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WAVE

WEB APPLICATION VIDEO ECOSYSTEM

WAVE Interoperability Boot Camp

October 2nd, 2018

Technology & Standards Forum | Los Angeles, CA

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AGENDA

- Introduction to WAVE – Paul Hearty, Sony Electronics
- Presentations:
  - WAVE Technical Overview – Will Law, Akamai
  - WAVE Content Specification – Mike Bergman, CTA
  - WAVE Applications Environment – Mark Vickers, Comcast
  - WAVE Device Playback Capabilities – Mike Bergman, CTA
  - WAVE Test Suites – Mike Bergman, CTA
- Q&A/Wrap-up
  - – Paul Hearty, Moderator

WAVE

WEB APPLICATION VIDEO ECOSYSTEM

Overview of the WAVE Project

Paul Hearty / Sony Electronics, Inc.

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Introduction to WAVE

- What are the problems WAVE is addressing?
- What are the WAVE solutions?
- WAVE participating companies
- WAVE work structure


Fragmentation
is
Expensive

Supporting a fragmented OTT world

- Fragmentation impacts content providers and device makers:
  - Multiple streaming formats (HLS, HDS, DASH, Smooth)
  - Multiple device types from laptops to phones to gaming consoles
  - Inconsistent device performance capabilities
  - Inconsistent device compliance to industry specifications
- The result:
  - Content providers: Increased cost to prepare, store and support OTT
  - Device makers: Increased test and support costs for devices

Commercial OTT Video Issues: WAVE Solution

Content

Content Specification

- Based on MPEG Common Media Application Format (CMAF)
- Compatible with DASH and HLS.

Device Playback Capabilities

Testable requirements

- covering most common playback interoperability issues.

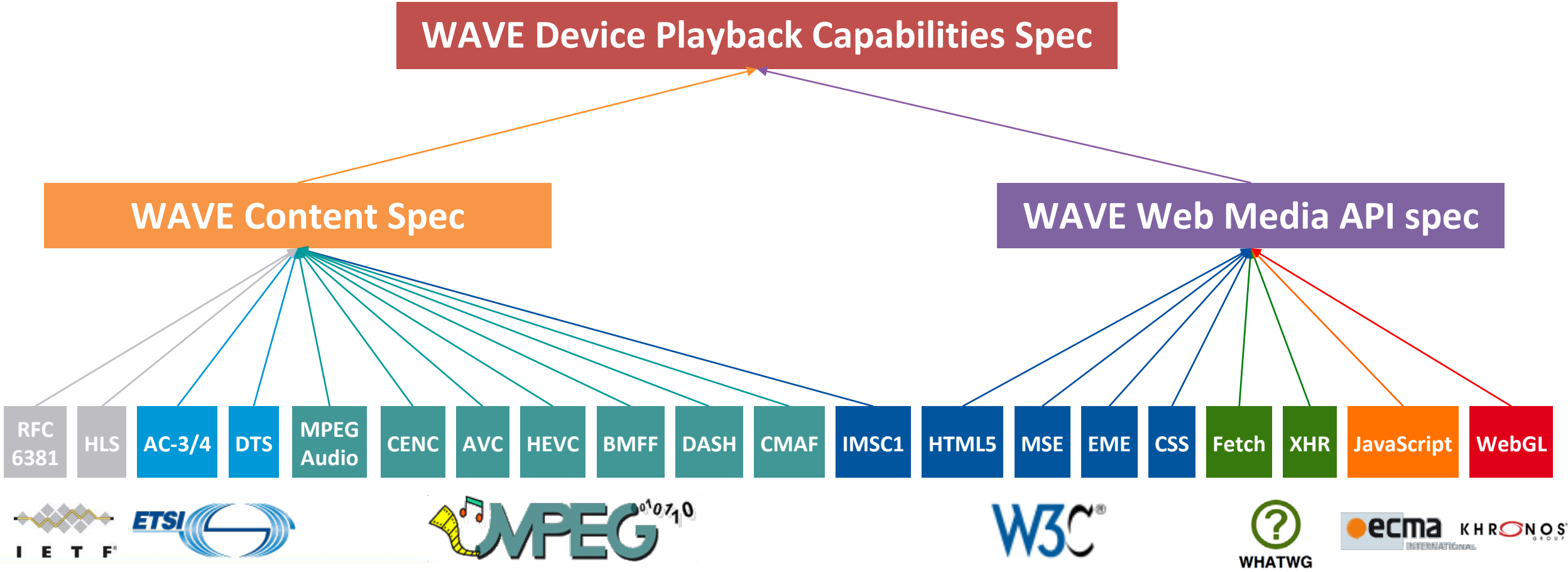
Device HTML5 Reference Platform

Reference application framework

- Based on HTML5
- Provides functional guidelines for playback interoperability.

WAVE Test Suite

WAVE bridges media standards & web standards

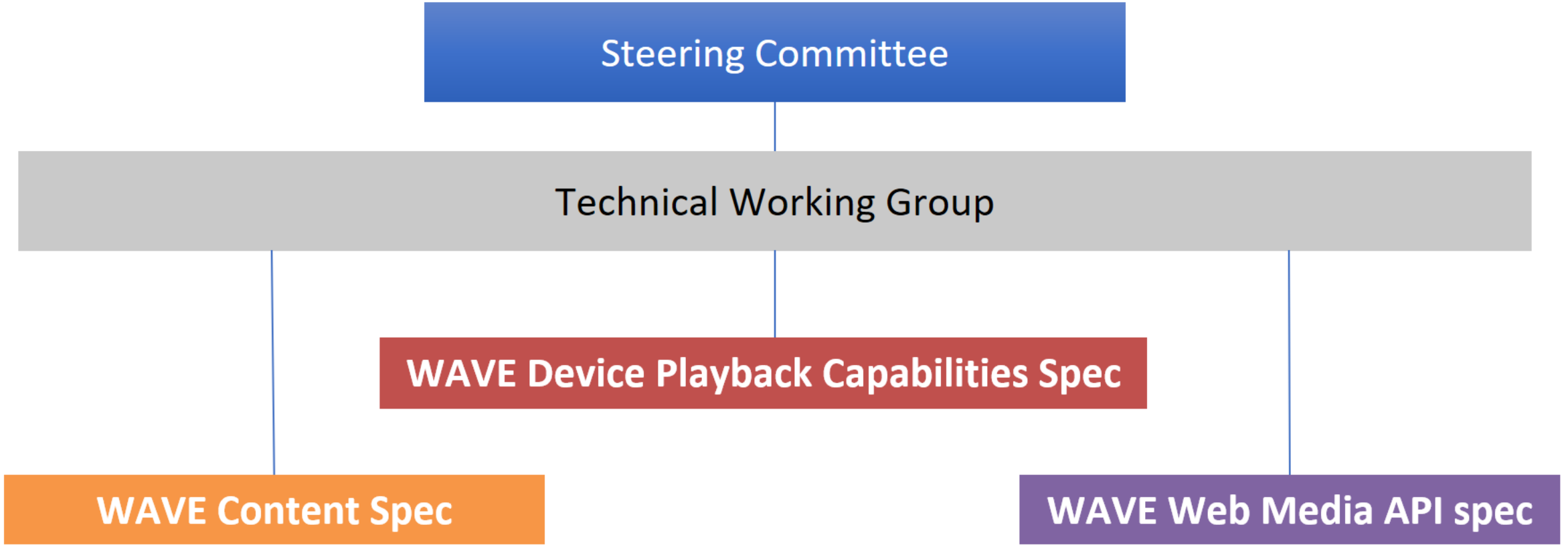


Current WAVE Membership

Adobe Systems
AGP
Akamai
Amazon.com
Apple
AT&T
AwoX
BAMTECH Media
BBC Research & Dev.
BitRouter
Brazilian Soc. of TV Eng.
BrightCove
Cable Television Labs
castLabs
CBS Interactive
Charter Communications
Cisco Systems
Comcast Cable
Cox Communications
Discovery Communications
Disney/ABC/ESPN
Dolby Laboratories
Ericsson
Eurofins Digital Testing
Facebook
Fraunhofer
Google
Home Box Office (HBO)
Huawei Device Co.
Intel Corporation
JR Consulting
JW Player
LG Electronics
Martin Freeman Consulting
Microsoft Corporation
MPAA
Motion Picture Laboratories
Mux
Nagravision
Nathan Zerbe LLC
Nat'l Assoc. of Broadcasters
Netflix
Nevelex Corporation
Opera Software
P Thomsen Consulting
Qualcomm Incorporated
RK Entertainment Technology Consulting
Samsung Electronics
Showtime Networks
Sky
Solekai Systems
Sony Electronics
SpireSpark International
Starz
Streaming Video Alliance
TBT
Toshiba
TP Vision
Turner Broadcasting System
UltraViolet / DECE
Verance Corporation
Verimatrix
Verizon
Viacom
Vizio
WJR Consulting
World Wide Web Consortium
WWE
Xperi/DTS

*Company names in **bold** are members of the WAVE Steering Committee.*

WAVE work structure



WAVE

WEB APPLICATION VIDEO ECOSYSTEM

WAVE Technical Overview

Will Law / Akamai

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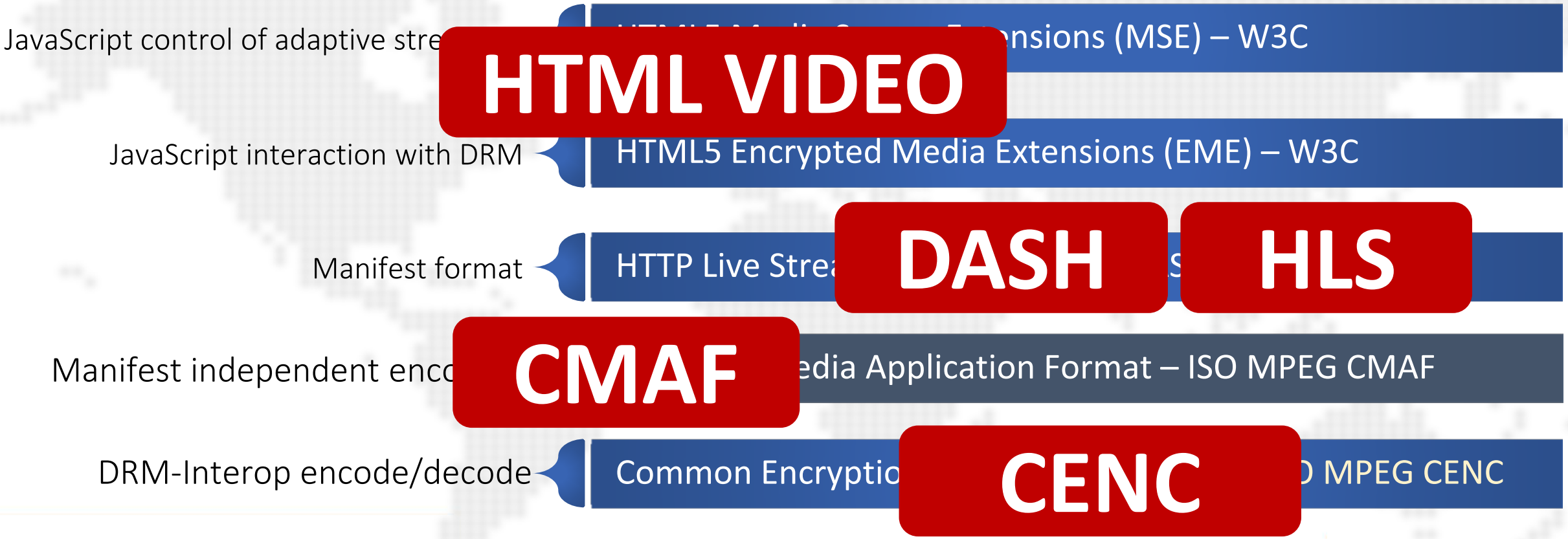
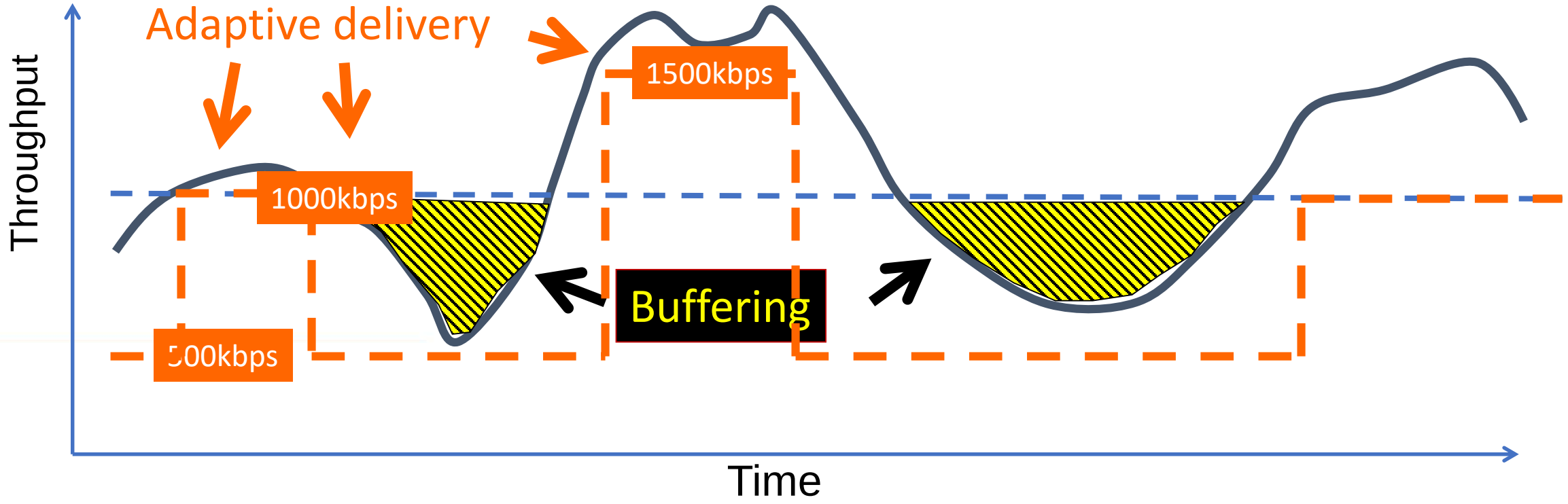
WAVE core technologies



