DVB DASH webinar

13 June 2018

DVB DASH: An overview

Simon Waller (Samsung)

DVB codecs and DVB DASH

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DVB DASH in the wild

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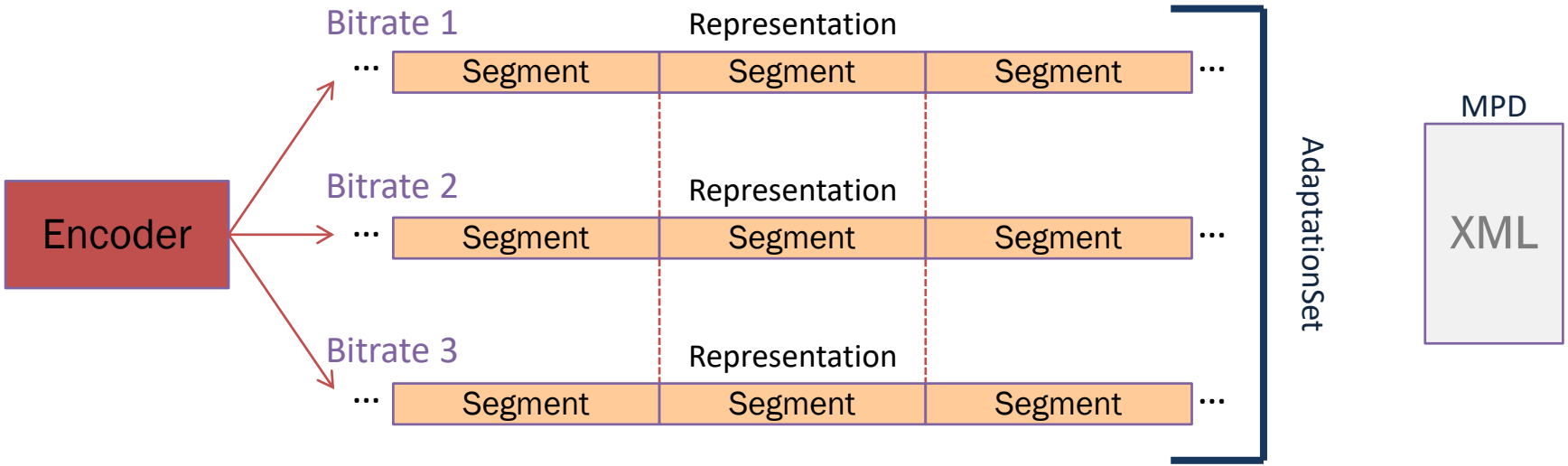
DVB DASH: An overview

- Quick ABR refresher
- Why DVB DASH?
- What does DVB DASH include?
- Relationship with HbbTV
- Where next?

ABR refresher and DASH nomenclature



MPEG DASH vs DVB DASH

- MPEG DASH is a large complicated specification
- DVB has defined a profile of MPEG DASH to help make services and players interoperable
  - This profile includes constraints, requirements, limitations, additions (e.g. A/V codec profiles) etc

What does DVB DASH cover

MPD and content constraints

- Profiles to identify features for players (DVB 2014 URN and the new DVB 2017 URN)
  - New 2017 profile required for some of the latest features
- MPD construction
  - Required elements and attributes
  - Maximum number of some elements
- Segment construction
  - E.g. Min and max segment durations
- Live vs On Demand

Profiled A/V codecs

- Video codecs:
  - AVC
  - HEVC
- Audio codecs:
  - AC-3, AC-4 parts 1 and 2
  - AAC (including HE-AAC, HE-AACv2 and AAC-LC)
  - MPEG-H
  - MPEG Surround
  - DTS, DTS-HD, DTS-LBR

Subtitles

- DVB DASH defines the carriage of XML based subtitles, as per EBU-TT-D
- Downloadable fonts are supported
  - Particularly useful for non-Latin based languages

Content protection

- DVB does not specify a DRM but does reference MPEG Common Encryption which defines how content is encrypted and how license metadata can be carried.
- DVB requires players to support AES-128 CTR encryption mode
- Key rotation is allowed
- DRM metadata can be carried in the media segments and/or the MPD
- All Representations must use the same key

Events

- Events can be carried either in the MPD or in the media segments
- DVB has defined 4 different event types:
  - Application messages, equivalent to stream events
  - Triggers for an MPD update in the player
  - Equivalent to AIT for launching apps
  - Equivalent to EIT for programme metadata

Player behaviour

- Unlike most other DVB specifications, DVB DASH does not limit itself to just “bits on wire”
- It includes mandatory requirement for players
- Reference to TS 101 154 Annex L for codec profiles
  - But no codec is mandatory in DVB DASH
  - Players supporting HD have to support a list of specific resolutions. Likewise for UHD.
- Players have to support seamless switching between Representations within certain limits
  - E.g. within the same video frame rate family
- Players have to be resilient to certain errors on the network
  - E.g. fall back to different BaseURL, using alternative DNS records
- Reporting metrics
  - Players are required to be able to report certain metrics whenever a network error occurs

Content guidelines

- Video resolution choices
- Audio codec parameters
  - NGA encoding and signalling
- Subtitle encoding
- Retaining A/V sync on a 24/7 service
- Use of temporal layers for HFR

Changes in DVB DASH 2017

- Bug fixes for 2014 profile
  - List of changes included in an Annex
- Better definition of video codec profiles
  - The specification references the new Annex L in TS 101 154
- Addition of HDR/HFR/NGA codecs plus the new signalling in the MPD
- Definition of the DVB 2017 profile

High Dynamic Range – HLG10

- The AdaptationSet containing the video with HLG10 is signalled with:
  - EssentialProperty descriptors with the appropriate colour primaries, matrix coefficients and transfer characteristics for BT.2020
  - SupplementalProperty descriptor with the transfer characteristics for BT.2100
- If the player is known to support BT.2020, the MPD may use the 2014 DVB profile URN and omit the EssentialProperty descriptors.
  - This will allow “legacy” players to present video which contains HLG10.
- Otherwise, the 2017 DVB profile is signalled.
  - The use of EssentialProperty descriptors ensures that players not supporting BT.2020 do not try to present the video.
    - “Legacy” players should reject this AdaptationSet anyway due to the 2017 DVB URN.

