

# Enabling HbbTV Interoperability for Low Latency, DAI and 360° Streaming

8th HbbTV Symposium and Awards

Louay Bassbouss | 21st – 22nd November 2019 | Athens

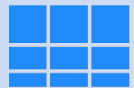


# Introduction

- There are already proven Web APIs (e.g. MSE, EME, ....) that support media web applications across different browsers.
- These APIs are also relevant for HbbTV applications: Many of them are already part of the HbbTV specification, but some important APIs like the Media Source Extensions API (MSE) are still missing.
- The CTA WAVE Project (<http://cta.tech/WAVE>) started in 2017 with the Web Media API Snapshot (<https://w3c.github.io/webmediaapi/>) which references existing specifications (from W3C and other groups) that are already supported across all four widely used user agent code bases.
- The Web Media API Test Suite (<https://github.com/cta-wave/WMAS/>), developed by Fraunhofer FOKUS within the CTA WAVE project with focus on embedded devices is already available
  - Hosted Test Suite for Web Media API Snapshot 2017: <https://webapitests2017.ctawave.org>
  - Hosted Test Suite for Web Media API Snapshot 2018: <https://webapitests2018.ctawave.org>

# Relevant Web Media APIs

API	Description
Media Source Extensions (MSE)	<ul style="list-style-type: none"><li>• W3C Recommendation 17 November 2016</li><li>• Extends HTML5 media elements to generate media streams for playback</li><li>• <a href="https://www.w3.org/TR/media-source/">https://www.w3.org/TR/media-source/</a></li></ul>
Encrypted Media Extensions (EME)	<ul style="list-style-type: none"><li>• W3C Recommendation 18 September 2017</li><li>• Extends HTML5 media elements to control playback of encrypted content</li><li>• <a href="https://www.w3.org/TR/encrypted-media/">https://www.w3.org/TR/encrypted-media/</a></li></ul>
Fetch API	<ul style="list-style-type: none"><li>• WHATWG Living Standard</li><li>• Provides an interface for fetching resources via HTTP (similar to XHR but more powerful and flexible)</li><li>• <a href="https://fetch.spec.whatwg.org/">https://fetch.spec.whatwg.org/</a></li></ul>
Streams API	<ul style="list-style-type: none"><li>• WHATWG Living Standard</li><li>• Provides APIs for creating and consuming streams of data</li><li>• Fetch API allows to expose responses as Readable Streams and get access to the chunks before the whole content is downloaded → IMPORTANT for Low Latency</li><li>• <a href="https://streams.spec.whatwg.org/">https://streams.spec.whatwg.org/</a></li></ul>

# Selected Open Source MSE/EME-based DASH/HLS players

Player	Description
 <b>dash.js</b>	<ul style="list-style-type: none"><li>• A reference client implementation for the playback of MPEG DASH in the Browser based on HTML5 Video and MSE/EME APIs</li><li>• <a href="https://github.com/Dash-Industry-Forum/dash.js">https://github.com/Dash-Industry-Forum/dash.js</a></li></ul>
 <b>hls.js</b>	<ul style="list-style-type: none"><li>• A JavaScript library which implements HTTP Live Streaming (HLS) using HTML5 Video and MSE/EME APIs</li><li>• Supports transmuxing of MPEG-2 Transport Stream and AAC/MP3 streams into ISOBMFF (MP4) fragments (Transmuxing in a Web Worker is supported)</li><li>• <a href="https://github.com/video-dev/hls.js/">https://github.com/video-dev/hls.js/</a></li></ul>
 <b>Shaka Player</b>	<ul style="list-style-type: none"><li>• JavaScript library supporting the playback of DASH and HLS in the Browser using HTML5 Video and MSE/EME APIs</li><li>• <a href="https://github.com/google/shaka-player/">https://github.com/google/shaka-player/</a></li></ul>



# Evaluation of open source DASH/HLS players on existing HbbTV sets

TV	dash.js		hls.js		shaka player				FOKUS
	DASH VOD	DASH LIVE	HLS VOD	HLS Live	DASH VOD	DASH LIVE	HLS VOD	HLS Live	DASH 360°
TV1, 2017, HbbTV1.5									
TV2, 2017, HbbTV1.5									
TV2, 2018, HbbTV2.0.1									
TV2, 2019, HbbTV2.0.1									
TV3, 2017, HbbTV1.5									
TV3, 2019, HbbTV2.0.1									
TV4, 2019, HbbTV1.5									