Adaptive Segmented Media

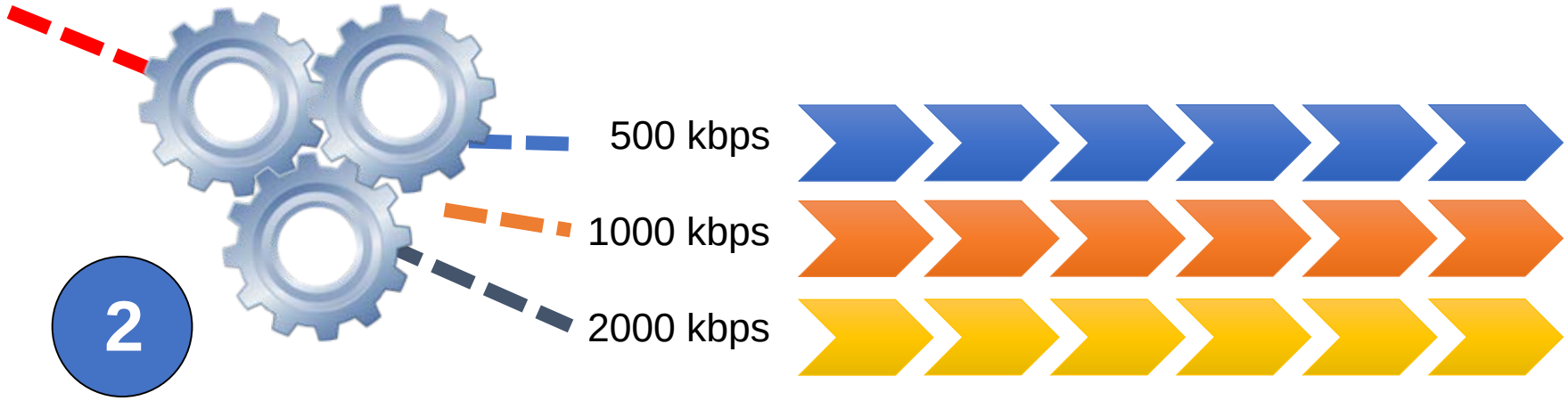
- The internet does not offer a fixed QoS. Throughput (goodput) fluctuates constantly over the timescale of video content delivery
- Ideally we would like to switch bitrates constantly to always give the user the highest quality they can sustain at any point in time.



How does segmentation work?

1 Incoming video

2 is split by an encoder

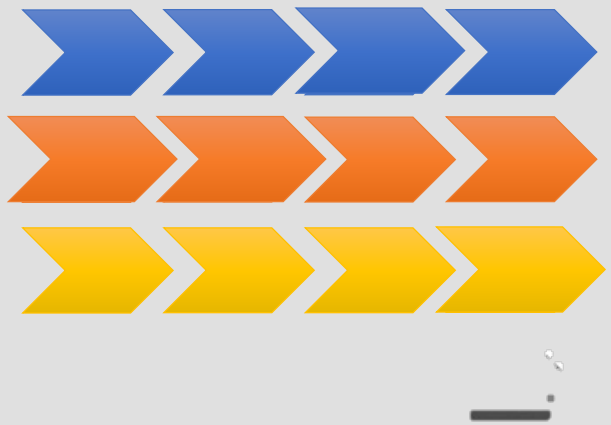


3 into multiple short blocks. Each block holds the same section of video, encoded at a different size and bitrate.

How does adaptive delivery work?

The segmented video is stored on a server, along with a text file which describes the names of each segment. This text file is called a **manifest**.

A player downloads the manifest and then begins requesting individual segments of video.



SERVER

CLOUD

It makes its choice based on bandwidth conditions, grabbing the best quality it can at the time.

PLAYER

How does adaptive delivery work?

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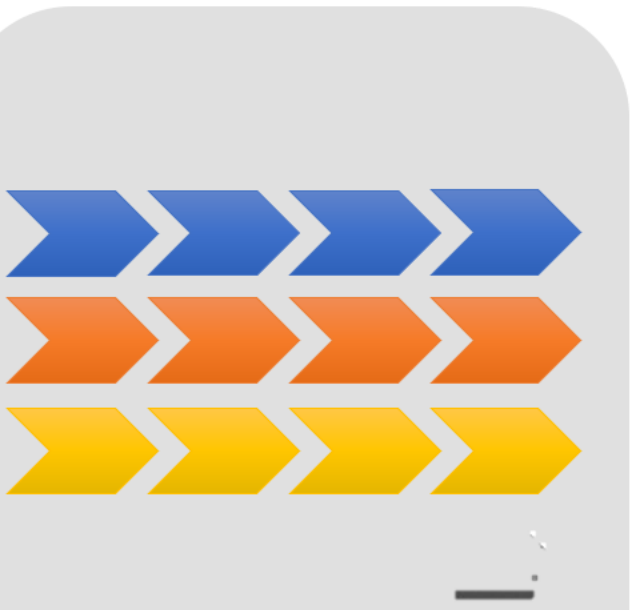


SERVER

CLOUD

It makes its choice based on bandwidth conditions, grabbing the best quality it can at the time.