High Dynamic Range – PQ10

- The AdaptationSet containing the video with PQ10 is signalled with:
  - EssentialProperty descriptors with the appropriate colour primaries, matrix coefficients and transfer characteristics for BT.2100 PQ system
- The MPD uses the 2017 DVB profile URN.
  - The use of EssentialProperty descriptors ensures that players not supporting PQ10 do not try to present the video.
    - An AdaptationSet with alternative video should always be included for these players.
    - “Legacy” players should reject this AdaptationSet anyway due to the 2017 DVB URN

Example MPDs

HLG10

```
…
<AdaptationSet segmentAlignment="true" maxWidth="3840" maxHeight="2160" maxFrameRate="25" par="1:1" lang="und">
  <Representation id="1" mimeType="video/mp4" codecs="hev1.2.4.L153.90" width="3840" height="2160" frameRate="25"
sar="1:1" startWithSAP="1" bandwidth="3600000“/>
  <EssentialProperty schemeIdUri="urn:mpeg:mpegB:cicp:ColourPrimaries" value="9"/>
  <EssentialProperty schemeIdUri="urn:mpeg:mpegB:cicp:MatrixCoefficients" value="9"/>
  <EssentialProperty schemeIdUri="urn:mpeg:mpegB:cicp:TransferCharacteristics" value="14"/>
  <SupplementalProperty schemeIdUri="urn:mpeg:mpegB:cicp:TransferCharacteristics" value="18"/>
</AdaptationSet>
…
```

PQ10

```
…
<AdaptationSet segmentAlignment="true" maxWidth="3840" maxHeight="2160" maxFrameRate="25" par="1:1" lang="und">
  <Representation id="1" mimeType="video/mp4" codecs="hev1.2.4.L153.90" width="3840" height="2160" frameRate="25"
sar="1:1" startWithSAP="1" bandwidth="39807553"/>
  <EssentialProperty schemeIdUri="urn:mpeg:mpegB:cicp:ColourPrimaries" value="9"/>
  <EssentialProperty schemeIdUri="urn:mpeg:mpegB:cicp:MatrixCoefficients" value="9"/>
  <EssentialProperty schemeIdUri="urn:mpeg:mpegB:cicp:TransferCharacteristics" value="16"/>
</AdaptationSet>
…
```

High Frame Rate

- HFR uses the concept of HEVC temporal layers.
- A Representation must contain all the temporal layers needed to decode it
  - In other words, DVB DASH does not support the separate carriage of temporal layers (the equivalent of multi-PID for broadcast). The player only ever downloads a single video Representation.
- Each Representation using temporal layers includes a SupplementalProperty descriptor indicating the highest temporal ID that it carries.
- The frame rate is marked on every representation to allow the player to choose only those which they are able to support

Next Generation Audio

- NGA allows the player to decode only those audio components that are:
  - Signalled by the content provider to make up a collection that provides a complete user experience, e.g. M&E plus dialogue
  - Decodable by the player
  - According to the users wishes, e.g. English language dialogue
- The content provider signals these collections as Preselections
  - Players have to support the SRMP (Single Representation, Multiple Preselection) and SRSP (Single Representation, Single Preselection) modes
    - Players may support MRMP (Multiple Representations, Multiple Preselections) mode
- Players select the best Preselection based upon the existing criteria (language, role, etc)
- AdaptationSets are tagged with an id which is referenced from a Preselection.
  - This allows the player to download the correct audio segments
- Preselections indicate which audio components in the referenced Representation(s) are applicable
  - This allows the player to decode only those audio components which are required for the selected Preselection

Example SRMP MPD

```
  <!-- The one available Adaptation Set -->
  <AdaptationSet id="1" mimeType="audio/mp4" codecs="ac-4.02.01.03" audioSamplingRate="48000" frameRate="25" lang="en" segmentAlignment="true"
startWithSAP="1">
    <SupplementalProperty schemeIdUri="urn:mpeg:dash:preselection:2016" />
    <Role schemeIdUri="urn:mpeg:dash:role:2011" value="main"/>
    <Representation id="r0" bandwidth="256000">
      <AudioChannelConfiguration schemeIdUri="tag:dolby.com,2015:dash:audio_channel_configuration:2015" value="0000C7"/>
    </Representation>
  </AdaptationSet>

  <!-- Preselection Element – Primary Preselection -->
  <Preselection id="10" tag="101" preselectionComponents="1" codecs="ac-4.02.01.03" frameRate="25" audioSamplingRate="48000" lang="en">
    <Role schemeIdUri="urn:mpeg:dash:role:2011" value="main"/>
    <AudioChannelConfiguration schemeIdUri="tag:dolby.com,2015:dash:audio_channel_configuration:2015" value="0000C7"/>
  </Preselection>

  <!-- Preselection Element – Audio Description -->
  <Preselection id="20" tag="102" preselectionComponents="1" codecs="ac-4.02.01.03" frameRate="25" audioSamplingRate="48000" lang="en">
    <Role schemeIdUri="urn:mpeg:dash:role:2011" value="commentary"/>
    <Accessibility schemeIdUri="urn:tva:metadata:cs:AudioPurposeCS:2007" value="1"/>
    <AudioChannelConfiguration schemeIdUri="urn:mpeg:mpegB:cicp:ChannelConfiguration" value="1"/>
  </Preselection>

  <!-- Preselection Element – Clean Audio -->
  <Preselection id="30" tag="103" preselectionComponents="1" codecs="ac-4.02.01.03" frameRate="25" audioSamplingRate="48000" lang="en">
    <Role schemeIdUri="urn:mpeg:dash:role:2011" value="alternate"/>
    <Accessibility schemeIdUri="urn:tva:metadata:cs:AudioPurposeCS:2007" value="2"/>
    <AudioChannelConfiguration schemeIdUri="tag:dolby.com,2015:dash:audio_channel_configuration:2015" value="0000C7"/>
  </Preselection>
```

Relationship with HbbTV

- HbbTV is a major “customer” of the specification
- DVB DASH (TS 103 285) has been a requirement since 2015
  - First referenced from TS 102 796 v1.3.1 (HbbTV v2.0)
- HbbTV provided input into DVB DASH with special focus on making the specification testable
  - They have generated test materials to ensure interoperability in the market
- HbbTV v2.0.2 now references TS 103 285 v1.2.1 and includes HDR/HFR/NGA

Implementing DVB DASH

- DVB DASH content can be played using MSE
  - MSE cannot be used to decode audio that requires multiple Representations
    - Receiver Mix Audio Description
    - MRMP NGA
  - Dash.js is a mature open source JavaScript DASH library
- DASH-IF have a validation tool
  - This checks the MPD and also the media segments
  - It is being extended to cover DVB DASH specifically
- HbbTV have commissioned a DASH DRM Reference Application

Future developments

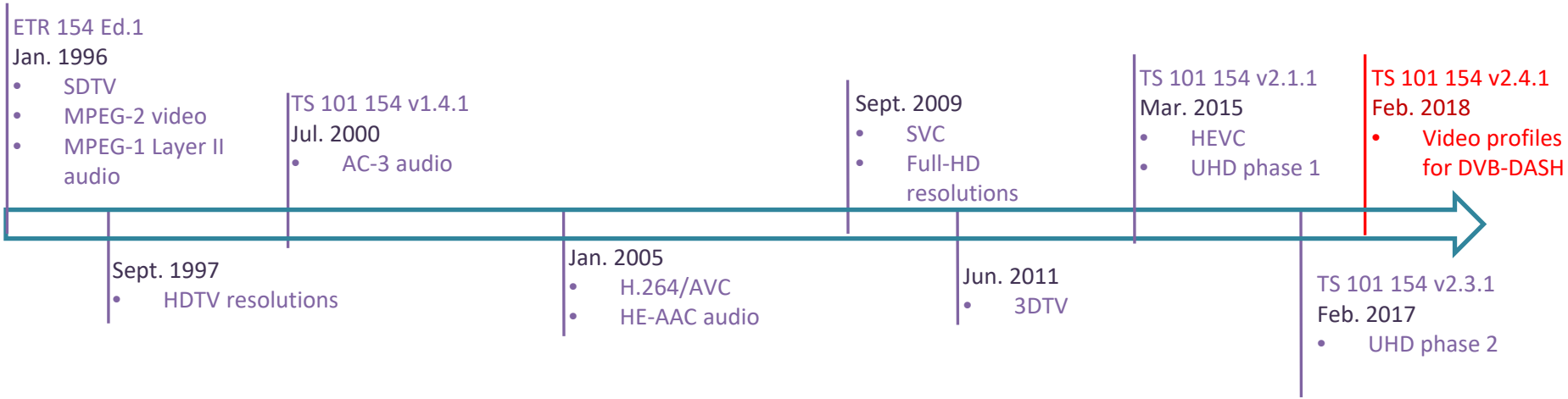
- DVB TM is working on:
  - Extensions for low latency live DASH
  - ABR multicast across the internet
- DVB CM is working on:
  - DVB-I
  - Targeted advertising