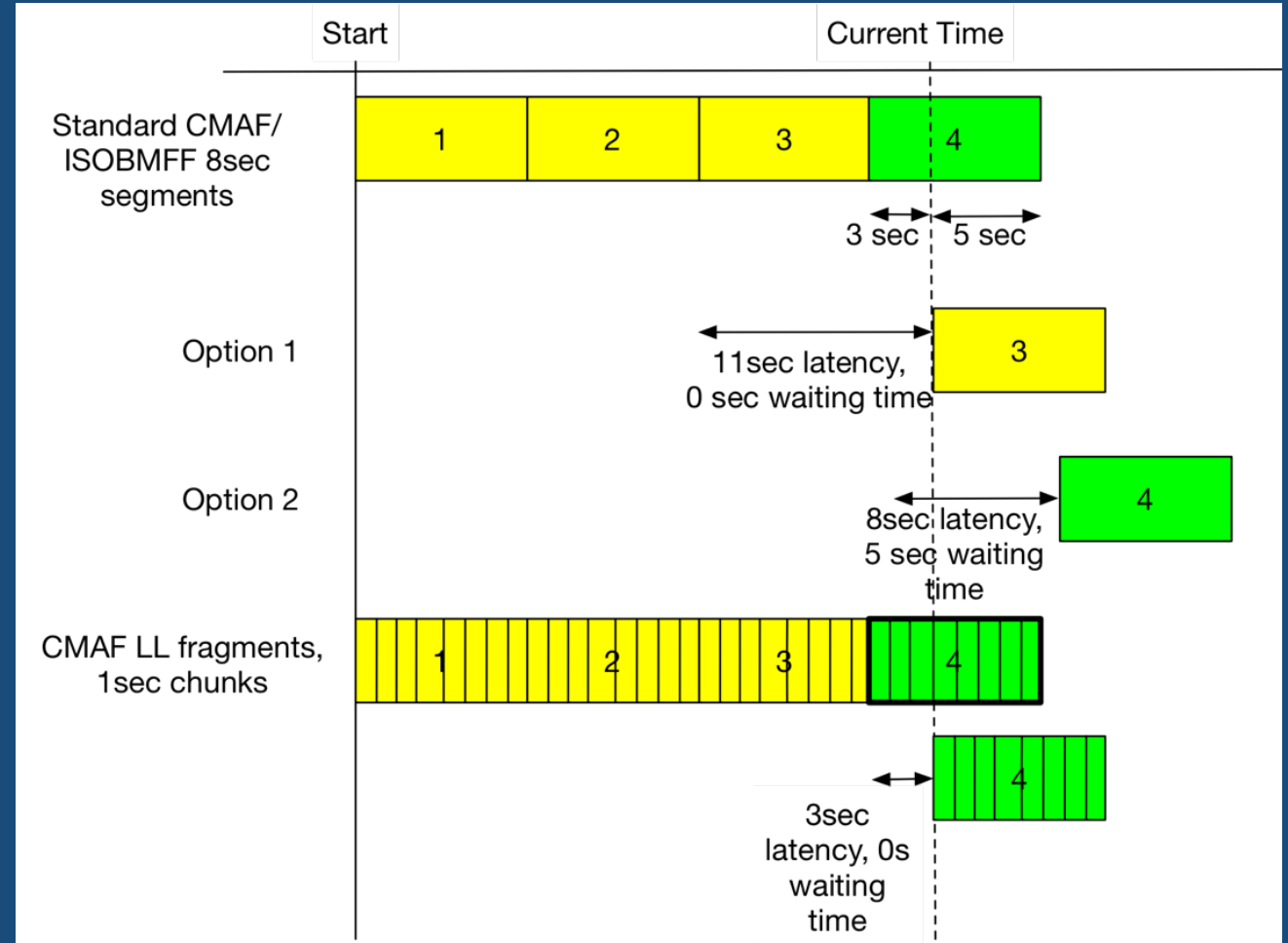
1. Latest version of the open source players
2. All streams are clear content
3. FOKUS 360° Stream is a DASH stream with multiple video AdaptationSets. Each AdaptationSet represents a FOV in the video

