



HASHing It Out

Bringing Interoperability to DASH and HLS



Zachary Cava

Video Platform Architect (Hulu)
DASH-HLS Interoperability Group Chair (CTA WAVE)



Patrick Gendron

Innovation Director (Harmonic)
Live Group Co-Chair (Streaming Video Alliance)

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Topics for Today

- CMAF Overview
- Interoperability: Expectation vs Reality
- The DASH / HLS Interoperability Spec

CMAF Overview

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MPEG CMAF initial target

Fragmentation is often an enemy of a sustainable business

Big internet players decided to define a new format for the media distribution over internet

Media Format Priorities

Combine broadly adopted MPEG technologies but reduce the scope through profiling

Support adaptive streaming (live and on demand)

Enable DRM interoperability

Enable efficient and interoperable encoding, caching and delivery

Make presentation composition and decoding simple

Design for extensibility to make it future-proof (UHD/HDR, VR etc.)

MPEG CMAF : Core Technologies

Fragmented ISO Base Media File Format

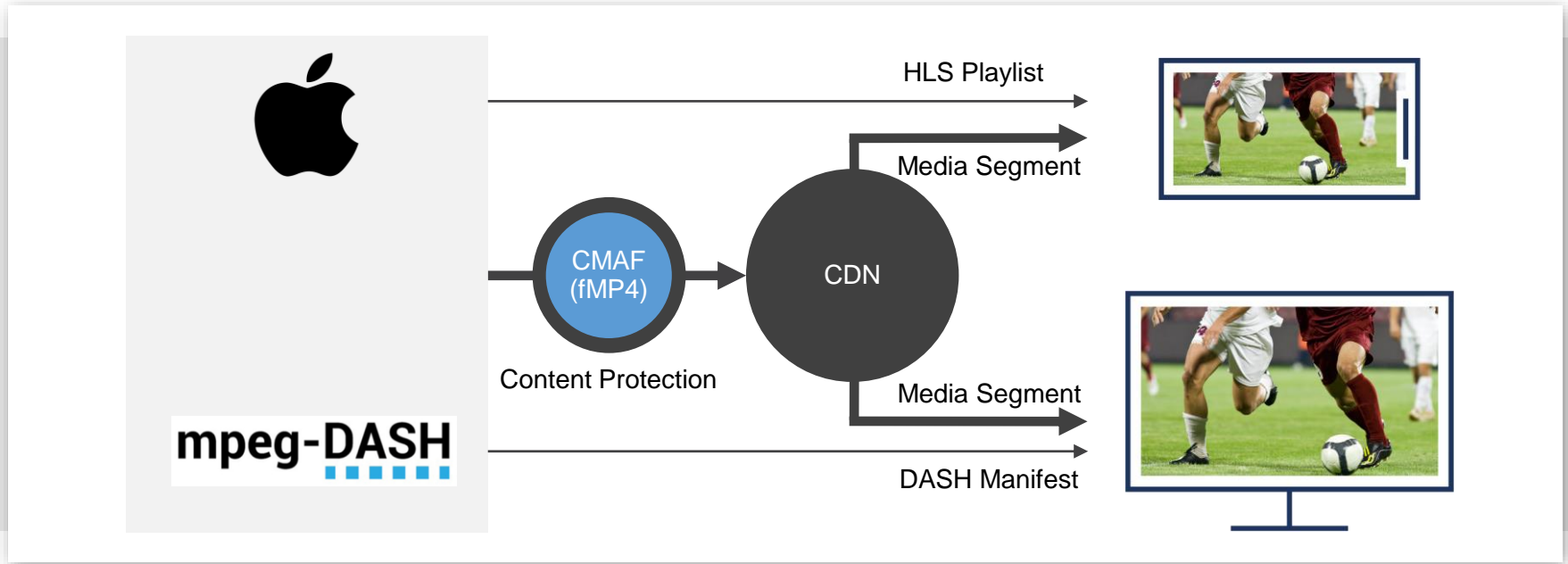
Common Encryption use either 'cenc'(AES-CTR) or 'cbcs'(AES-CBC) schemes

Video Tracks: General Constraints & specific constraints for AVC/HEVC

Audio Tracks: General Constraints & specific ones for AAC & HE-AAC

Subtitles and Captions (WebVTT, TTML IMSC1, CEAx08)