DVB codecs and DVB DASH

Chris Poole, 13th June 2018

Background

- DVB has addressed codec interoperability since 1990s
- Originally for broadcast but now also for DASH



ETSI TS 101 154

- Version 2.4.1 (Feb 2018) includes profiles for DVB DASH
- Re-titled to reflect addressing both broadcast and broadband applications

DASH is different to broadcast

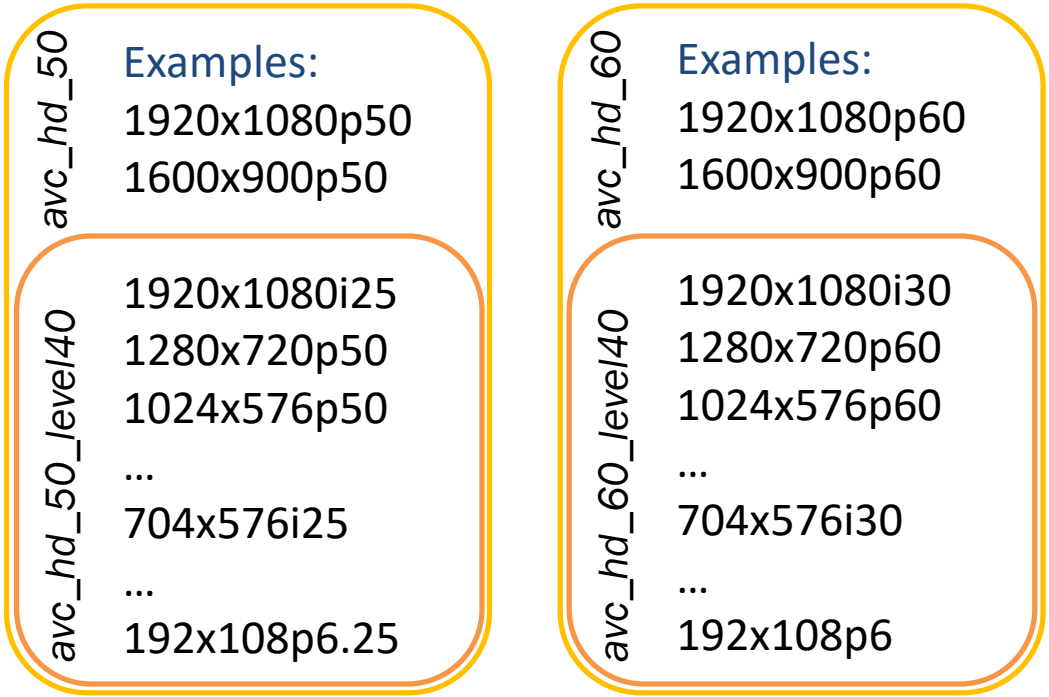
- We can’t just re-use the broadcast profiles for DASH
  - Broadcast uses Transport Stream; DVB DASH uses ISO BMFF
  - Random access requirements are different
  - DASH streams target more than just TV-like devices
  - DASH allows for multiple encodings
    - DASH MPD includes detailed information on codec, resolution, frame rate etc.
    - Client can choose
    - Requirement for bitrate/resolution/frame-rate switching

A different approach

Broadcast	DASH
1:1 mapping between *bitstreams* and *IRDs*	One set of *bitstream requirements* for each video codec Upper limits defined for each *DASH player conformance point*
IRDs have some additional backward compatibility requirements	All *player conformance points* support lower resolutions and frame rates

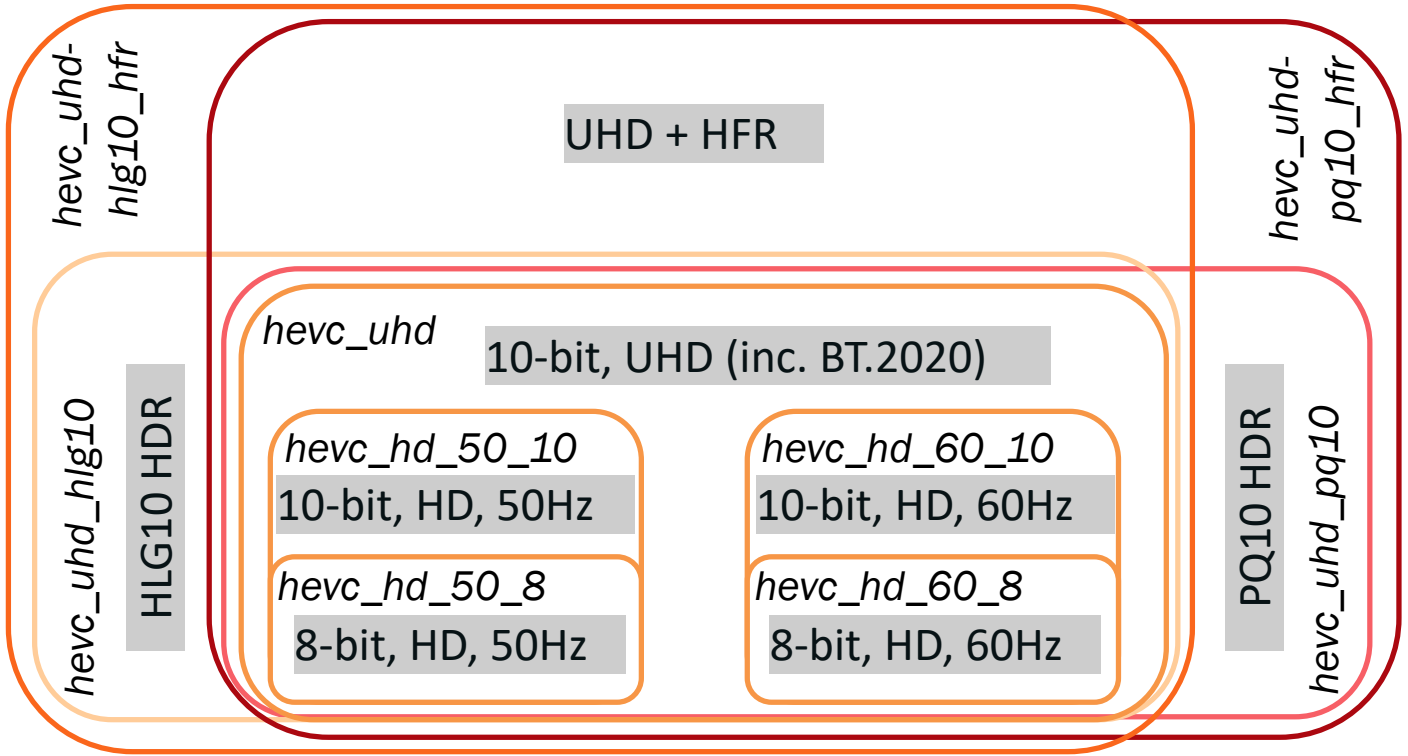
- *DASH player conformance points* are defined in terms of broadcast *IRDs*
  - Allows for maximum interoperability with hardware supporting the broadcast IRDs
  - But there are some differences
- *DASH bitstream requirements* are specified independently at the codec level
- A single *DASH presentation* can target many *player conformance points*

