated period.

presentation_time: indicates the MPD time corresponding to the timestamp carrying this packet;

for MPEG-2 TS, associates the PTS indicated in the PES header of this packet to the media presentation time in the active period, expressed in the value of the timescale attribute of the SegmentBase element referring to this PID or to the PCR PID of the program . Let PTS_0 be the PTS of the packet carrying presentation time MPT_0. Until a new *DASHTime* packet is received, the PTS of subsequent PES packets of other PIDs in this program have a Media Presentation Time, relative to the period start (cf 7.2.1 of DASH spec), of:

$$\text{MPT (in seconds)} = (PTS - PTS_0)/90000 + (MPT_0 - \text{@presentationTimeOffset})/\text{SegmentBase.timescale}$$

for RTP, associates the TS indicated in the RTP header of this packet to the media presentation time in the active period, expressed in the value of the timescale attribute of the SegmentBase element referring to this RTP stream. Let TS_0 be the TS of the RTP packet carrying presentation time MPT_0. Until a new *DASHTime* packet is received, the RTP TS of subsequent RTP packets of other streams in this session have a Media Presentation Time, relative to the period start (cf 7.2.1 of DASH spec), of:

$$\text{MPT (in seconds)} = (TS - TS_0)/RTP\_TimeScale + (MPT_0 - \text{@presentationTimeOffset})/\text{SegmentBase.timescale}$$

If *period_switch_timer* is not 0, this value can be ignored.

period_id: indicates the name of the current period of the program. When a DASH hybrid client detects a change in the period id, it shall switch to the indicated period_id regardless of the current payback state of other broadband media. If this string is empty, this implies that no MPD is currently associated with the program.

We furthermore propose to allow carrying this DASHTimeLine over RTP using the following rules:
- mime of the payload format is DASH-TIME
- timescale could be anything
- each DASHTime AU is carried in a single RTP packet; several DASHTime AUs shall not be aggregated in one RTP packet; if fragmentation is desired (long period ID), the M bit shall be set for the packet carrying the end of a DASHTime AU

3 Conclusion

In this contribution, we have proposed a solution covering most of the hybrid delivery use cases for using DASH with either an MPEG-2 system broadcast or an RTP / SDP multicast. We suggest the following actions:

- define the new descriptor in DASH, possibly extended with other output from DASH-GTS (eMBMS or others)
- define the DASHTime packet format in DASH
- Start AMD to MPEG-2 Systems allowing carrying of DASHTime in TS
- Draft DASHTime RTP RFC