# How can these APIs improve media playback in HbbTV?

1. Speed up the development of HbbTV applications by using the same players as for web apps on desktop and mobile
2. Faster support of new features, e.g. Low Latency (using CMAF), without the need to wait for extending the native player
3. Full control on buffering and adaptive bitrate streaming algorithms. Buffer control is for example an important requirement for the FOKUS 360° video player
4. Enable HLS playback in HbbTV
5. Use different networking APIs/protocols e.g. WebSockets. Example: send media segments from companion screen to HbbTV terminal via WebSockets and use MSE for playback

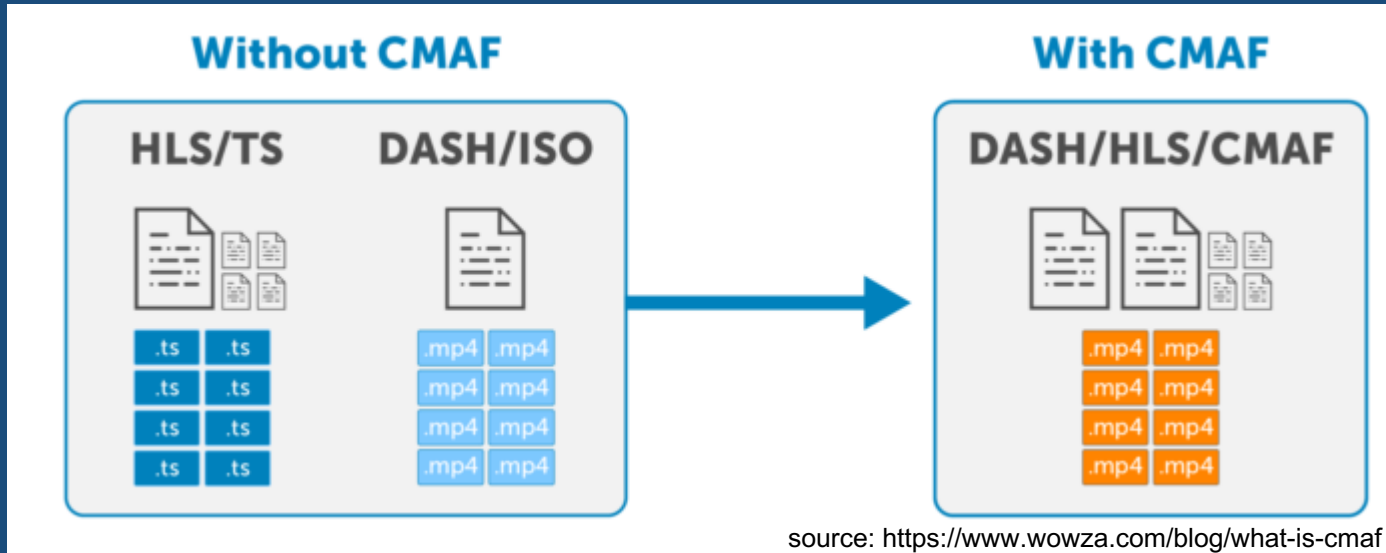
# Low Latency (DASH)

- dash.js provides support for Low Latency DASH using CMAF
- Requires Fetch API and ReadableStreams to access chunks of a CMAF segment and start the playback even before the entire segment is downloaded
- Use video.playbackRate during startup to adjust the position in the current segment