AVC player conformance points



- 60 Hz conformance points also include 59.94, 24 Hz and submultiples
- Interlace included in AVC conformance points

HEVC player conformance points



- Progressive only
- Details of colorimetry requirements not shown
- Slightly simplified

Features

- HD, UHD, HDR and HFR player conformance points defined
- Support for 4:3 and 16:9 required
- Interlace supported for AVC; progressive only for HEVC
- Bitstreams can be both DVB and MPEG CMAF compatible simultaneously
  - But one does not automatically comform to the other
- HLG HDR is always signalled as backwards compatible
- HEVC bitstreams can use temporal layers for HFR
  - But no equivalent of dual-PID approach from broadcast

Thanks

Deployment of DVB-DASH in Germany

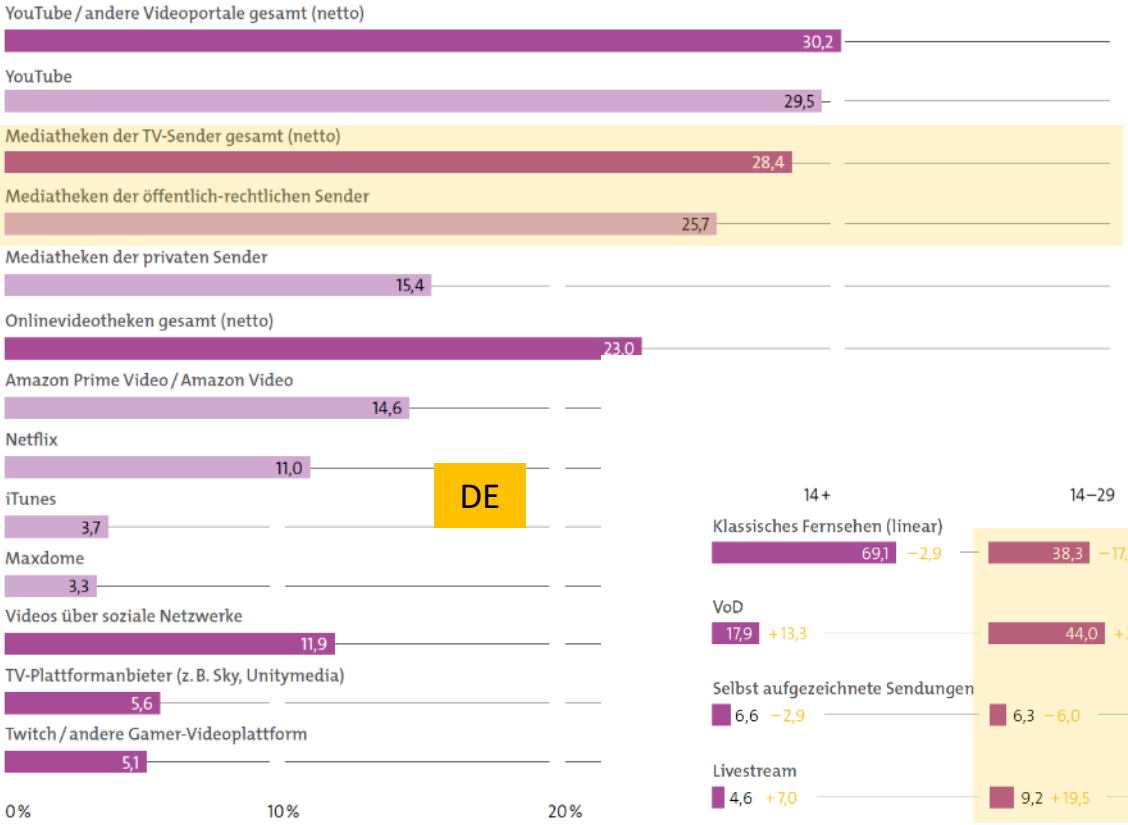
Martin Schmalohr, 13th June 2018

AGENDA

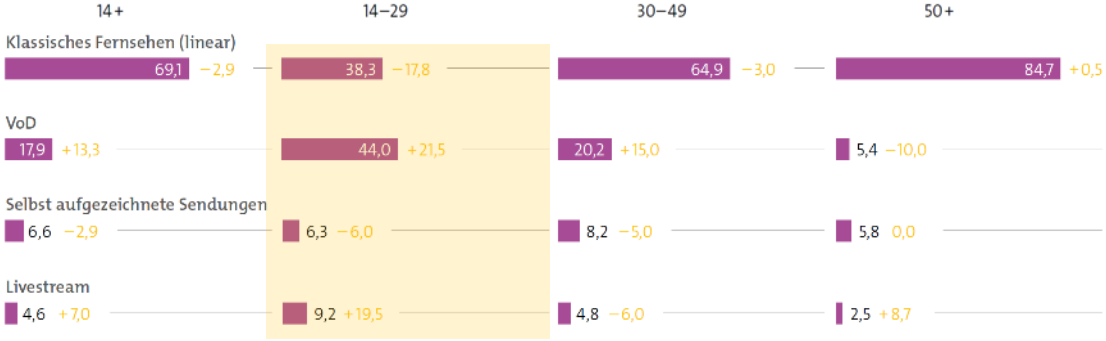
- ✓ OTT/Streaming traffic 2017
- ✓ Browser/OS usage at ARD
- ✓ MPEG-DASH Livestreams extend DVB-T2
- ✓ HDR interoperability testing
- ✓ Videoencoding profiles, testing at IRT
- ✓ Media Formats and Transitioning in HbbTV
- ✓ Workflow/status of combined delivery using CMAF
- ✓ IRT Reference Clips cross-platform interop testing