PLAYER

Adaptive Segmented Media Formats

MOVE Networks - 2007

Microsoft Smooth Streaming - 2008

Apple HTTP Live Streaming (HLS) - 2009

Adobe HDS - 2010

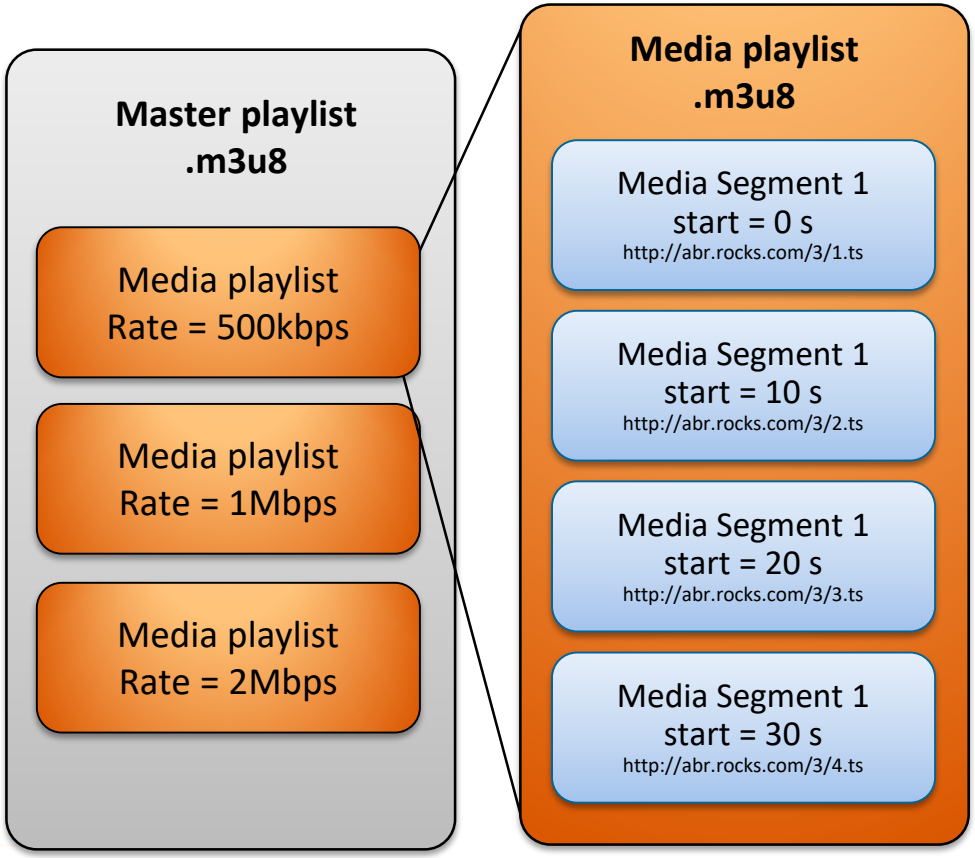
MPEG DASH - 2012

Adaptive Segmented Media Formats

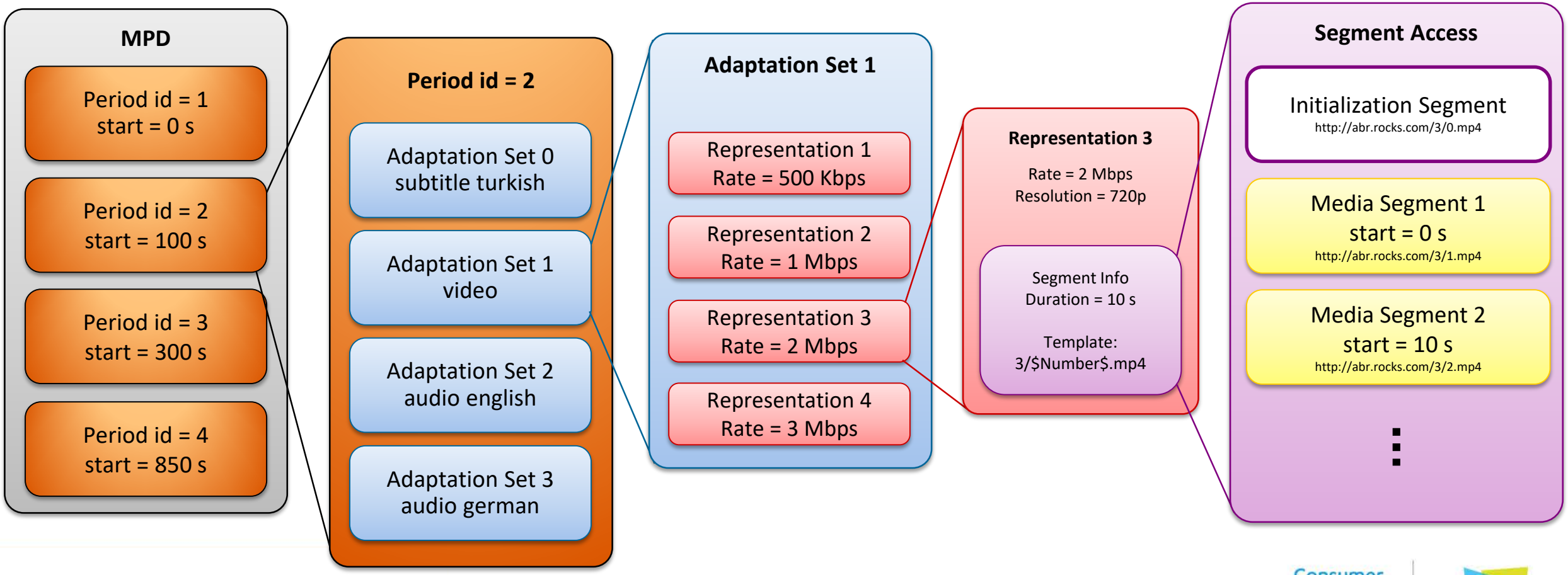
Apple HTTP Live Streaming (HLS) - 2009

MPEG DASH - 2012

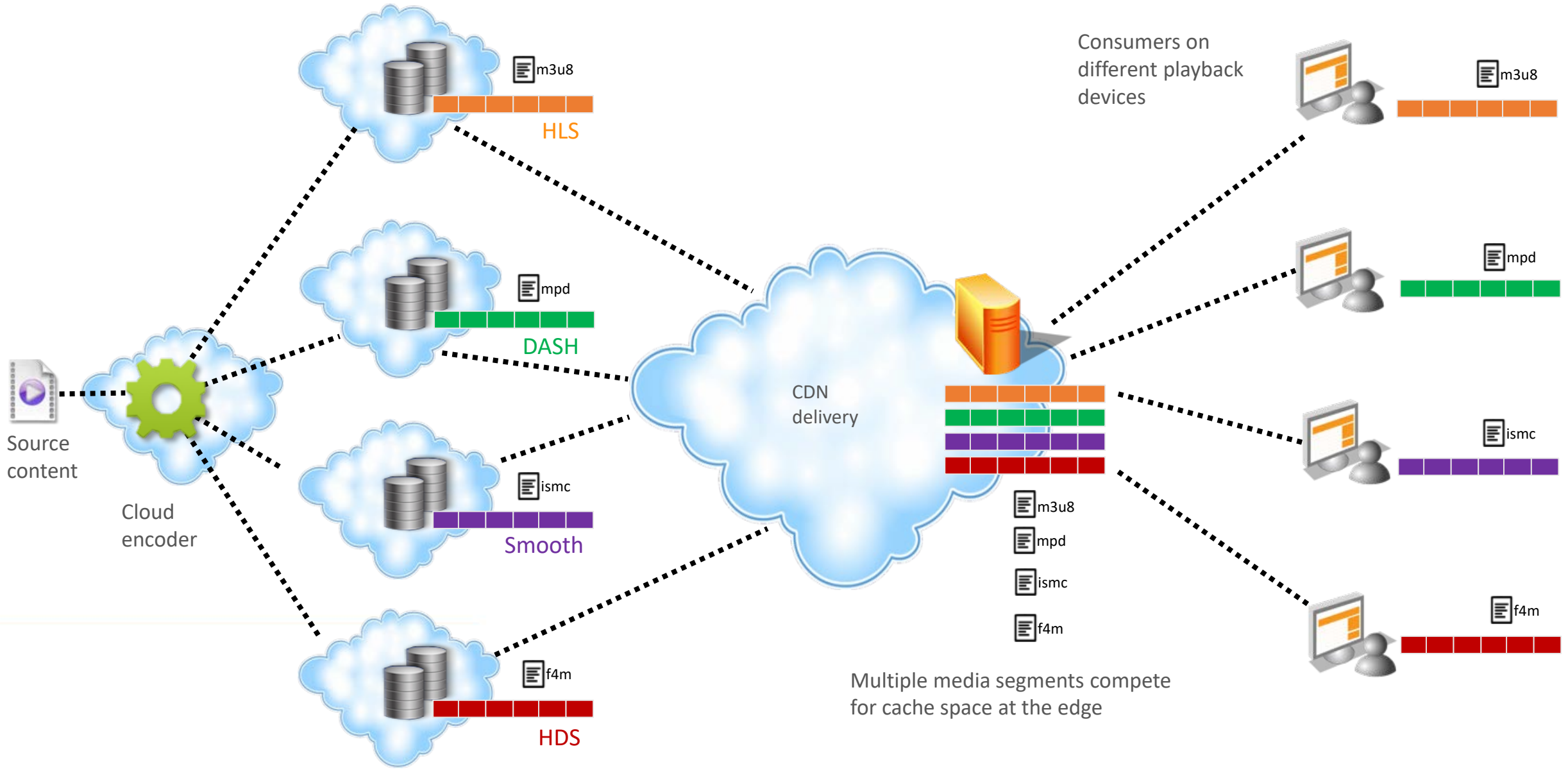
HLS– object hierarchy



MPEG DASH – object hierarchy



CMAF – Multi-platform OTT workflow today



CMAF History and Roadmap

- In January 2015, **Microsoft and Apple** proposed a new media format which would be common between HLS and DASH.
- Worked with other companies to develop the format.

CMAF Development Timeline: a very fast standardization pace (C. Concolato)

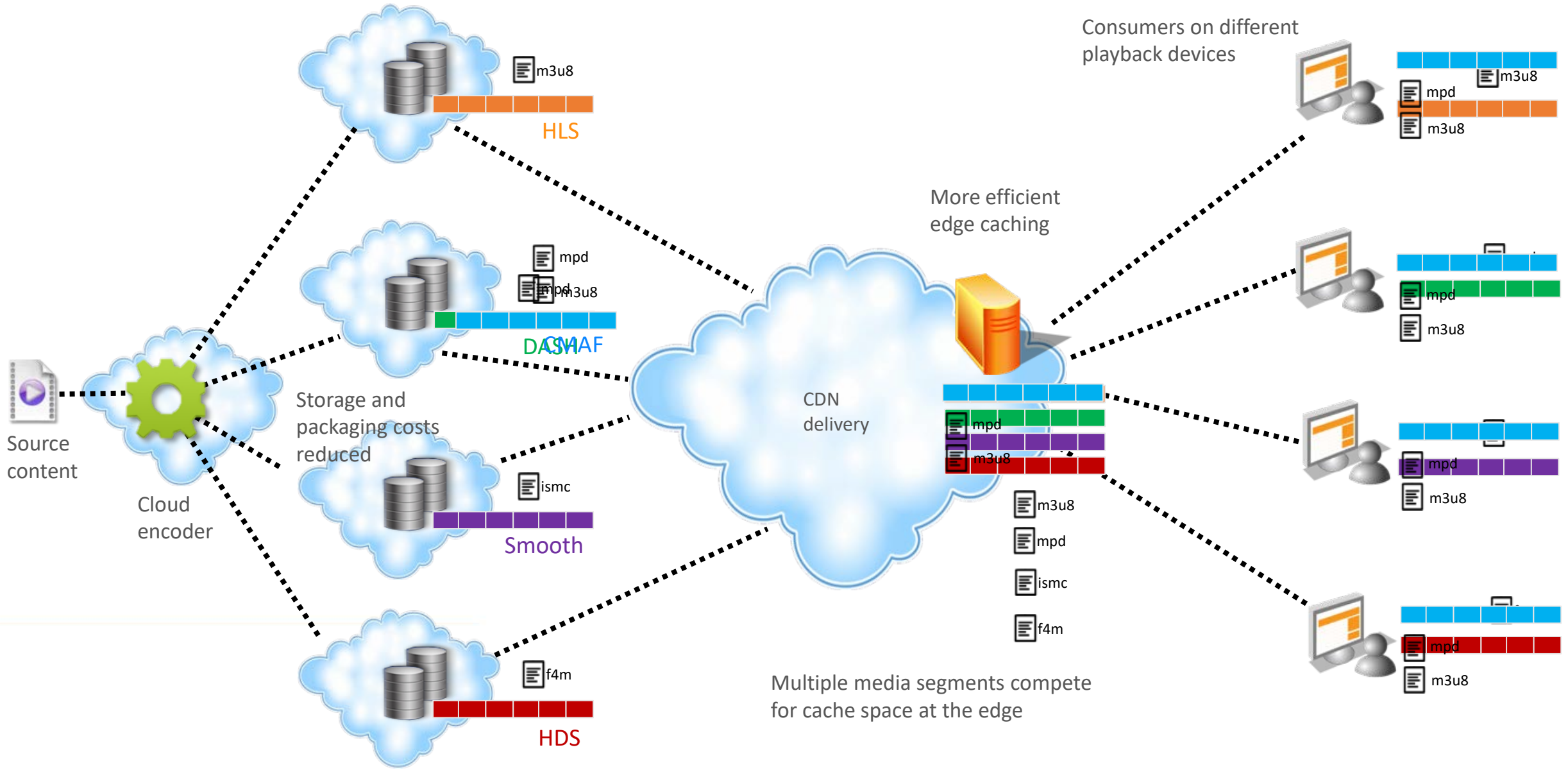
- Proposed Feb 2016 at MPEG's 114th meeting.
- "Requirement Proposal" presented by:
  - Adobe, Akamai, Apple, BBC, Cisco, Comcast, DTG, Ericsson, Fraunhofer, iStreamPlanet, LG Electronics, Microsoft, MLBAM, Qualcomm, Samsung, Starz, Telecom Italia, Turner, Verimatrix, WWE.
- "Draft Specification" presented by:
  - Apple, Microsoft, MLBAM, Cisco, Akamai and Comcast.
- MPEG approved the establishment of a new standard:

ISO/IEC 23000-19 - Common Media Application Format

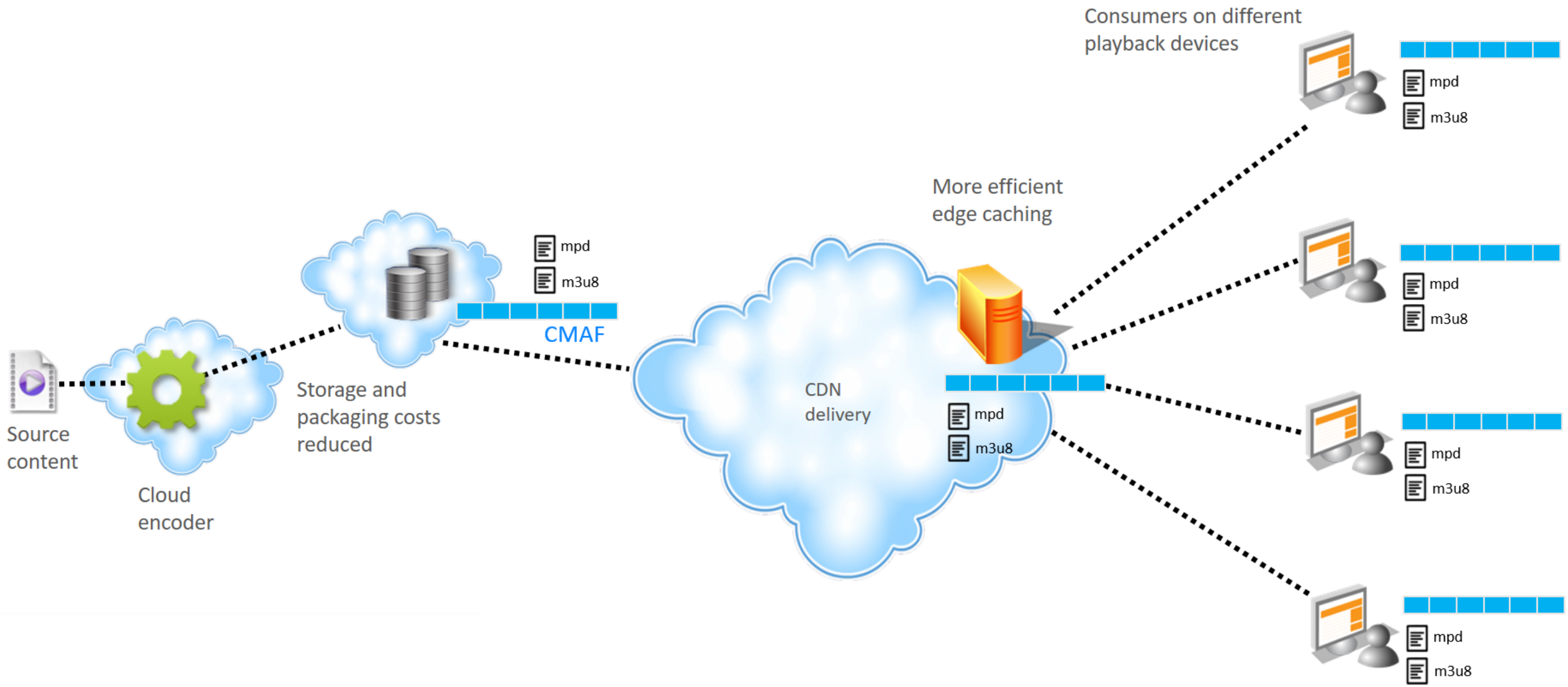
CMAF Scope

The Common Media Application Format defines the container that holds the audio and video content. It is not another presentation format itself.

Multi-platform OTT workflow with CMAF



Multi-platform OTT workflow with CMAF



Core Technologies

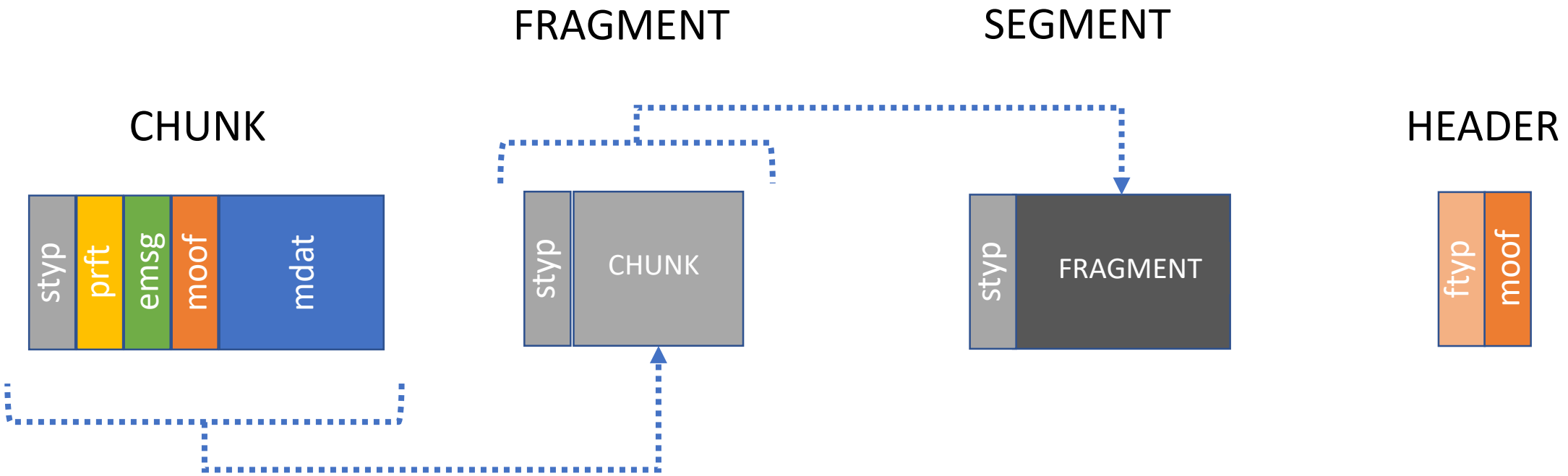
- **ISOBMFF**, fMP4 container, specifically ISO/IEC 14496-12:201
- Common Encryption (**CENC**) - ISO/IEC 23001-7: 2016
  - Allows “cenc”, “cbcs”, “cens” and “cbc1” modes of operation

- Supports the MPEG codec suite of
  - **AVC** (ISO/IEC 14496-10),
  - **AAC** (ISO/IEC 14496-3) and
  - **HEVC** (ISO/IEC 23008-2) codecs

  …in a baseline interoperability but allows other audio and video codecs (such as VP9 or Dolby AC4) to be signaled.