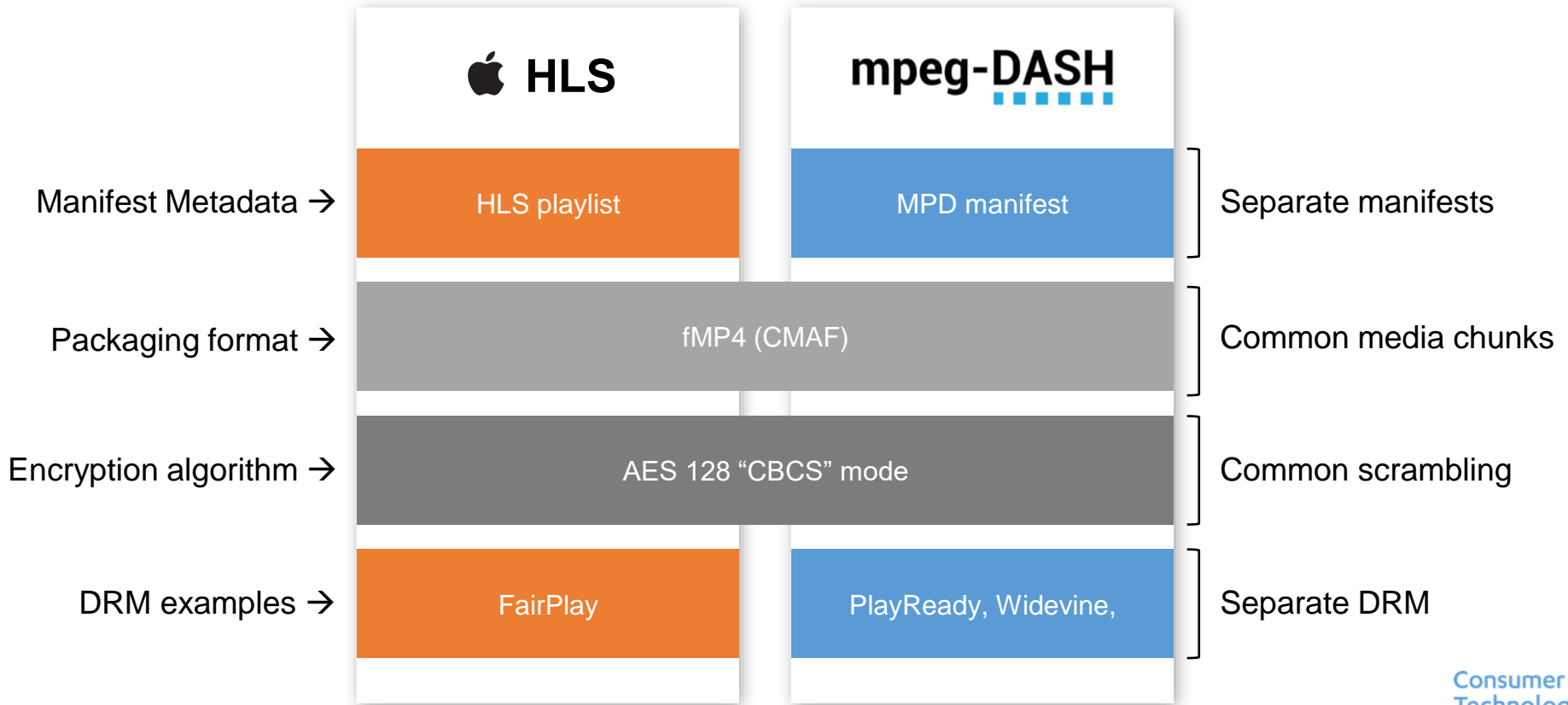
CMAF Packaging Enables HLS/DASH Convergence



CMAF: Common Media Application Format → unique data stream delivery for HLS and DASH

CBCS: Common Encryption Scheme → unique data scrambling for HLS and DASH

VOS CMAF Convergent Stacks



CMAF created many industry expectations



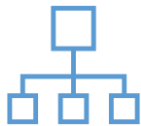
Make possible common workflows and common caching of content

- Encode once / Package once / Cache once
- Just two different manifests
- Encryption was identified as a hard topic because this touch legacy HW



CMAF should improve the profitability of the services as the delivery chain is simplified

- CMAF should become the common denominator that any device will support



CMAF, for live content, is often associated with Low Latency thanks to CMAF chunks

- This is the format to achieve Live Delivery "on par" or faster than broadcast

Interoperability: Expectation vs Reality

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Expectation vs Reality



Real-world Implementation Observes Divergence and Incompatibility



Divergence and Incompatibility Stalls Adoption



Defining Interoperability Will Lead To Greater Adoption



3 Example Scenarios to Explore

Low-Latency Live Streaming

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Low-Latency Overview



“low latency” streaming has a natural application for sport events



Betting applications are also demanding for low latency



Most of the requests today is to have a latency equivalent to broadcast - between 3 to 8 seconds



Sports drive large audience : Delivery at scale for Low Latency service is challenging



Monetization is key to deliver these high cost services

- Content protection using DRM
- DAI is often requested



In order to address as many device as possible, DASH and HLS are required

Issues For Interoperability

Experiments in DASH/CMAF uncovered issues with player bandwidth estimates.