OTT/Streaming 2017

Source: Die Medieanstalten, Digitalisierungsbericht 2017



World Cup 2014: 529.500 Das Erste & Sportschau.de



Browser & OS @ ARD: usage & market share Q3 2017

Nutzungsanteil		IE	Firefox	Safari	Opera	Chrome	Edge
		16,4% 14%	*37,8%*	*16,1%*	*1,4%*	*17,3%* 22%	*6,1%*
Windows XP	*1,6%*		1,2%		0,1%	0,4%	
Windows Vista	*1,7%*	0,2%	1,1% 0,7%		0,1%	0,4%	
Windows 7	*32,7%* 25,3%	11,0% 9%	14,3%	> 0,1%	0,5%	6,8%	
Windows 8 (V8.1)	*8,2%*	2,6%	3,5%	> 0,1%	0,2%	1,9%	
Windows 10	*26,2%* 37,6%	2,7% 3%	12,3% 14%		0,5%	4,7% 9,7%	6,1% 8,1%
Mac OS (ab V10.9)	*22,3%* 24,3%		3,7%	16,1%	> 0,1%	2,5%	
Linux	*2,4%*		1,7%			0,7%	

Update Q3 2017

	Version	Nutzung	Marktanteil
iOS	9.3	58% 60,6%	34% 29,7%
Android	4.4	41% 38,1%	63% 67,2%
Windows Phone	8.1	0,5% 0,7%	1,2% 2,0%

Update Q3 2017

	Nutzung
HbbTV 1.0	4,7% 3,3% →
HbbTV 1.0 ETSI 1.1.1 Errata 2	40% 49,8% ↘
HbbTV 1.5 ETSI 1.2.1	54% 46,5% ↗
HbbTV 2.0 ETSI 1.3.1	0,2% 0,43% ↗
HbbTV 2.0.1 ETSI 1.4.1	0,002%

Update Q3 2017

Safari	Android Browser	Samsung	IE Mobile	Opera	Firefox	Chrome	Edge
v9			v11			v54	
28,6% ↗	5,6% ↘	17,1% ↘	1,6% ↘	0,8% ↘	0,2% ↘	43,8% ↗	0,39% ↗
26,6% ↘	9,1% ↗		1,50% ↘	0,44% ↘	0,68% ↗	54,2% ↗	0,4% ↘

Source: regular measurements of ARD-broadcasters & StatCounter Global Stats, Germany Nov 2016

Testcase 2016: HbbTV 2.0 UHD Livestream

- ✓ Live Broadcast „Le Corsaire“ Opera from Vienna
- ✓ DVB-S2 decoded to 4x3G SDI transcoded to MPEG-TS segm. to DASH
- ✓ Kooperation IRT, Arte, ATEME for Encoding and Live-Streaming
- ✓ MPEG DASH via Akamai Live Pull Mode, available OnDemand
- ✓ H.265/HEVC, 3840x2160p50, 7500k, HE/AAC 256k
- ✓ Playback on LG 2016 Model, Panasonic, HbbTV 1.5

Testcase 2018: HbbTV 2.0 UHD HDR DASH

- ✓ Arte HLG Production „Carmen“
- ✓ Kooperation IRT, Arte, DVB, Encoded with ATEME Titan File 3.8.14.0
- ✓ Pre-segmented MPEG DASH live profile via Akamai NetStorage
- ✓ H.265/HEVC, 3840x2160p50, HLG,HD-UHD 3.5/5/8 Mbit/s, hvc1.2.4
- ✓ Playback on HbbTV 1.5 Panasonic TX-49EXW604, Retail Model 2017
- ✓ Demo: [UHD HDR Streams using HLG-HDR shown at DVB-World 2018]

MPEG-DASH in HbbTV

- ✓ 2017: more than 54% of terminals (ARD.de) in the German market are HbbTV 1.5 capable devices

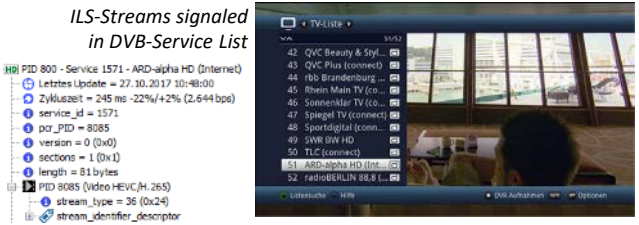
ARD/DVB-T2 Internet Link Service (ILS)

- ✓ MPEG-DASH Livestreams provide additional TV channels via HbbTV 1.5+
- ✓ Streams visible in the regular device channel list.
- ✓ Video streaming starts automatically when selecting the a “Channel (Internet)” if connected to the web. If not: Infoscreen shown

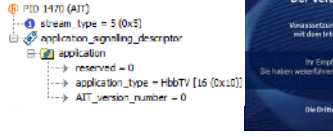
Olympic Games 2016

- ✓ First use of MPEG DASH-Livestreaming
- ✓ in Germany by public broadcasters
- ✓ providing up to 6 HD-Livestreams

ILS-Streams signaled in DVB-Service List



Infoscreen from DSM-CC Carousel Audiodescription



Loading Animation, Channel Logo, Red Button

HbbTV App playing DASH-Stream or Shoutcast-Radio

Source: [ARD-Programmangebot über DVB-T2 HD wird weiter ausgebaut]

Primary MPEG-DASH Livestream: HbbTV 2.0 ETSI 1.4.1, HbbTV 1.5 ETSI 1.2.1

- ✓ ISO-BMFF Container (ISO/IEC 14496-12:2012)
- ✓ Inband Storage für SPS/PPS Einträge using avc3 rather than Common Initialization with avc1
- ✓ Can include EBU-TT-D Subtitling (EBU Tech 338110) using application/mp4, stpp

Secondary MPEG-TS Livestream: HbbTV 1.0 Errata 2, ETSI 1.1.1

- ✓ HTTP chunked transfer coding for HbbTV 1.0 (RFC2616, 3.6.1)

Video Auflösung	Video Codec	Video Bit-rate	Audio Codec	Audio Bitrate	Frame Rate
640x720*	AVC/H.264	1800kbit/s	AAC-LC	128kbit/s	50p
1280x720*	AVC/H.264	3584kbit/s	AAC-LC	128kbit/s	50p

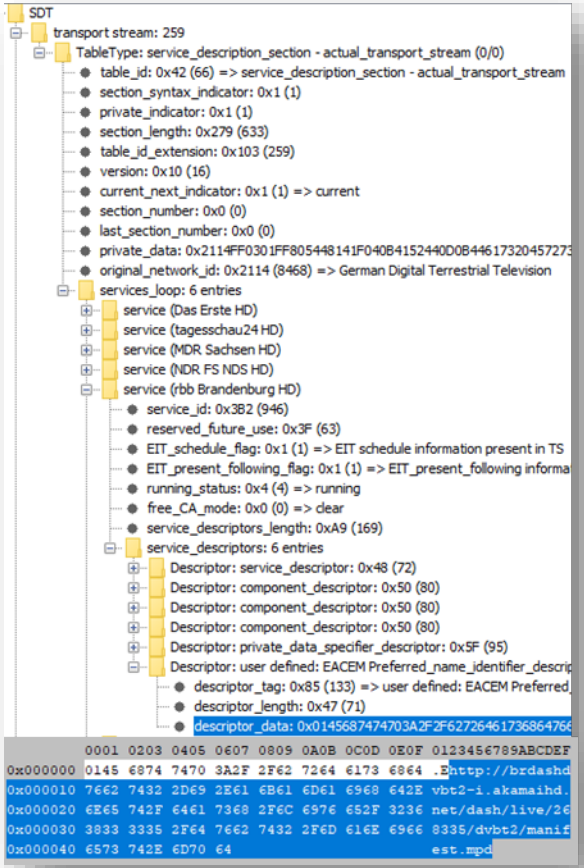
Adaptionset	Video Auflö-sung	Video Codec	Video Bitra-te	Framerate
0	1280x720	AVC/H.264	3584kbit/s	25p/50p
	960x540	AVC/H.264	1800kbit/s	25p/50p
	640x360	AVC/H.264	1024kbit/s	25p/50p[11]