- Supports captioning and subtitles: **TTML IMSC1, WebVTT (CEAx08 allowed)**

Media Object Box Tables - Components



Logical Media Objects for delivery

TRACK FILE

SERIES OF SEGMENTS

CHUNKS

CMAF Defined brands

Brand	Location	Conformance Requirements
'cmfc'	FileTypeBox and SegmentTypeBox	CMAF Header CMAF Track Format
'cmfs'	SegmentTypeBox	CMAF Segments
'cmfl'	SegmentTypeBox	CMAF Chunks
'cmff'	SegmentTypeBox	CMAF Fragment (containing the first samples of the CMAF Fragment)

CMAF Presentation Profiles

urn:mpeg:cmaf:presentation_profile:cmfhd:2017

- At least ‘cfhd’ (HD video)
- At least ‘caac’ (AAC core audio)
- At least ‘im1t’ (IMSC1 Text subtitles)
- Not encrypted

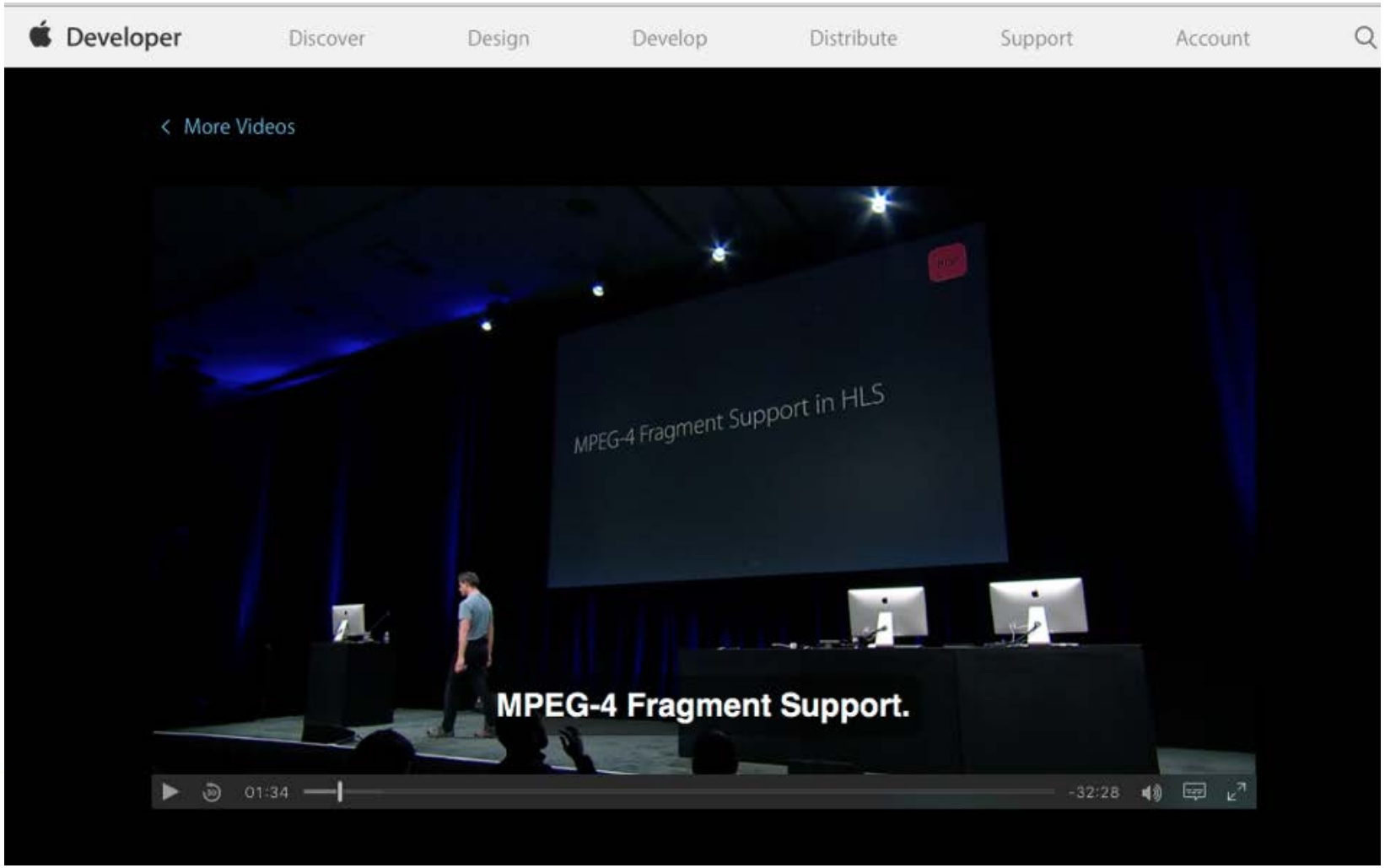
urn:mpeg:cmaf:presentation_profile:cmfhdc:2017

- CMFHD but with at least one ‘cenc’ encrypted media

urn:mpeg:cmaf:presentation_profile:cmfhds:2017

- CMFHD but with at least one ‘cbcs’ encrypted media

Apple Support



Apple @ WWDC, June 2016: "*Fragmented MPEG-4 (fMP4) will be added as a Segment format to the HLS spec, and that it will be supported on all Apple HLS clients.*"

Compatibility to CMAF and DASH ISO BMFF segment formats is available beginning with the following software releases: macOS 10.12, iOS 10, tvOS 10 *(released September 13th 2016)*

HLS and DASH with CMAF

HLS/TS

m3u8

.ts .ts
.ts .ts
.ts .ts
.ts .ts

DASH/ISO

mpd

.mp4 .mp4
.mp4 .mp4
.mp4 .mp4
.mp4 .mp4

DASH/HLS/CMAF

mpd m3u8

.mp4 .mp4
.mp4 .mp4
.mp4 .mp4
.mp4 .mp4

Live vs ondemand for DASH/HLS/CMAF

LIVE

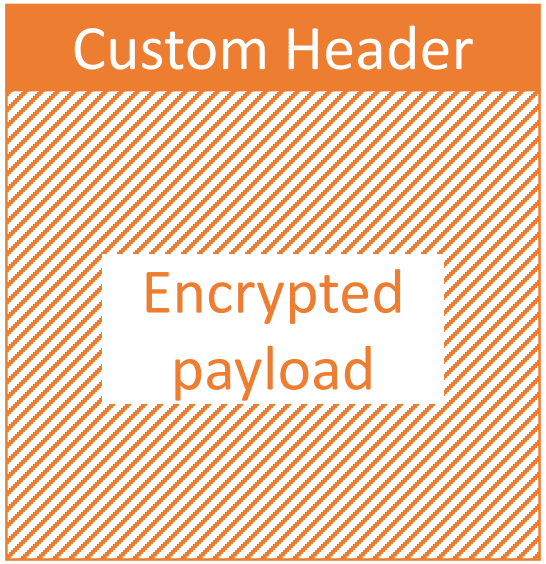
ONDEMAND

Track files

OR

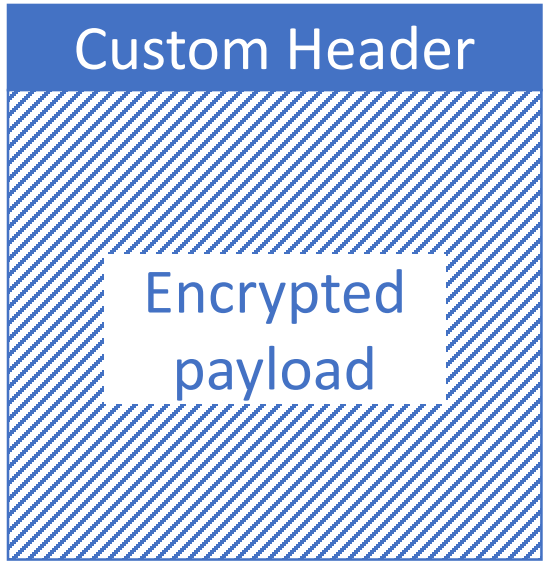
Separate segments

Common Encryption ISO/IEC 23001-7:2016



DRM “A”

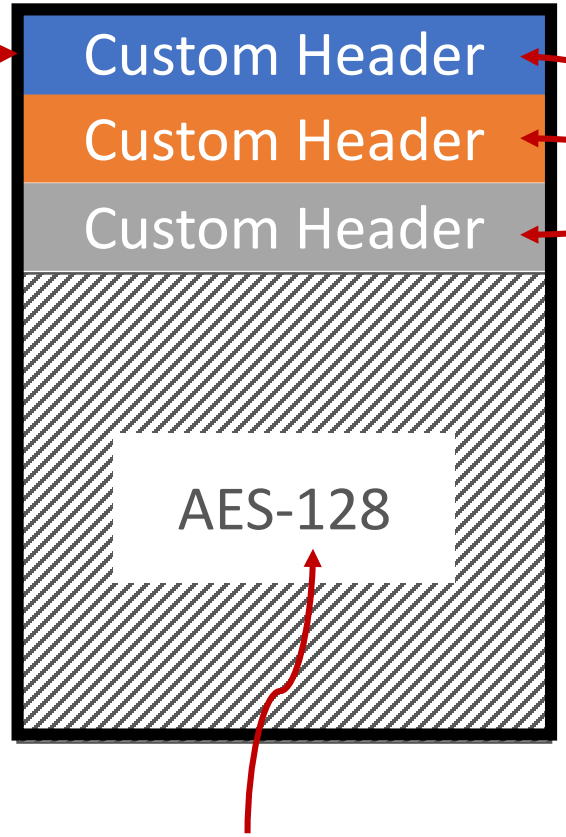
DRM “B”



DRM “C”

Common Encryption ISO/IEC 23001-7:2016

Single ISOBMFF container



Multiple concurrent DRM header information

AES-128 commonly encrypted audio or video payload

Common Encryption ISO/IEC 23001-7:2016

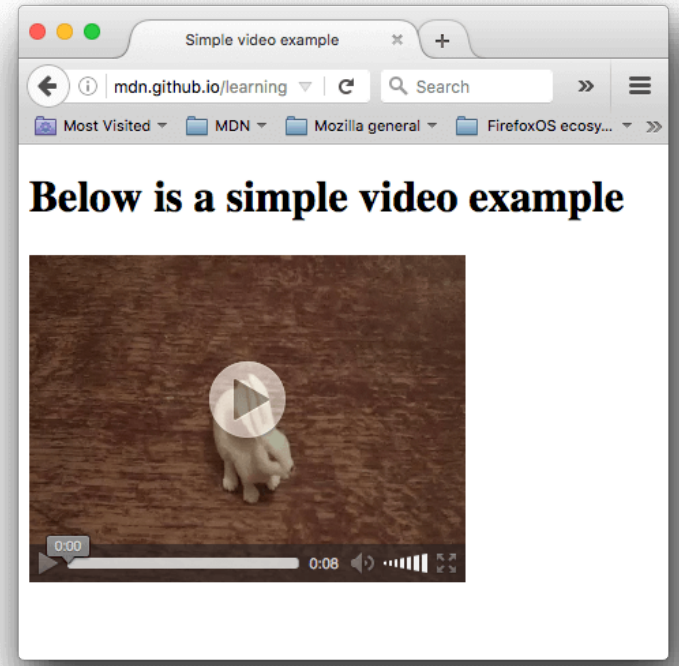
Unfortunately, there are 4 versions of AES-128 encryption that are allowed:

- **CENC AES-CTR** or **cenc**: CENC Protection Scheme using AES 128-bit keys in Counter Mode (AES-128 CTR)
- **CENC AES-CBC** or **cbc1**: CENC Protection Scheme using AES 128-bit keys in Cipher-block chaining mode (AES-128 CBC)
- **CENC AES-CTR Pattern** or **cens**: CENC Protection Scheme using AES 128-bit keys in Counter Mode (AES-128 CTR) using pattern of unencrypted/encrypted bytes
- **CENC AES-CBC Pattern** or **cbcs**: CENC Protection Scheme using AES 128-bit keys in Cipher-block chaining mode (AES-128 CBC) using pattern of unencrypted/encrypted bytes

…but only two versions are allowed in WAVE.