# Common Application Media Format (CMAF)

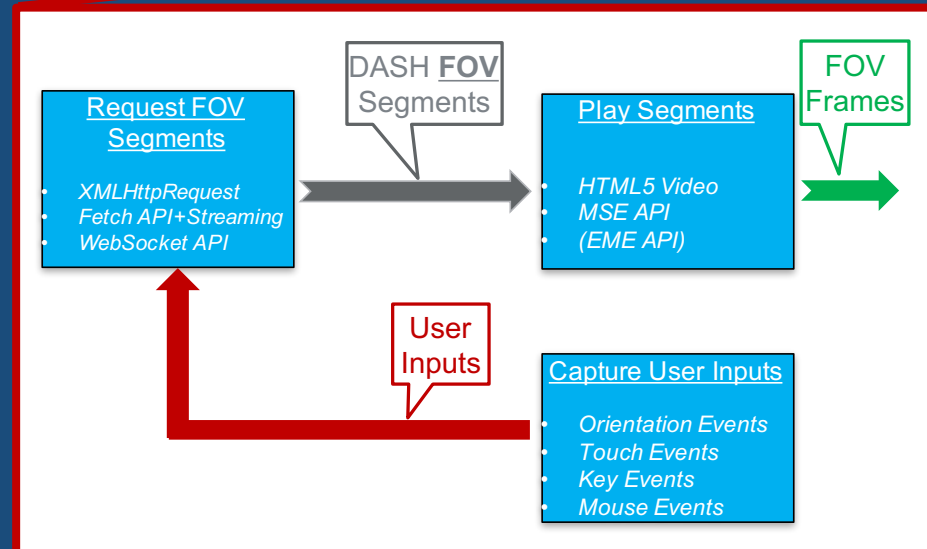
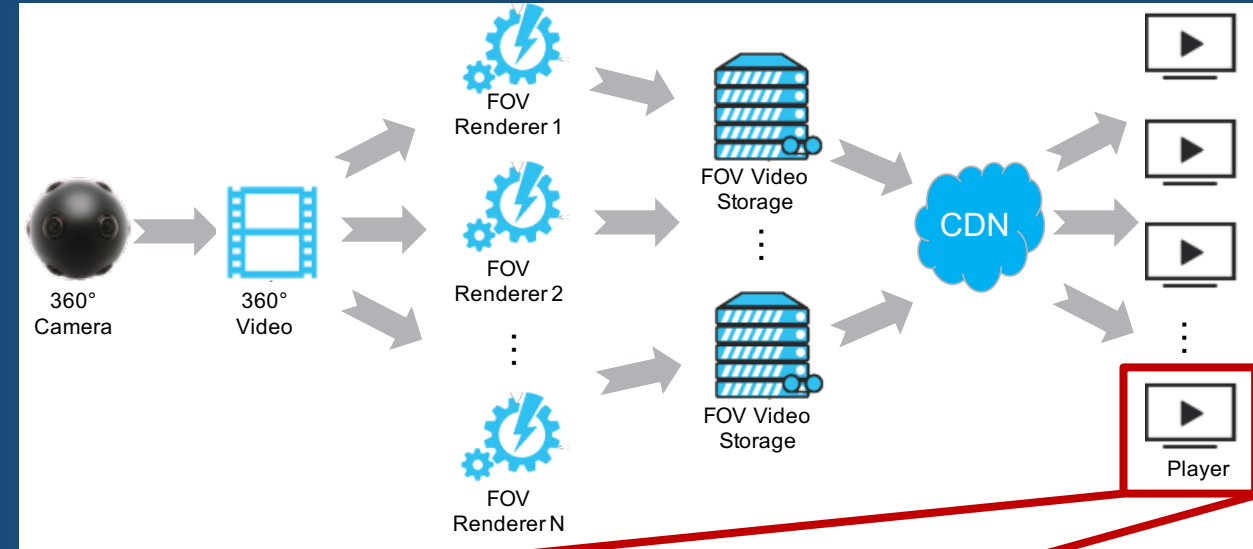
- Enables encode/package/store once and play everywhere



- Enables Low Latency Live Streaming and fast startup times through Chunked Encoding
- For MSE-based HLS players, no need to transmux MPEG2-TS streams into ISOBMFF fragments

# Fraunhofer FOKUS 360° Video Playout for HbbTV

- Prerendering of field of view (FoV) videos for different of camera angles
- No need to preform the geometrical transformation on the client (TV). HTML5 Video and MSE are used for playback and buffer control
- Reduce bandwidth by streaming only the visible FoV using XHR or Fetch APIs
- Use existing Video delivery infrastructures (CDNs)
- Any video codec can be supported