Adaptionset	Audio Codec	Audio Bitrate
1	AAC-LC	192kbit/s[12]

Adaptionset	Untertitel	mime Type	Bitrate	Codec
2	EBU-TT	application/mp4	9,6kbit/s	stpp

Direct DASH Play (DDP)

- ✓ Freenet TV Connect, German platform operator Media Broadcast
- ✓ HbbTV-based service accompanying DVB-T2 platform Freenet TV
- ✓ New channels and a video-on-demand (VOD) offering
- ✓ The linear TV additions to free-to-air channels
- ✓ viewers can select streamed channels as part of the regular channel listing
- ✓ Dash Direct Play (DDP) for fast channel change between DVB-T2 and IP channels



Source: [New channels and VOD on Freenet TV Connect]

Supported Media Formats in HbbTV

System	Bitrate	Video	Audio	mime-type
MPEG-2/DVB transport stream MPEG-4 file format	8 Mbit/s for HD/SD	MPEG-4/AVC HD/SD MPEG-4/HEVC 8bit, 10bit and UHD	(Dolby AC3) MPEG-4/AAC Dolby E-AC3	video/mpeg video/mp4
MPEG-DASH (ISO-BMFF)	8 Mbit/s for HD/SD 12 Mbit/s if UHD is not supported 26 Mbit/s if UHD is supported			application/dash+xml
MPEG-4 file format	-	-	MPEG-4/AAC Dolby E-AC3	audio/mp4
(RAW)		-	MPEG-1 layer 3	audio/mpeg

HbbTV 1.0 if supported for broadcast (HTTPS only HTML) **AVC/HEVC/AAC as defined by DVB A/V spec**

HbbTV 1.5 (HTTPS via DASH up to 12 Mbps total)

HbbTV 2.0 if supported for broadcast (HTTPS via DASH up to 12 Mbps total) **as defined in DVB-DASH spec**

Note: HbbTV-Terminals have no problem with "mixed content" if HTML comes via HTTPS and Media via HTTP.

Supported transitioning in HbbTV

Video	HbbTV 1.5	HbbTV 2.0 DVB DASH
Bit-rate	Shall	Shall
Profile and/or level	Shall *	Shall
Resolution	Shall *	Shall
Interlaced ↔ Progressive	May	May **
25fps ↔ 50 fps	May	Shall
	* Transitions may include repeated frames	** A non-seamless switch should be preferred to stopping presentation

If terminal supports HDR: transitions to SDR should be avoided

Audio		
Bit-rate	Shall	Shall
MPEG AAC ↔ Dolby EAC3	May	May
Stereo ↔ Multichannel	May	May
Sampling Frequency	May	May

Segments shall contain complete GOP-sequences

max. 32 Periods

max. 16 Adaptation Sets per Period

max. 16 Representations per Adaptation Set and per Period

Segment Length 1-15 sec

ETSI TS101154 HbbTV 1.5:

Interlaced Representations shall be supported, but switching i/p is not mandatory.

Players should only make switches between Representations that can be done seamlessly

…unless the switch is necessary to prevent interruption to the media presentation due to lack of data.

HDR Interoperability Testing: Formats

Focus: HEVC/H.265, 10 Bit, 2160p, Hybrid Log Gamma “HLG10” as defined in BT.2010

Resolution	Sampling	FrameRate	Colorspace	SDR/HDR *(ffmpeg-Param)*	Quantisation *(ffmpeg-Param)*	HEVC Profile/Level *(ffmpeg-Param)*
2160	p	50	BT.2020	SDR *(bt2020-sdr)* HDR PQ10 *(bt2020-pq10)* HDR HLG10 *(bt2020-hlg10)* HDR10 *(bt2020-hdr10)*	10 bit *(yuv420p10le)*	Main 10 *(main10)* ; Main Tier; Level 5.1
			BT.709[*1] (vgl. DVB 101 154 Chap. 5.14.2)	SDR *(bt709)*	8 bit *(yuv420p)*	Main *(main)*, Level 5.1
					10 bit *(yuv420p10le)*	Main 10 *(main10)* Level 5.1
1080	p	50	BT.2020	SDR *(bt2020-sdr)*	~~8~~ [*3] ~~oder~~ 10 bit *(yuv420p10le)*	~~Main oder~~ Main 10 *(main10)*; Level 4.1
				HDR PQ10 *(bt2020-pq10)* HDR HLG10 *(bt2020-hlg10)* HDR10 *(bt2020-hdr10)*	10 bit *(yuv420p10le)*	Main 10 *(main10)*; Level 4.1
	P ~~i~~ [*2]	50 ~~25~~	BT.709 (vgl. DVB 101 154 Chap. 5.14.2)	SDR *(bt709)*	8 bit *(yuv420p)*	Main *(main)*, Level 4.1
					10 bit *(yuv420p10le)*	Main 10 *(main10)* Level 4.1
720	p	50 ~~25~~ [*2]	BT.709 (vgl. DVB 101 154 Chap. 5.14.2)	SDR *(bt709)*	8 bit *(yuv420p)*	Main *(main)*, Level 4.1
					10 bit *(yuv420p10le)*	Main 10 *(main10)* Level 4.1
			BT.2020[*4]	SDR *(bt2020-sdr)* HDR PQ10 *(bt2020-pq10)* HDR HLG10 *(bt2020-hlg10)* HDR10 *(bt2020-hdr10)*	10 bit *(yuv420p10le)*	Main 10 *(main10)*; Level 4.1

[*1] testing only [*2] no interlace in HEVC [*3] BT.2020 table 5, only 10 or 12 bit [*4] non DVB, testing only

Resolution	Sampling	FrameRate	Colorspace	SDR *(ffmpeg-Param)*	Quantisation *(ffmpeg-Param)*	H.264 Profile/Level *(ffmpeg-Param)*
2160[*5]	p	50	BT.709	SDR *(bt709)*	8 bit *(yuv420p)*	High Profile *(high)*; Level ?
					10 bit *(yuv420p10le)*	High Profile *(high10)*; Level 4.2 ?
1080	p	50	BT.709	SDR *(bt709)*	8 bit *(yuv420p)*	High Profile (8bit) *(high)*; Level ?
	i	25			10 bit *(yuv420p10le)*	High Profile (10bit) *(high10)*; Level 4.x
720	p	50				
		25				
SDTV 576			BT.601	SDR *(bt601)*	8 bit *(yuv420p)*	Main Profile *(main)*
Web <576			BT.601	SDR *(bt601)*	8 bit *(yuv420p)*	Baseline *(baseline)*