- Solutions exists but implementation will take time
- Should not have the same issues with LL-HLS (not CTE)

Service description in DASH is well understood and the customer sees the value to control the experience

- There isn't an obvious equivalent for LL-HLS

DAI : more challenging in a “low-latency” environment

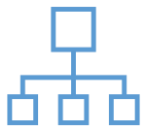
Descriptions for Interoperability



Service Description in DASH ↔ X-Server-control tags in HLS



DAI: we need to describe the workflow in the “low-latency” context



Still 2 set of media files for LL live due to part files (HLS) vs CTE (DASH)

- Pushing for byte range addressing in LL HLS would make the compatible mode a reality having a single set of media file

DRM Protected Streaming

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DRM Protection Overview



Distribution Of Content Considered High Value



CMAF Compliant Encryption Utilized



On-Device Security via DRM Vendors



Deployment to a Multi-Device Ecosystem

Issues For Interoperability

DRM Systems availability varies across devices

- PlayReady
- Widevine
- FairPlay

Differing approaches to content security features

- Initialization data carriage
- Secure key exchange
- Key rotation: Full vs Root/Leaf

Optional and underspecified aspects of the MPEG
Common Encryption Specification

- Encryption scheme support
- IV Handling and Sizing
- Encrypt:Skip patterns

Descriptions for Interoperability

CBCS Requirement of CBCS Encryption Scheme

16-Byte Clarified Initialization Vector Sizing

1:9 Video
10:0 Other Specific Encrypt:Skip Patterns for Unconstrained Codecs



Realities of Duplicate Encryption for Sufficiently Large Ecosystems

Dynamic Ad Insertion

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Dynamic Ad Insertion Overview



Distributor Has Opportunity to Monetize Content



Advertisements Are Independent Assets



Requirement of Smooth Transitions Between Assets

Issues For Interoperability

Seamless asset transitions are hard to get right

- Frame level accuracy
- Cross-rendition alignment
- IDR frame placement

Content streams typically have more features than advertisements

- Dubbed languages
- Alternate views / audio

Common need to trade-off implementation complexity with device reach

- High and low powered devices
- Varying implementors
- More complexity, more bugs

Descriptions for Interoperability



Splice Conditioning Requirements for Insertion Points



Encoding Consistency Requirements

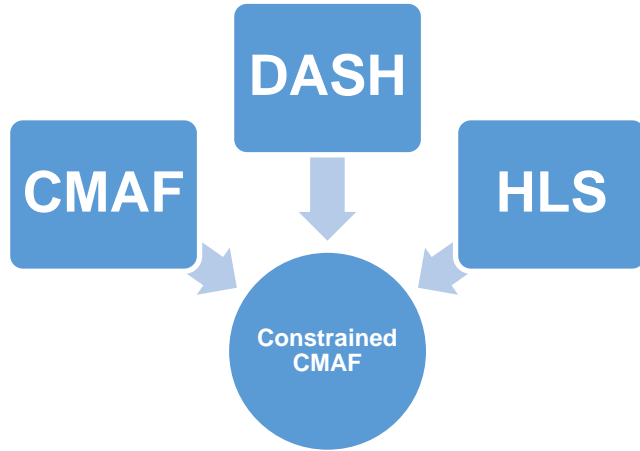


Fallback Rendition Mapping of Logical Structures

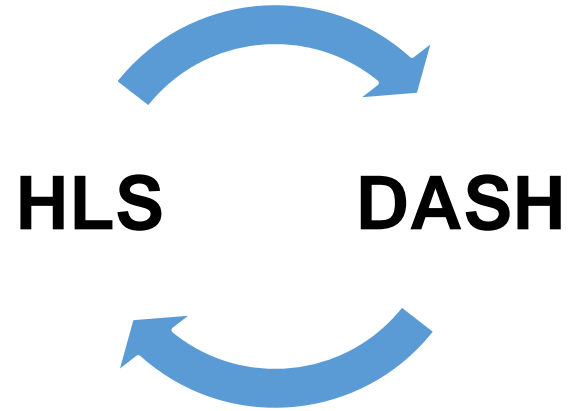
The DASH / HLS Interoperability Spec

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Specification Scope



CMAF Constraints for Manifest Interoperability



DASH / HLS Cross-Conversion Methods

Initial Publication Targets



Basic On-Demand Streaming



Basic Live Streaming



Low-Latency Live Streaming



Encrypted Media Presentations



Presentation Splicing

Interoperability Use Cases



Publication Target

Get Involved Today!

- Join CTA WAVE
 - standards@CTA.tech
- Raise Additional Interoperability Use Cases
 - <https://github.com/cta-wave/dash-hls/issues>
- Reach out to me for a discussion
 - zachary.cava@hulu.com





Thank You