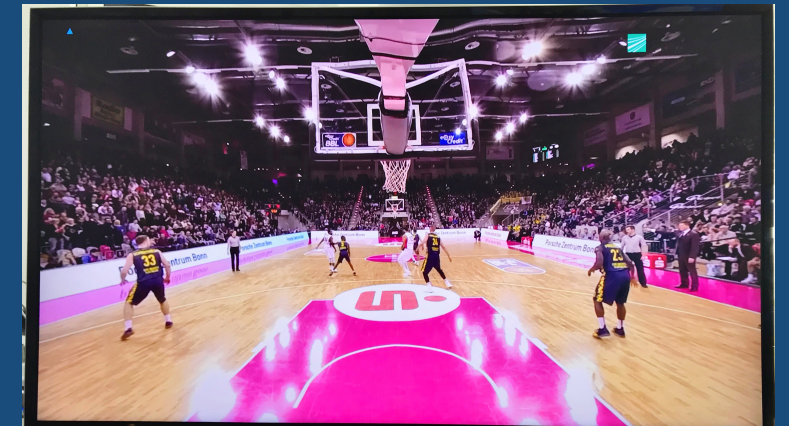
# 360° Video Playout for HbbTV



FIFA World Cup 2018 - ERT



Kumpel-Tag mit Andy - WDR



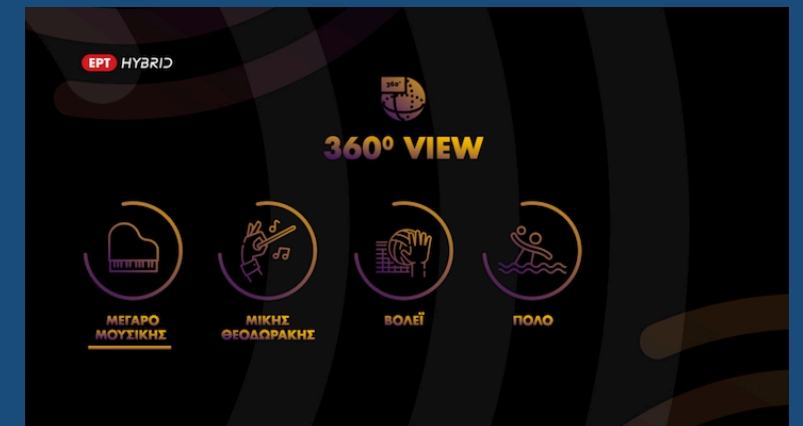
Basketball 360° - DT



Biathlon 2019 - ZDF



Fernsehgarten 2019 - ZDF



360° View - ERT



## Jetzt live in 360° – Biathlon aus Oberhof!

Zum ersten Mal als 360°-Livestream: Seien Sie dabei an der Strecke und am Schießstand – einfach das Video starten und mit den Pfeiltasten in die gewünschte Richtung navigieren!  
(Hinweis: Diese Anwendung wird nur von neueren TV-Geräten ab 2017 unterstützt.)



# How it works?



static view 0°, 4s



transition video 0° → 270°, 1s



static view 270°, 2s



All together, 7s

- static and transition videos are available as DASH AdaptationSets
- on FoV change, the player removes the buffer of the current AdaptationSet and starts buffering of the AdaptationSet corresponding to the new FoV or transition video



# 9<sup>th</sup> FOKUS MEDIA WEB SYMPOSIUM

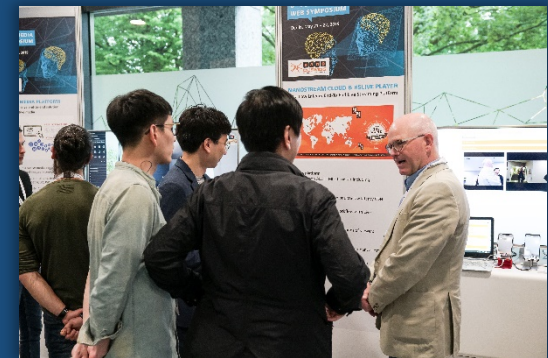
May 05– 06, 2020, Berlin

**MARK YOUR  
CALENDAR!**



## 9<sup>th</sup> FOKUS Media Web Symposium – And Still Diving Deeper

The FOKUS Media Web Symposium has been taking place since 2010 and developed into a well received expert meeting for all topics related to video technologies. The conference, tutorials and workshops of the 9<sup>th</sup> FOKUS Media Web Symposium 2020 will cover deep insights in internet delivered media, discussing the newest developments in media meets AI, media meets 5G and media meets scale. In between, coffee breaks and lunch offer the opportunity to network and visit demos and exhibits of Fraunhofer FOKUS and event partners.



[www.fokus.fraunhofer.de/go/mws](http://www.fokus.fraunhofer.de/go/mws)



# Thank you!

## Visit Fraunhofer FOKUS booth to see our demos

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