[*5] testing only

Videotest Cheatsheet

Device

Vendor/Model: **TVX-66ABC123 (HDR)**

Browser/OS/Version: **SmardTV 2018,Android TV,Opera**

Capabilities/Transport: **HEVC_UHD_25:** true **DASH:** true **hdr_hlg10:** false **hdr_pq10:** false

Date: **28.02.2018**

Speedtest: **80M**

User Agent: **HbbTV 1.4.1**

					playback ok	no playback	playback stop after [sec]	Low Quality startup	Time To Play [sec]	Realtime Delay [sec]	rebuffering (1..5)	infinite buffering, connecting	stuttering or gaps (1..5)	not switching, staying low (a/v)	frequent switching (a/v)	no Video	HDR/HFR active [d/f]	resolution or color not stable [r/c]	Visual artifacts, false color (1..5)	black or dropped frames	motion artifacts, wrong framerate	(Variant) Cropping, false borders	Wrong Aspect Radio [h/v]	no Audio	stuttering or gaps (1..5)	Audio distorted, artifacts	Volume to high/low (+/-)	AV or Subs out of sync (1..5)	Correct Seeking (s), trick play (t)	Timeshift available [min]	Subtitles available (1..n)	corr. Multichannel (m), downmix (d)	Multiple Audiotracks (1..n)	App crashed	Error shown (No.?)	*Comments*
Stream Group 1 (SDR)	Encoder 1 HD AVC MP4	O	1 Video, 1 Audio-2ch-deu		x				7				3														-		x							
	Encoder 1 UHD HEVC DASH	O	3 Video, 1 Audio-2ch-deu				10																												x	transitioned to error state: error 3
	Encoder 1 UHD HEVC CMAF DASH	O	4 Video, 2 Audio-2ch-deu 1 Audio-6ch-eng		x			x	3						v														x			m	2			
	Encoder 2 HD AVC HLS	L	1 Video, 30min 1 Audio-2ch-deu,2 Sub		x				9	35																			x	30	2					
	Encoder 2 HD AVC CMAF HLS	L	1 Video, 1h 1 Audio-2ch-deu,2 Sub			x						x																						x		
Stream Group 2 (HDR)	CDN 1 HD DASH Dynamic Packaging	O	5 Video, 2 Audio-2ch-deu			x												c																		
	CDN 2 HD DASH Static Packaging	O	5 Video, 2 Audio-2ch-deu		x				6															x					x							
	Encoder 2 UHD HEVC DASH HLG10	L	5 Video, 2 Audio-2ch-deu			x						x					d																		x	transitioned to error state: AV Format not
	Encoder 2 UHD HEVC DASH PQ10 CMAF	L	5 Video, 2 Audio-2ch-deu		x				4										1																		
	Encoder 2 HD HEVC MP4 HLG	O	1 Video, 2 Audio-2ch-deu		x				4								d		2				h						x								
	Encoder 2 HD HEVC MP4 HLG	O	1 Video, 2 Audio-2ch-deu													x	d											+								
	Overall				6	3	10	1	6	35			1		1	1	3	1	2				1	1			2		5	1	1	1	1	1	2	

Example

Impairment scale (1..5): *1 Bad, Very annoying - 2 Poor, Annoying - 3 Fair, Slightly Annoying - 4 Good, Perceptible but not annoying - 5 Execellent,Imperceptable*

User Agent Mozilla/5.0 (Linux armv7l) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/62.0.3202.94 Safari/537.36 OPR/46.0.2207.0 OMI/4.12.0.release.20180227 HbbTV/1.4.1 (+DRM;;5597;4.12;;;) FVC/3.0 (;)

Capabilities

```
<profilelist>
<ui_profile name="OITF_HD_UIPROF+META_EIT+META_SI+HTML5_MEDIA+ANA+DVB_S+DVB_S2+DVB_T+DVB_T2+DVB_C+DVB_C2+POINTER+DRM+DVB_T_FVC_P2">
```

SmartTV Test Center

- ✓ Automated testing of SmartTVs, DOM Tree
- ✓ IR Remotecontrol emulation, Web UI, API


```
# Focus the "Forward" button on the control panel.
5 Press down once
6 Wait until element 'Pause' button focused has properties
  but at most 2s then continue
7 Press right once
8 Wait until element 'Forward' button focused has properties
  but at most 2s then continue
```

Source: IRT, MPAT Final Review, System design and quality assurance, Suite.st, Codeless test automation, For Smart TV and Xbox apps

30. HbbTV IOP Workshop 03/2018

- ✓ 16 devices, 9 vendors, 8x HbbTV 1.5ETSI 1.2.1, 8x HbbTV 2.0ETSI 1.4.1, 2014-2018
- ✓ DASH-Streams (Live Profile, OnDemand) & MP4 Progressive Download in UHD and HDR
- ✓ Arte Production, Ateme Titan File Encoding in HLG in 2160p/50, 1080p/50 and 720p/50
- ✓ Backwardscompatibility on SDR-Receivers