HTML Video


Windows Media Player
File View Play Favorites Go Help
Radio Music Media Guide
Windows Media
Show:
Clip:
Author:
Copyright:


Simple video example
mdn.github.io/learning
Search
Most Visited
MDN
Mozilla general
FirefoxOS ecosy...
Below is a simple video example
0:00
0:08


1:17:25
52:15
Everything Must Go


RealPlayer: DIRECTE CATALUNYA RADIO
Location: http://www.catradio.es/audio/dircatradio.ram?mode=compa
Click to Play!
LAUNCH
Interactive TV On Your Computer
Updated 10/2
Radio Tuner
Guide
Search
Message Service


You are watching
Battleground Did You Win?
3 minutes left
face match
closed captions
quality & buffer
settings

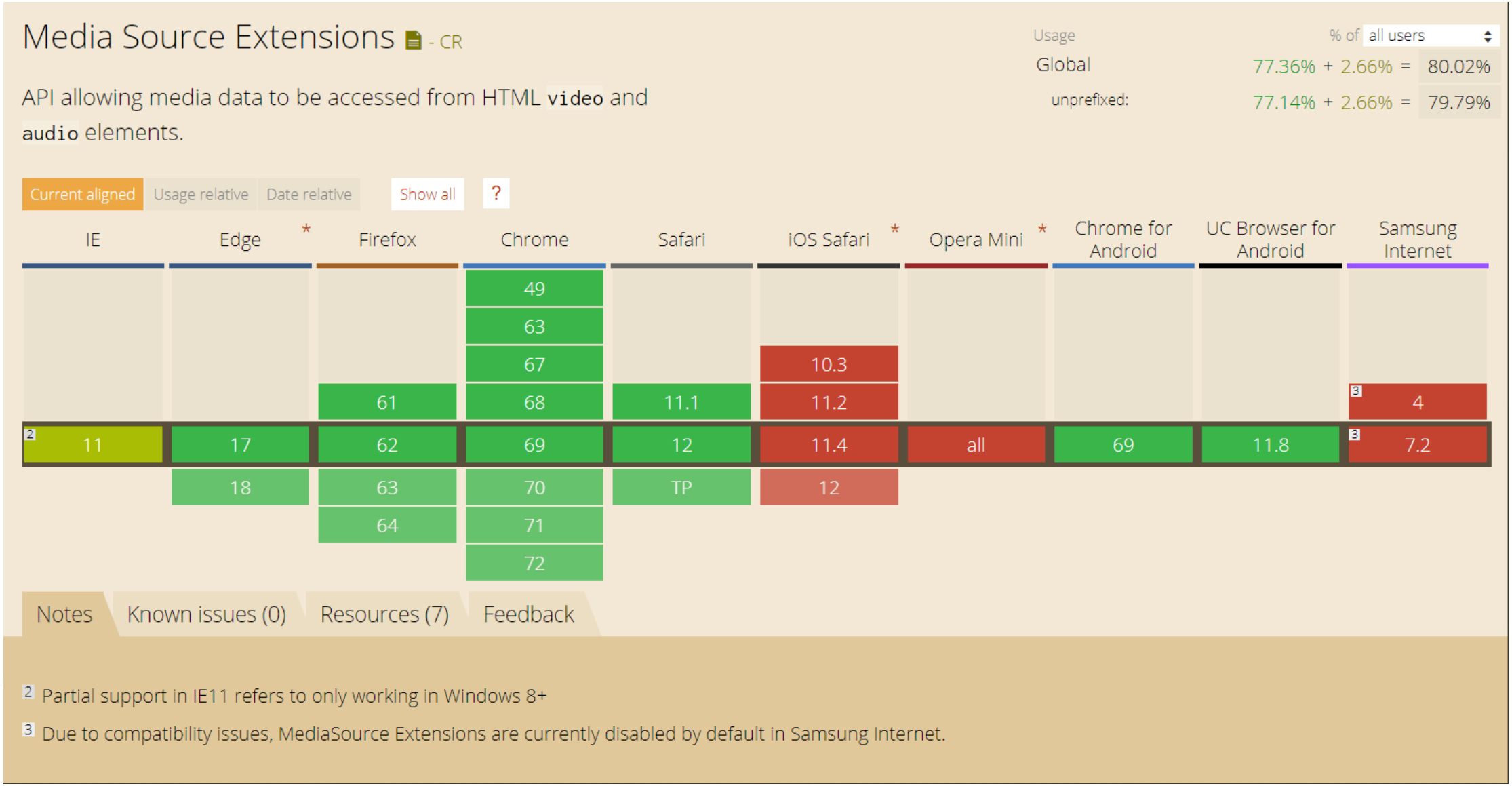
Media Source Extensions (MSE)

1. https://www.w3.org/TR/media-source/
2. This specification extends HTMLMediaElement to allow JavaScript to generate media streams for playback.
3. Allows the creation of <audio>, <video> and <text> source buffers.
4. Delivery is format agnostic.

Encrypted Media Extensions (EME)

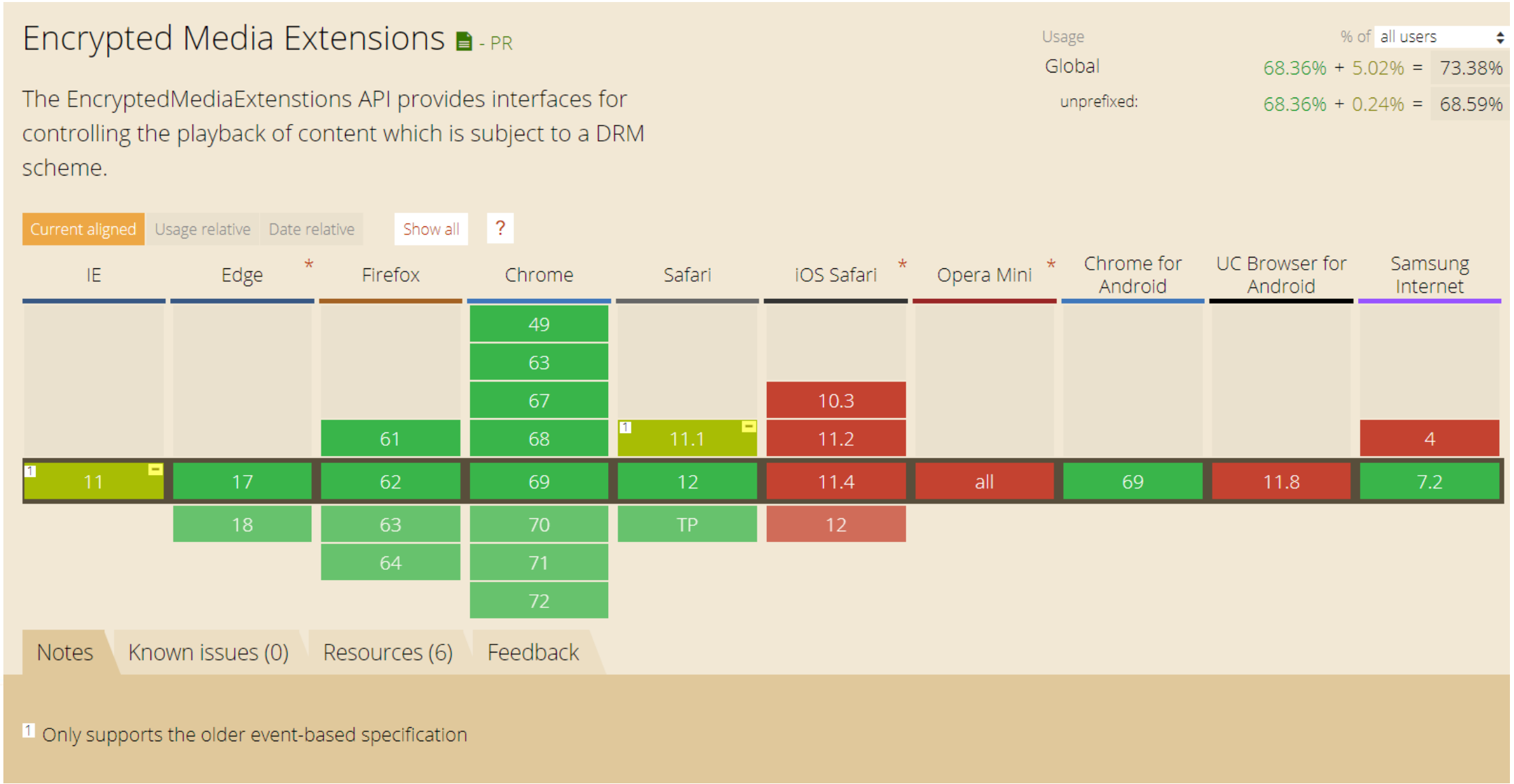
1. W3C standard https://www.w3.org/TR/encrypted-media/
2. This proposal extends HTMLMediaElement providing APIs to control playback of protected content.
3. The API supports use cases ranging from simple clear key decryption to high value video (given an appropriate user agent implementation). License/key exchange is controlled by the application, facilitating the development of robust playback applications supporting a range of content decryption and protection technologies.

Which browser code bases support MSE today?



Source: https://caniuse.com/#search=mse

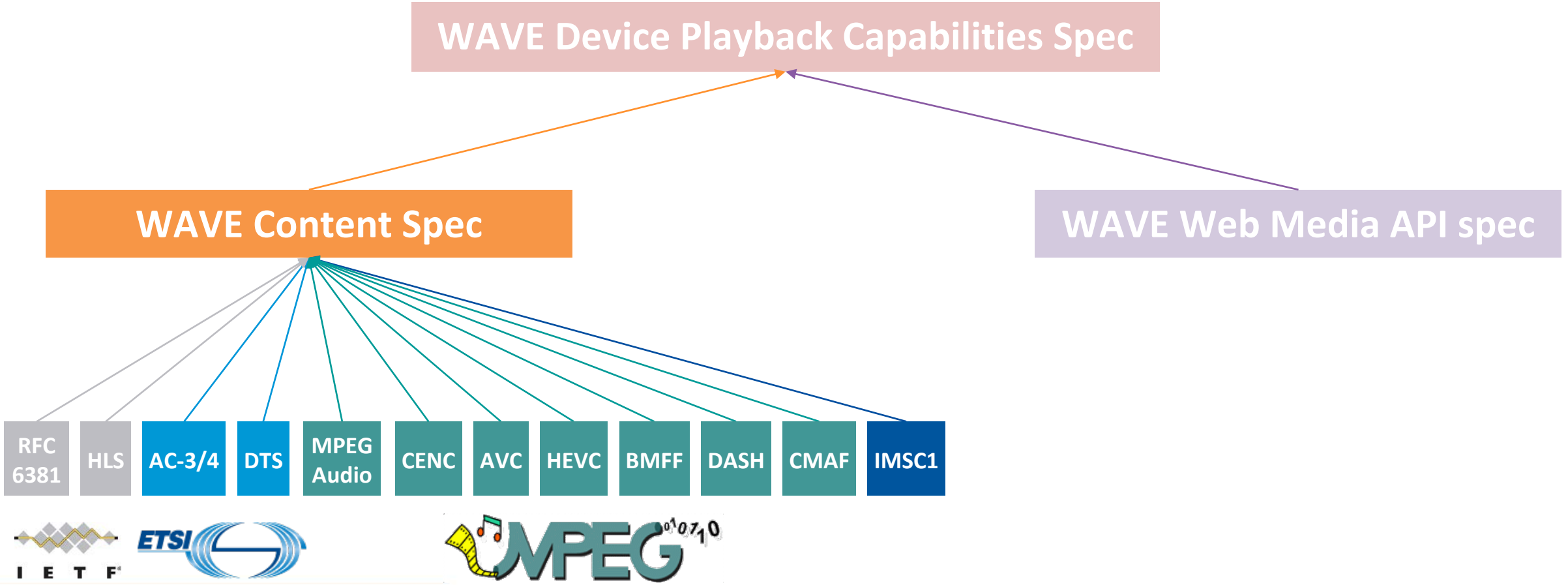
Which browser code bases support EME today?



Source: https://caniuse.com/#search=eme

HTML5 players….many choices!

Content Specification

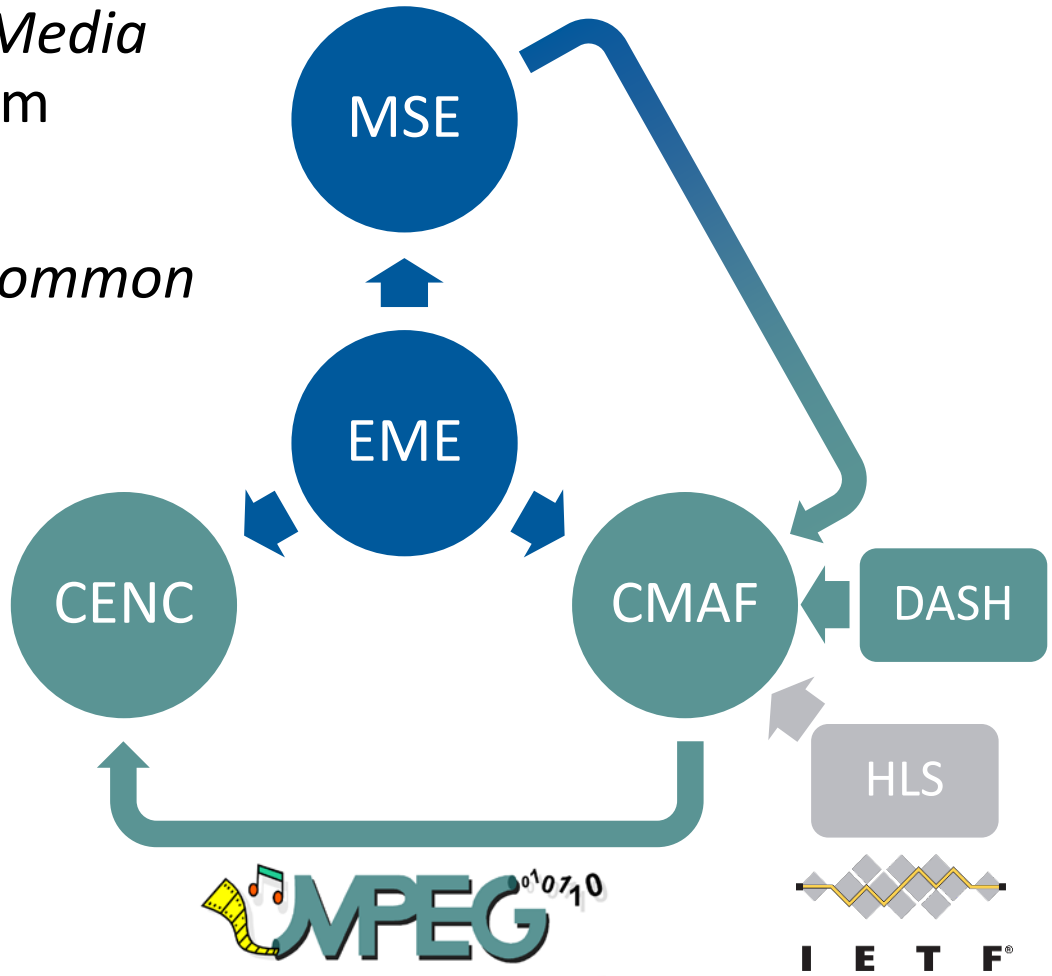


WAVE Content in Context

HTML5 *Media Source Extensions* (MSE) and *Encrypted Media Extensions* (EME) work together to enable cross-platform commercial media web apps

MSE works with segmented media formats like MPEG *Common Media Application Format* (CMAF).

