DVB DASH webinar
13 June 2018

DVB DASH: An overview
Simon Waller (Samsung)

DVB codecs and DVB DASH
Chris Poole (BBC)

DVB DASH in the wild
Martin Schmalohr (IRT)
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

Encoder

Bitrate 1
Segment
Segment
Segment
...

Bitrate 2
Segment
Segment
Segment
...

Bitrate 3
Segment
Segment
Segment
...

Representation

AdaptationSet

MPD

XML
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

...<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>
...

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="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>
...

PQ10
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 schemIdUri="urn:mpeg:dash:preselection:2016" />
  <Role schemIdUri="urn:mpeg:dash:role:2011" value="main"/>
  <Representation id="r0" bandwidth="256000">
    <AudioChannelConfiguration schemIdUri="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 schemIdUri="urn:mpeg:dash:role:2011" value="main"/>
  <AudioChannelConfiguration schemIdUri="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 schemIdUri="urn:mpeg:dash:role:2011" value="commentary"/>
  <Accessibility schemIdUri="urn:tva:metadata:cs:AudioPurposeCS:2007" value="1"/>
  <AudioChannelConfiguration schemIdUri="urn:mpeg:mpegB:cipc:ChannelConfiguration" value="1"/>
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<!-- Preselection Element – Clean Audio -->
<Preselection id="30" tag="103" preselectionComponents="1" codecs="ac-4.02.01.03" frameRate="25" audioSamplingRate="48000" lang="en">
  <Role schemIdUri="urn:mpeg:dash:role:2011" value="alternate"/>
  <Accessibility schemIdUri="urn:tva:metadata:cs:AudioPurposeCS:2007" value="2"/>
  <AudioChannelConfiguration schemIdUri="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

ETR 154 Ed.1
Jan. 1996
- SDTV
- MPEG-2 video
- MPEG-1 Layer II audio

TS 101 154 v1.4.1
Jul. 2000
- AC-3 audio

Sept. 1997
- HDTV resolutions

TS 101 154 v1.4.1
Jan. 2005
- H.264/AVC
- HE-AAC audio

Sept. 2009
- SVC
- Full-HD resolutions

Jun. 2011
- 3DTV

TS 101 154 v2.1.1
Mar. 2015
- HEVC
- UHD phase 1

TS 101 154 v2.1.1
Feb. 2018
- UHD phase 2

TS 101 154 v2.3.1
Feb. 2017
- Video profiles for DVB-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

<table>
<thead>
<tr>
<th>Broadcast</th>
<th>DASH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:1 mapping between bitstreams and IRDs</td>
<td>One set of bitstream requirements for each video codec Upper limits defined for each DASH player conformance point</td>
</tr>
<tr>
<td>IRDs have some additional backward compatibility requirements</td>
<td>All player conformance points support lower resolutions and frame rates</td>
</tr>
</tbody>
</table>

- **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 conform 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
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

### Quelle: Die Medienanstalten, Digitalisierungsbericht 2017

<table>
<thead>
<tr>
<th>Plattform/Angebot</th>
<th>Deutschland</th>
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<tr>
<td>YouTube/andere Videoportale gesamt (netto)</td>
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<tr>
<td>YouTube</td>
<td>29.5</td>
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<td>Mediatheken der TV-Sender gesamt (netto)</td>
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<td>Mediatheken der öffentlich-rechtlichen Sender</td>
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<td>Mediatheken der privaten Sender</td>
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<td>Netflix</td>
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<td>Maxdome</td>
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<td>Videos über soziale Netzwerke</td>
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<tr>
<td>TV-Plattformanbieter (z. B. Sky, Unitymedia)</td>
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<td>Twitch/andere Gamervereins-Plattform</td>
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### World Cup 2014: 529.500 Das Erste & Sportschau.de
Browser & OS @ ARD: usage & market share Q3 2017

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<tr>
<th>Nutzungsanteil</th>
<th>IE</th>
<th>Firefox</th>
<th>Safari</th>
<th>Opera</th>
<th>Chrome</th>
<th>Edge</th>
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<td>Windows Vista</td>
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<td>0,5%</td>
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<td>Windows 8 (V8.1)</td>
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<td>2,6%</td>
<td>3,5%</td>
<td>&gt; 0,1%</td>
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<td>Windows 10</td>
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<td>Mac OS (ab V10.9)</td>
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<td>Linux</td>
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<td>Windows Phone</td>
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Update Q3 2017

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

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

- 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)

<table>
<thead>
<tr>
<th>Video Auflösung</th>
<th>Video Codec</th>
<th>Video Bitrate</th>
<th>Audio Codec</th>
<th>Audio Bitrate</th>
<th>Frame Rate</th>
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<tbody>
<tr>
<td>640x720*</td>
<td>AVC/H.264</td>
<td>1800kbit/s</td>
<td>AAC-LC</td>
<td>128kbit/s</td>
<td>50p</td>
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<tr>
<td>1280x720*</td>
<td>AVC/H.264</td>
<td>3584kbit/s</td>
<td>AAC-LC</td>
<td>128kbit/s</td>
<td>50p</td>
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<table>
<thead>
<tr>
<th>Adaptationset</th>
<th>Video Auflösung</th>
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<th>Video Bitrate</th>
<th>Frame Rate</th>
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<tr>
<td>0</td>
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<td>AVC/H.264</td>
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<td>9.6kbit/s</td>
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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