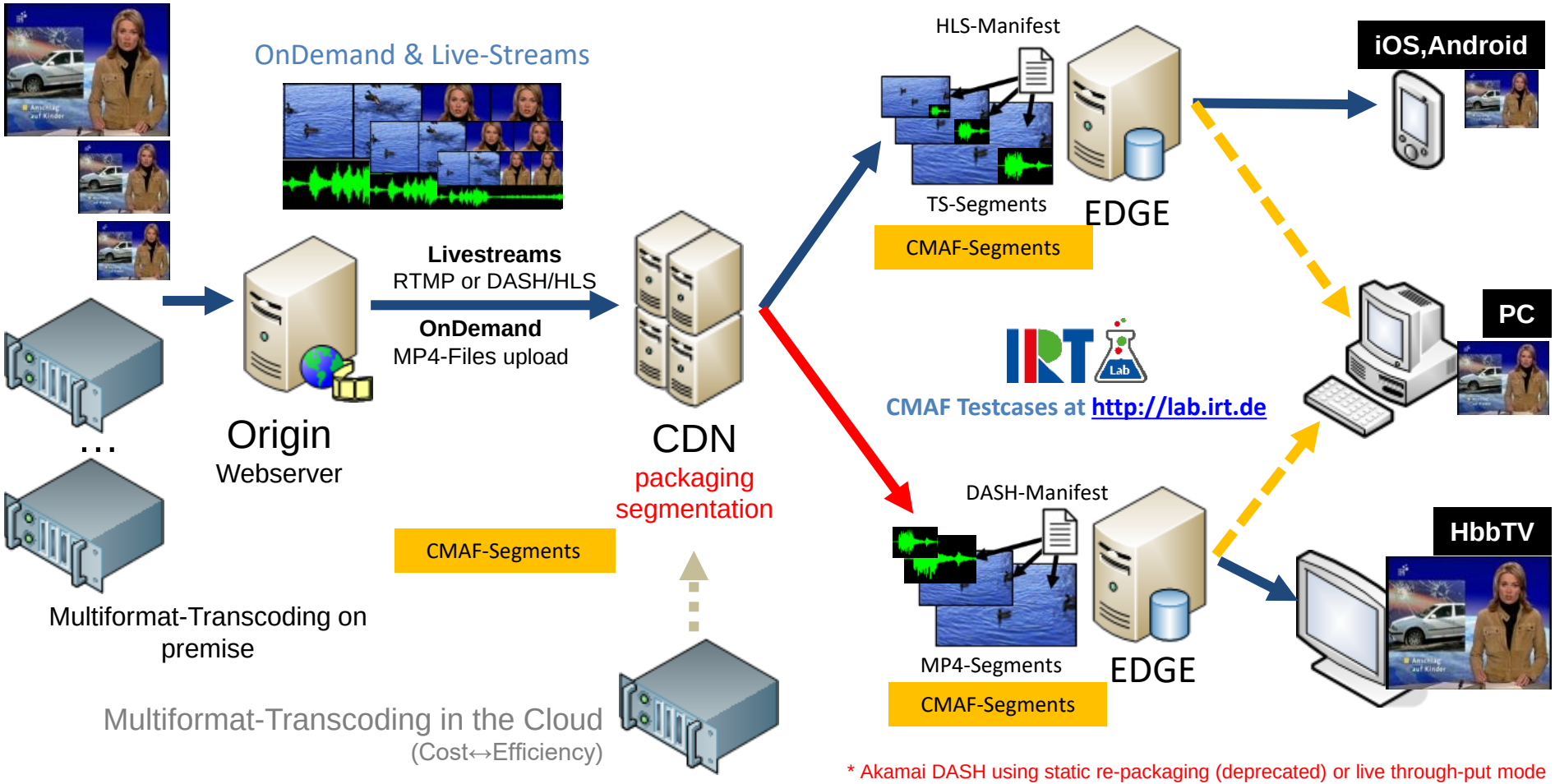
  All HLG-Streams playing in SDR on all HbbTV 1.5 devices 2016+ using both MPEG-DASH and MP4 Progressive Download

- ✓ HLG-Support on HDR-Receivers

  HLG-Decoding in HDR supported on most HbbTV 1.5+ HDR-devices 2017+

  Some Problems in HLG-Decoding (unstable HDR) with lower resolutions **≤ 1080p, 720p**
  either using Single Bitrate (SBR: MP4, DASH) and/or Alternate Bitrate (ABR: DASH)

  No Problems in HLG-Decoding using Single Bitrate (SBR) in **UHD = 2160p** (SBR: MP4, DASH)



* Akamai DASH using static re-packaging (deprecated) or live through-put mode

Common Media Applikation Format: Status of multi-platform provisioning

Devices

- ✓ **Good CMAF-interoperability** today on HbbTV 1.5+ with DASH
- ✓ Need to **„simulcast“ HLS with TS + fMP4** until iOS<10 disappears
- ✓ Could provide **HEVC to HbbTV 1.5+ and iOS 10+** using CMAF only
- ✓ **Lack of HEVC-support** in HTML5-Browsers today **require H.264** for PC/Smartphone.
- ✓ Allthough **HEVC Advance** allowed **royalty-free** streaming, **AV1** may be **preferred**

Live Services

- ✓ Need to use **multiple upstreams to entrypoint** unless OnTheFly-Repackaging in the CDN supported
- ✓ **Encoders available** with **parallel publishing** $CMAF^{HLS+DASH}$ and TS^{HLS}

OnDemand

- ✓ Need to use **Cloud Transcoding unless OnTheFly**-repackaging in the CDN is supported
  → change of todays repackaging-workflow MP4 to HLS
- ✓ Extra **storage costs to CMAF for TS^{HLS}** depending on iOS propagation

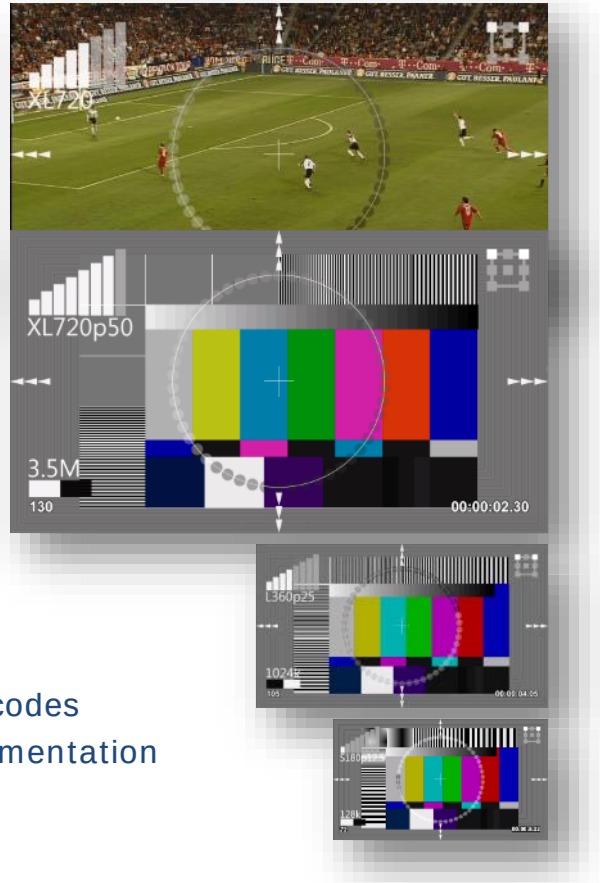
Interoperability Testing

- ✓ AV-Codecs (H.264,H.265,HE-AAC,EAC3,AC3)
- ✓ Videoquality, Transport-Protocols (DASH,HLS,HDS,DL
- ✓ All relevant DVB/OIPF-Formats (HbbTV)

Testsequences

- ✓ Safe Area, Title Safe Area, FPS-Clock
- ✓ Interlace Checker, Framerate Checker, Timecode
- ✓ Framecounter, Overscan-Check, SMPTE Colorbars
- ✓ Scaler-Checker, AV-Sync, Audio-Channelmapping

http://avtest.irt.de



Production

- ✓ Skriptbased Toolchain (TextToSpeech,AVISynth,ffmpeg,mp4box)
- ✓ HD- und SD-Formats 576p/i 720p 1080i from Hires Master-Footage
- ✓ Natively rendered Representations/Renditions for Adaptive Testing
- ✓ MPEG-DASH: segmentation, fragmentation, Group Of Pictures (GOP)
- ✓ Multiple bitrates „bars-overlay“, multiple framerates (p25, p50, i25)
- ✓ Constrained variable bitrate (VBR/CBR), including 4K/HFR/HDR… encodes
- ✓ Extensive Logging exposing all commandlines used for encoding/segmentation

Next webinar

DVB Single Illumination System (DVB-SIS)

3 July @ 15:00 CEST

Presenters:

- Frank Herrmann (Panasonic)
- Jean-Pierre Mosset (Harmonic)

dvb.org/webinars