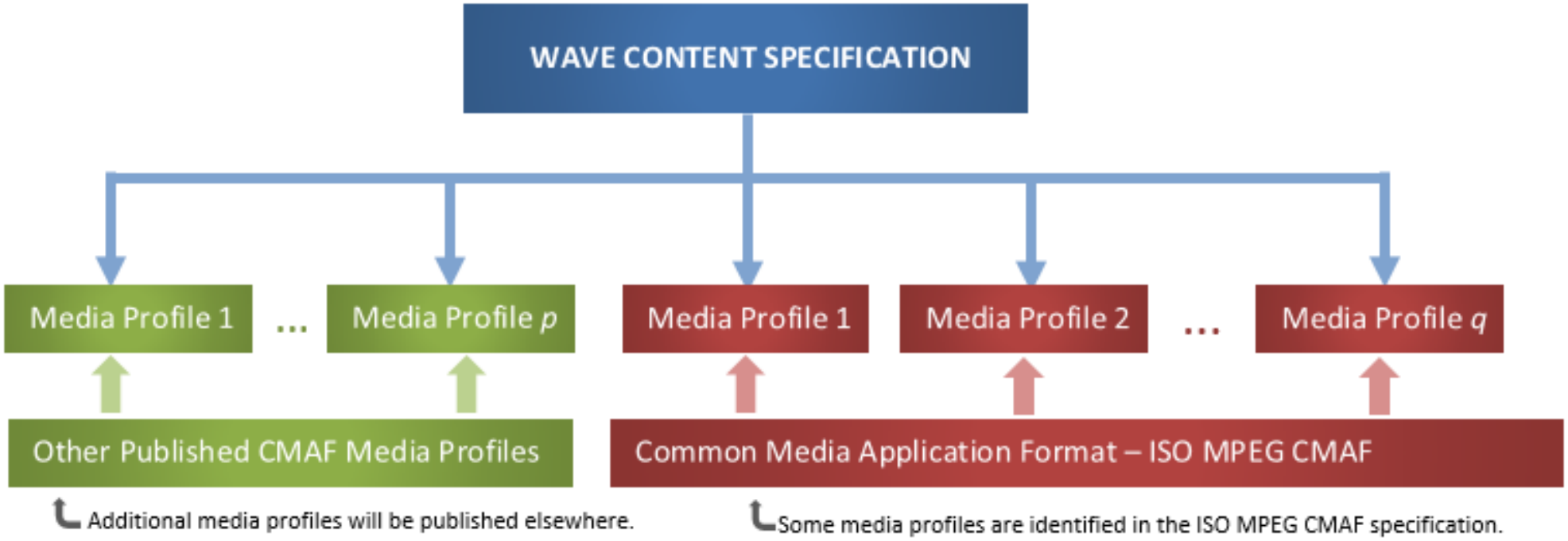
CMAF supports DRM-interop using MPEG *Common Encryption* (CENC); both work with EME.



Media presentations can be delivered with MPEG *Dynamic Adaptive Streaming over HTTP* (DASH) or Apple's IETF-published *HTTP Live Streaming* (HLS); both work with CMAF.

WAVE exists because the well-coordinated, global adoption of these standards can transform both the broadcast and Internet industries.

WAVE Content Spec and Published CMAF Media Profiles



- CMAF presentations can be constructed from a variety of codecs – the binding to the CMAF container format is called a "Media Profiles".
- CMAF defines 1) CMAF bindings for a variety of MPEG codecs, 2) extensibility for bindings outside MPEG.
- WAVE has an objective process to qualify Media Profiles for the WAVE Content Specification
  - Market relevance, MSE compatibility, and schedule for availability of test tools / test content.
  - WAVE's adoption of new Media Profiles is an ongoing process.

WAVE Content Specification 2018 - Video Profiles

Media Profile Name	*INFORMATIVE* Codec	*INFORMATIVE* Profile	*INFORMATIVE* Level	*INFORMATIVE* Color primaries & matrix coefficients	*INFORMATIVE* Transfer Characteristics	*INFORMATIVE* 'codecs' MIME subparameters	NORMATIVE CMAF Brand	NORMATIVE Normative Reference
HD	AVC	High	4.0	1 (BT.709)	1 (BT.709 OETF)	avc1.640028 avc3.640028	'cfhd'	[CMAF] Table A.1
HHD10	HEVC	Main10 MainTier	4.1	1 (BT.709)	1 (BT.709)	hev1.2.4.L123.B0 hvc1.2.4.L123.B0	'chh1'	[CMAF] Table B.1
UHD10	HEVC	Main10 MainTier 10-bit	5.1	1 (BT.709) 9 (BT.2020)	1 (BT.709 OETF) 14 (BT.2020 OETF)	hev1.2.4.L153.B0 hvc1.2.4.L153.B0	'cud1'	[CMAF] Table B.1
HLG10	HEVC	Main10 MainTier 10-bit	5.1	9 (BT-2020)	18 (BT.2100 Table 5 HLG OETF) 14 (BT.2020 OETF)	hev1.2.4.L153.B0 hvc1.2.4.L153.B0	'clg1'	[CMAF] Table B.1
HDR10	HEVC	Main10 MainTier 10-bit	5.1	9 (BT.2020)	16 (BT.2100 Table 4 PQ EOTF)	hev1.2.4.L153.B0 hvc1.2.4.L153.B0	'chd1'	[CMAF] Table B.1

The 2018 Edition of the WAVE Content Specification includes these video Media Profiles. Additional media profiles are likely to be added in an amendment prior to the 2019 edition of the WAVE Content Specification.

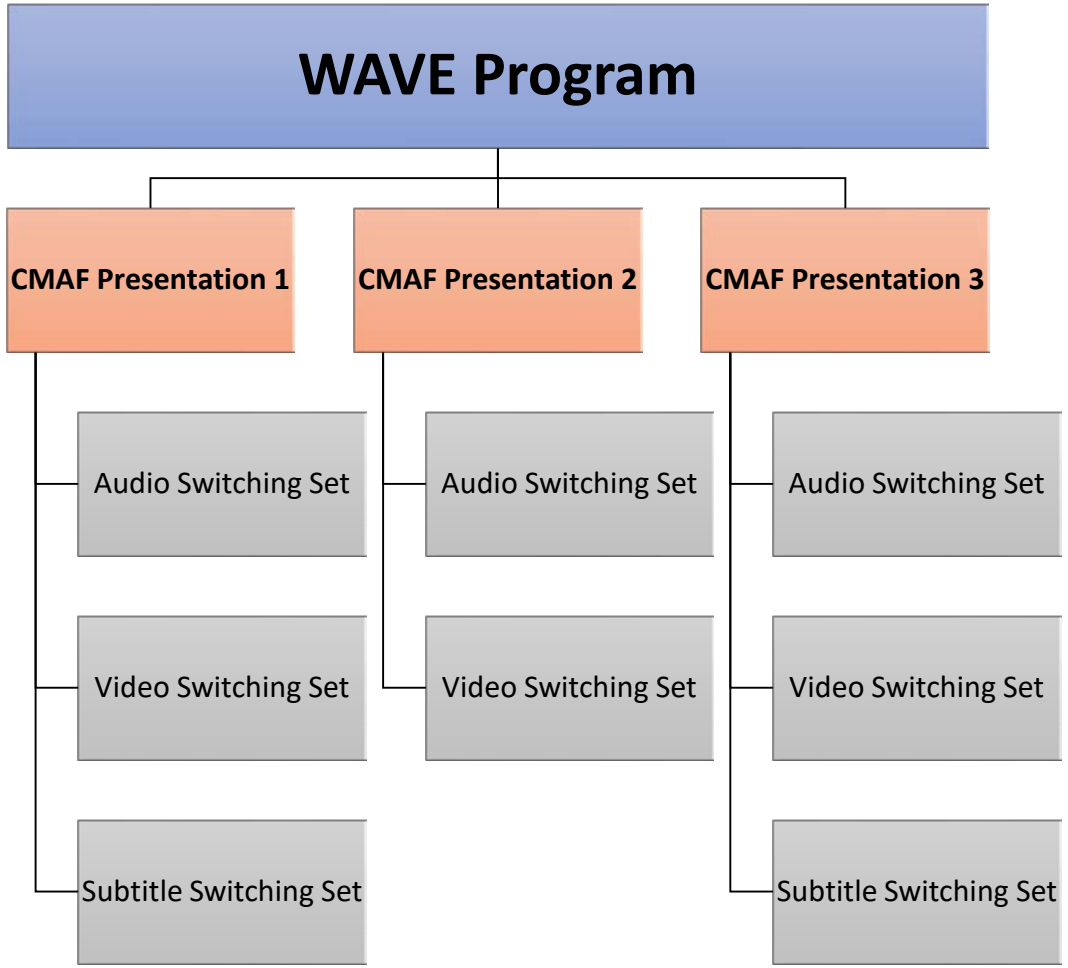
WAVE Content Spec 2018 - Audio Profiles

- Some organizations outside MPEG are publishing bindings specifications for CMAF.
- ETSI is publishing CMAF bindings specs for Dolby and DTS audio codecs.
- Other organizations have suggested they will publish CMAF bindings in 2018.
- The WAVE Content Specification also includes both IMSC1 Text and Image CMAF bindings.

Media Profile Name	*INFORMATIVE* Codec Family	*INFORMATIVE* Allowed Codecs or Profiles	*INFORMATIVE* Level	*INFORMATIVE* 'codecs' MIME subparameter	NORMATIVE CMAF Brand	NORMATIVE Normative Reference
AAC Core	AAC	AAC-LC, HE-AAC or HE-AAC v2	2	mp4a.40.2 mp4a.40.5 mp4a.40.29	'caac'	[CMAF] Table A.2
Adaptive AAC Core	AAC	AAC-LC, HE-AAC or HE-AAC v2	2	mp4a.40.2 mp4a.40.5 mp4a.40.29	'caaa'	[CMAF] Table A.2
AAC Multichannel	AAC	AAC-LC, HE-AAC	6	mp4a.40.2 mp4a.40.5 mp4a.40.29	'camc'	[CMAF A1] Table i.2
DTS-HD	DTS-HD	DTS, DTS-HD	n.a.	dtsc, dtse, dtsh	'dts1'	[DTS-HD]
AC-3 and Enhanced AC-3	AC-3 EAC-3	AC-3 EAC-3	n.a.	ec-3	'ceac'	[EAC3]
AC-4, Single Stream	AC-4	AC-4	3	ac-4.02.01.03	'ca4s'	[AC4]
MPEG-H, Single Stream	MPEG-H	Low Complexity (LC)	3	mhm1.0x0B mhm1.0x0C mhm1.0x0D	'cmhs'	[CMAF A1] Table j.2

WAVE Programs and Live Linear Content

- *WAVE Program*: Defined as a sequence of one or more CMAF Presentations.
  - Why? Because live linear content with ad insertions may require multiple CMAF Presentations (unlike VOD).
- A WAVE Program can (optionally) conform to a WAVE *Splice Constraint Profile*.
- The *Baseline Splice Constraint Profile* is:
  - Encoding constraints to enable continuous rendering of sequential Switching Sets in WAVE Programs
  - Intended for most existing adaptive streaming Players in the market today.
- WAVE will publish new, more advanced Splice Constraint Profiles as new devices enter the market.