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<thead>
<tr>
<th>System</th>
<th>Bitrate</th>
<th>Video</th>
<th>Audio</th>
<th>mime-type</th>
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<tbody>
<tr>
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<td>8 Mbit/s for HD/SD</td>
<td>MPEG-4/AVC HD/SD</td>
<td>(Dolby AC3)</td>
<td>video/mpeg</td>
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<tr>
<td>MPEG-4 file format</td>
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<td>MPEG-4/AVC HD/SD 8bit, 10bit and UHD</td>
<td>MPEG-4/AAC</td>
<td>video/mp4</td>
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<td>MPEG-DASH (ISO-8MFF)</td>
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<td>Dolby E-AC3</td>
<td>application/dash+xml</td>
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<tr>
<td>8 Mbit/s for HD/SD</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>12 Mbit/s if UHD is not supported</td>
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<td>26 Mbit/s if UHD is supported</td>
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<td>Dolby E-AC3</td>
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</tbody>
</table>

**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

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

**If terminal supports HDR:** transitions to SDR should be avoided

<table>
<thead>
<tr>
<th>Audio</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit-rate</td>
<td>Shall</td>
<td>Shall</td>
</tr>
<tr>
<td>MPEG AAC ↔ Dolby EAC3</td>
<td>May</td>
<td>May</td>
</tr>
<tr>
<td>Stereo ↔ Multichannel</td>
<td>May</td>
<td>May</td>
</tr>
<tr>
<td>Sampling Frequency</td>
<td>May</td>
<td>May</td>
</tr>
</tbody>
</table>

**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.2020

<table>
<thead>
<tr>
<th>Resolution</th>
<th>Sampling</th>
<th>FrameRate</th>
<th>Colorspace</th>
<th>SDR/HDR</th>
<th>Quantisation</th>
<th>HEVC Profile/Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>2160p</td>
<td>p</td>
<td>50</td>
<td>BT.2020</td>
<td>SDR</td>
<td>10 bit</td>
<td>Main 10 (main10); Main Tier; Level 5.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>BT.709</strong></td>
<td>SDR</td>
<td></td>
<td>Main (main), Level 5.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>BT.709</strong></td>
<td>SDR</td>
<td>10 bit</td>
<td>Main 10 (main10); Level 5.1</td>
</tr>
<tr>
<td>1080p</td>
<td>p</td>
<td>50</td>
<td>BT.2020</td>
<td>SDR</td>
<td>8 bit</td>
<td>Main 10 (main10); Level 4.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>BT.709</strong></td>
<td>SDR</td>
<td></td>
<td>Main (main), Level 4.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>BT.709</strong></td>
<td>SDR</td>
<td>10 bit</td>
<td>Main 10 (main10); Level 4.1</td>
</tr>
<tr>
<td>720p</td>
<td>p</td>
<td>50</td>
<td>BT.2020</td>
<td>SDR</td>
<td>8 bit</td>
<td>Main 10 (main10); Level 4.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>BT.2020</strong></td>
<td>SDR</td>
<td></td>
<td>Non-DVB, testing only</td>
</tr>
</tbody>
</table>

*HDR testing only  **no interface in HEVC  **BT.2020 table 5, only 10 or 12 bit  *non-DVB, testing only
## Videotest Cheatsheet

<table>
<thead>
<tr>
<th>Device</th>
<th>TVX-66A8C123 (HDR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Browser/OS/Version</td>
<td>SmartTV 2018, Android TV, Opera</td>
</tr>
<tr>
<td>Capabilities/Transport</td>
<td>HEVC_UHD_25: true DASH: true, hdr_hlg10: false, hdr_pq10: false</td>
</tr>
</tbody>
</table>

### Encoder 1 HD AVC MP4
- Video: 2, Audio: 1-2ch-deu
- Audio 1-2ch-deu

### Encoder 1 UHD HEVC DASH
- Video, 2 Audio: 1-2ch-deu
- Audio 1-2ch-deu

### Encoder 1 UHD HEVC CMAF DASH
- Video, 2 Audio: 1-2ch-deu
- Audio 1-2ch-deu

### Encoder 2 HD AVC HLS
- Video, 35ms, Audio: 1-2ch-deu
- Audio 1-2ch-deu, 2ch-deu

### Encoder 2 HD AVC CMAF HLS
- Video, 30ms, Audio: 1-2ch-deu
- Audio 1-2ch-deu, 2ch-deu

### CDN 1 HD DASH Dynamic Packaging
- Video, 30ms
- Audio: 1-2ch-deu

### CDN 2 HD DASH Static Packaging
- Video, 2 Audio: 1-2ch-deu

### Encoder 2 UHD HEVC DASH HLS10
- Video, 4 Audio: 1-2ch-deu

### Encoder 2 UHD HEVC DASH P10Q CMAF
- Video, 2 Audio: 1-2ch-deu

### Encoder 2 HD HEVC MP4 HLG
- Video, 1 Audio: 2ch-deu

### Overall
- Video: 6, Audio: 3
- 10 31 1 6 35 1 1 1 1 1 1 2
- Impairment scale (1-5): 1 Bad, Very annoying - 5 Excellent, Imperceptible

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DVB DASH webinar: Deployment of DVB-DASH in Germany
SmartTV Test Center

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

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)
OnDemand & Live-Streams

Livestreams
RTMP or DASH/HLS

OnDemand
MP4-Files upload

Multiformat-Transcoding on premise

Multiformat-Transcoding in the Cloud (Cost↔Efficiency)

Origin
Webserver

CDN

packaging segmentation

HLS-Manifest

TS-Segments

EDGE

CMAF-Segments

CMAF Testcases at http://lab.irt.de

DASH-Manifest

MP4-Segments

EDGE

CMAF-Segments

iOS, Android

PC

HbbTV

* 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** CMAFHLS+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

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