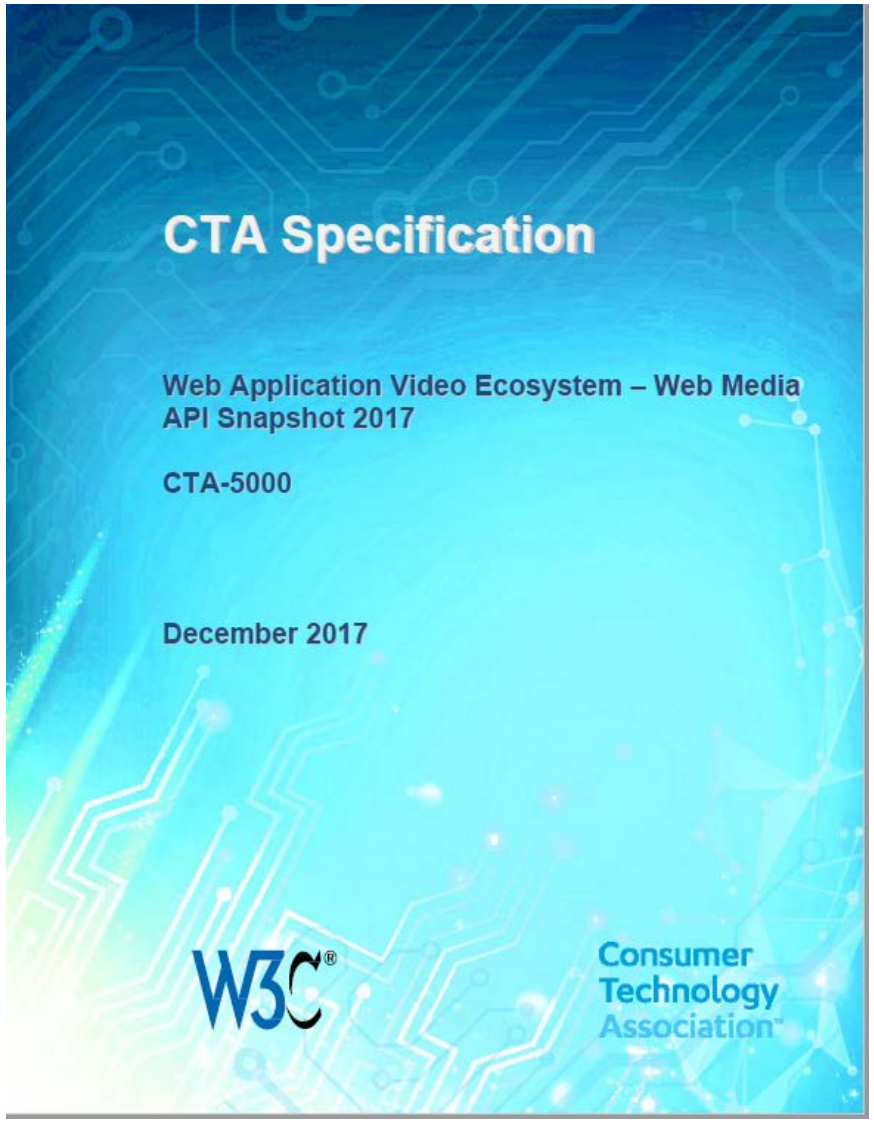
Continuous Rendering for a continuous user experience

The WAVE Content Specification

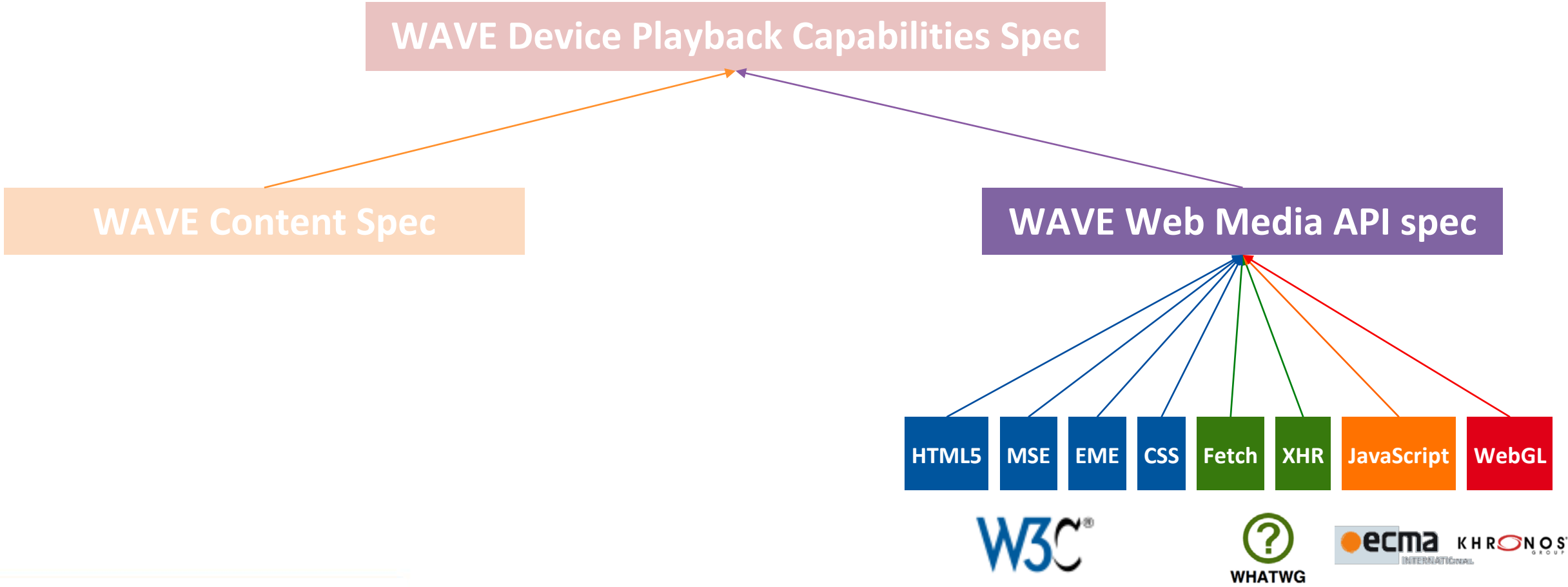
Download WAVE specifications in PDF format at:

https://cta.tech/WAVE

*This is a **free** download.*



HTML5 API Specification



HTML5 APIs: Reference Platform

One Content Format...

...but multiple devices

Reference Platform

Write reference tests in HTML5…

… then port tests to device platforms.

(HTML5 platforms run tests directly.)

HTM5 API Task Force: Work Plan

- **Web Media API Community Group:**
  - w3.org/community/webmediaapi/

1. **Annual Web Media API spec**
   - define baseline web APIs to support media web apps.
2. **Guidelines for media web app developers**
3. **Identify gaps in current web APIs**
   - work with W3C Working Groups to update web standards.

Web Media API Snapshot 2017

W3C Community Group Final Report

Web Media API Snapshot 2017

Final Community Group Report 20 December 2017

Latest editor's draft:
https://w3c.github.io/webmediaapi/

Editors:
David Evans, British Broadcasting Corporation
Mark Vickers, Comcast

Participate:
GitHub w3c/webmediaapi
File a bug
Commit history

Abstract

This specification lists the Web APIs to support media web apps that are supported across all four of the most widely used user agent code bases at the time of publication. This specification should be updated at least annually to keep pace with the evolving Web platform. We encourage manufacturers to develop products that support the APIs in the most recent version of Web Media API Snapshot. This specification is comprised of references to existing specifications in W3C and other specification groups. The target devices will include any device that runs a modern HTML user agent, including televisions, game machines, set-top boxes, mobile devices and personal computers.

The goal of this Web Media API Community Group specification is to transition to the W3C Recommendation Track for standards development.

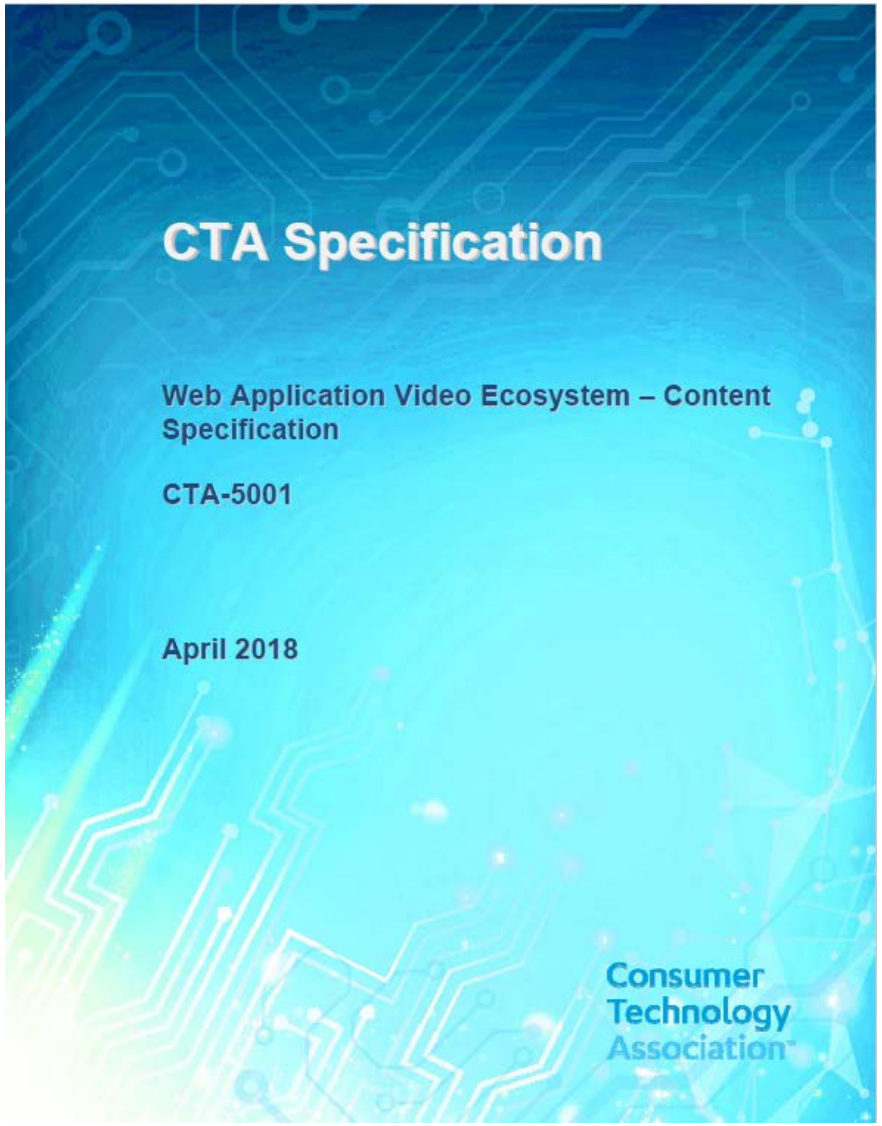
- **First annual API Snapshot published 20 December 2017:** https://www.w3.org/2017/12/webmediaapi.html
  - Lists key APIs supported in 2017 in all major HTML code bases.
  - CTA-W3C agreement to co-publish this spec.
  - Plan to propose Community Group spec as a W3C standards track spec
  - CTA WAVE released a test suite for all listed APIs based on W3C API tests (https://webapitests2017.ctawave.org).
  - Test suite will enable manufacturers to test that their HTML support is up-to-date!

The WAVE Web Media API Snapshot 2017

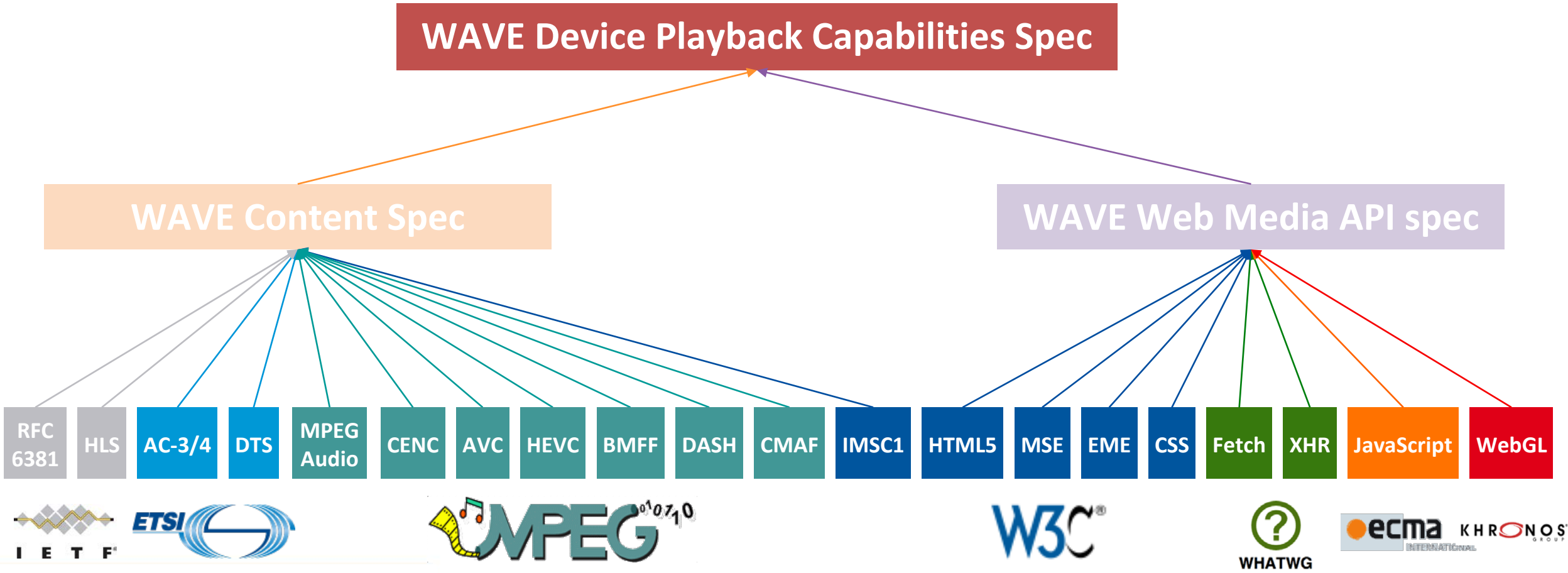
Download WAVE specifications in PDF format at:

https://cta.tech/WAVE

*This is a **free** download.*



Device Playback Capabilities Specification



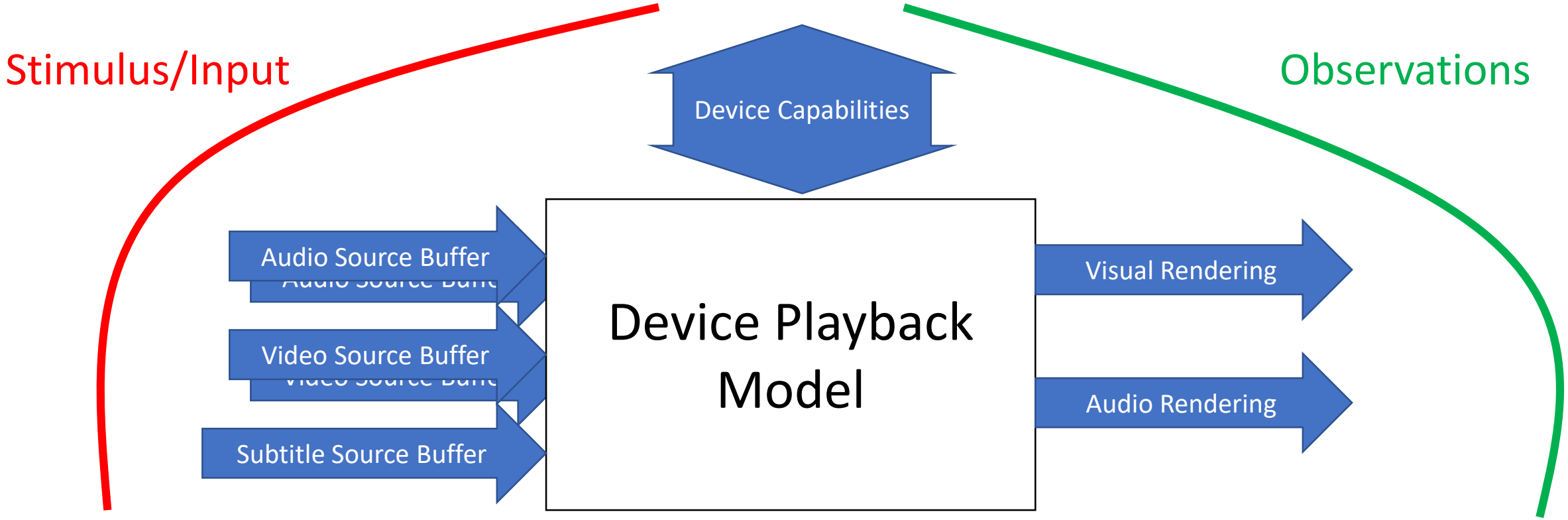
OTT Device Performance Challenges

- Ad splicing problems
- Regional profiles (50/60Hz)
- Request protocol deficiencies
- Unknown codec capabilities
- Unknown rendering capabilities
- Partial profile support
- Codec incompatibility
- Long-term playback instability
- Late Binding Synchronization
- Audio discontinuities
- Glitches when switching bitrate
- Memory problems
- Limited processing power
- Long start-up delay
- Performance monitoring
- DRM support
- Variable HDR support
- Scaling display issues

Device Playback Focus

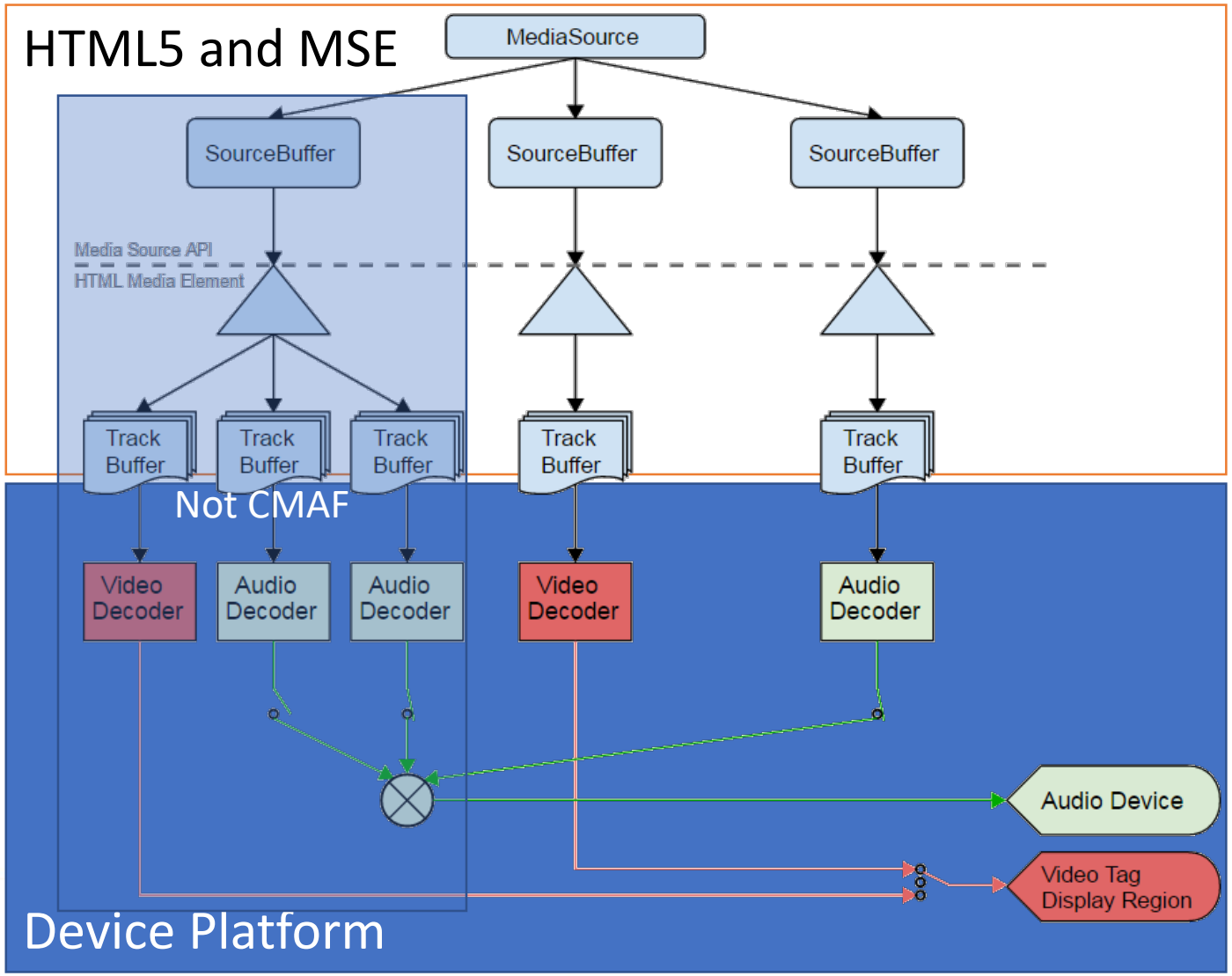
- Device definition:
  - Codecs & Rendering, possibly on different devices (HDMI, Miracast, etc.)
- Capabilities discovery
- Playback of *a Presentation (of Media Profiles)*
  - Player Requirements such as splicing segments, switching, random access
- Playback of *a sequence of Presentations*
  - Splicing—for example for ad insertion or program boundaries
- Other playback capabilities, e.g. support for multiple decoders

Abstracted Device Playback Model



Requirements: If you input WAVE content, this shall be the observation

Connection to HTML5 & MSE



HTML5 and MSE

- Provide APIs for applications to playback WAVE content
- Extend APIs to ensure more consistent and richer user experience

Device Playback Platform:

- Ensuring that WAVE content can be “played” consistently when using “MSE-like” APIs for different use cases and applications.
- Use HTML5 as reference and test platform, not excluding other platforms

Device Playback

One of the key missing pieces for consistent Internet TV Services

Media Source Extension

- Extends HTMLMediaElement
- Enables JavaScript to generate media streams for playback.
- Allowing JavaScript to generate streams facilitates a variety of use cases like adaptive streaming and time shifting live streams.

ByteStream Format for ISO BMFF

- https://www.w3.org/TR/mse-byte-stream-format-isobmff/
- This specification defines a Media Source Extensions™ [MEDIA-SOURCE] byte stream format specification based on the ISO Base Media File Format.

```
var ms = new MediaSource();
video.src = window.URL.createObjectURL(ms);
ms.addEventListener('sourceopen', onMediaSourceOpen);

function onMediaSourceOpen() {
  sourceBuffer = ms.addSourceBuffer('video/mp4; codecs="avc1.4d401f"');
  sourceBuffer.addEventListener('updateend', nextSegment);

  GET(initUrl, appendToBuffer);

  video.play();
}

function nextSegment() {
  var url = templateUrl.replace('$Number$', index);
  GET(url, appendToBuffer);
  index++;
  if (index > numberOfChunks) {
    sourceBuffer.removeEventListener('updateend', nextSegment);
  }
}

function appendToBuffer(videoChunk) {
  if (videoChunk) {
    sourceBuffer.appendBuffer(new Uint8Array(videoChunk));
  }
}
```

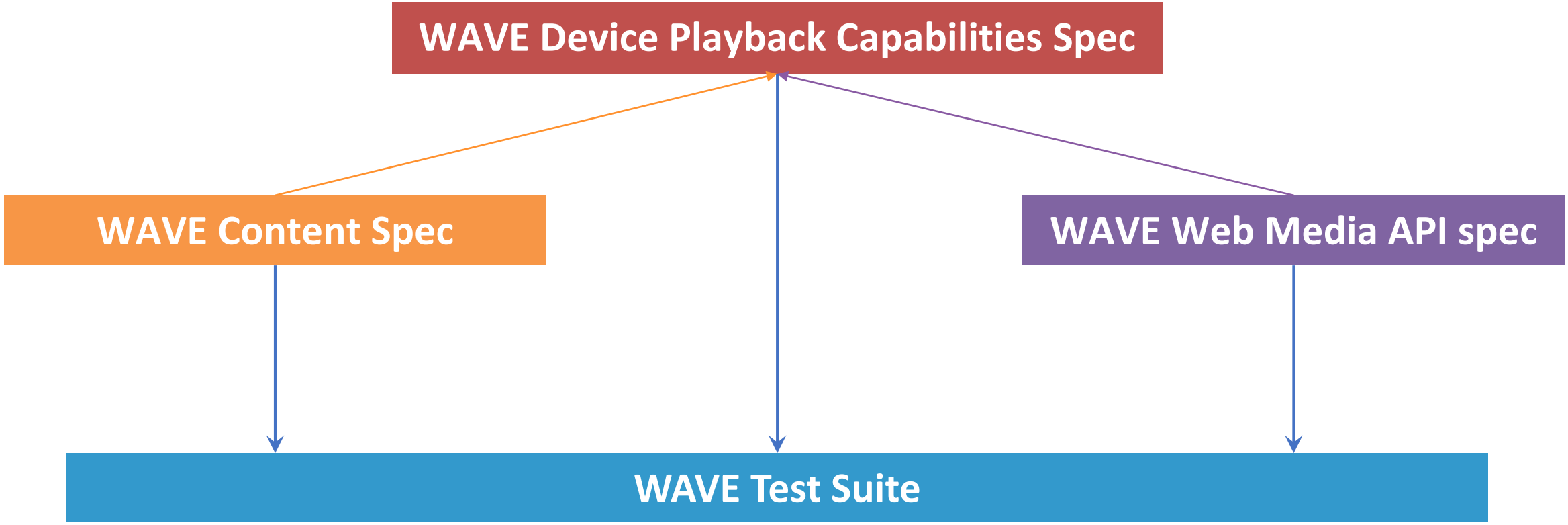
Capabilities Discovery by the Player App

- Apps need to know device capabilities—but it is not (yet) fully available
- Some possibilities under discussion:
  - `isSupportedType()` or `canPlayType()` APIs
    - Use MIME type to check device support of Media Profile
  - Device Platform can provide an API to check Media Profiles
    - Media Profile is provided in the manifest or in the CMAF Header (ftyp box).
  - MIME Subparameters
    - App uses a detailed MIME type string when checking capabilities
  - Media Capabilities API
    - Published by the W3C Web Platform Incubator Community Group
    - See https://wicg.github.io/media-capabilities/
- This topic is still under discussion

Device Playback – Next Steps

- Specification release – Q4 2018
- Test suite development begins – Q4 2018
  - Relies on specification
  - RFP process in Q4, award and development starting in Q1 2019
- Annual updates

WAVE Test Suite



Questions addressed with the WAVE Test Suite

- Given a content stream,

1. Does it comply to WAVE Content Spec requirements?

- Given a device platform with a User Agent,

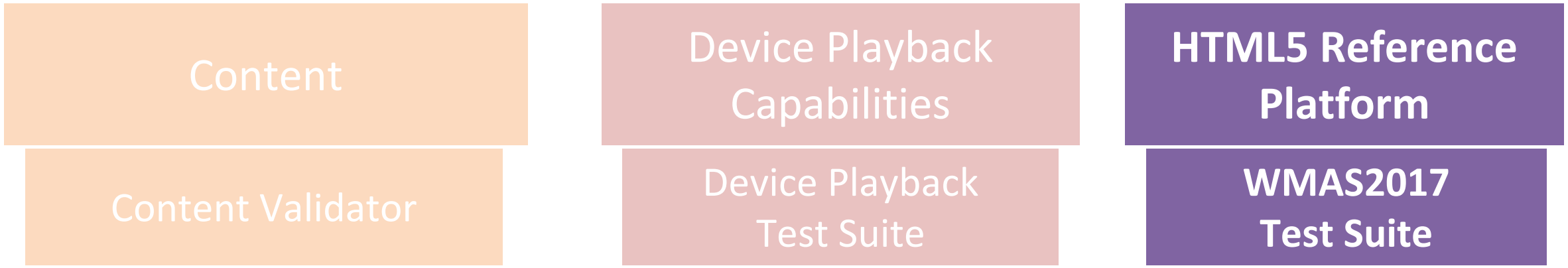
2. Does the underlying platform meet Device Playback Capabilities Spec requirements?

3. Does the API comply to WAVE HTML5 API requirements?

WAVE Approach to Test

- Compliance program (not certification or “logo” program)
- Partner with other groups where possible (e.g. DASH-IF, W3C)
  - Extend existing test efforts
  - Some new WAVE use cases lead to new tests
- WAVE arranges for the creation of new test material as needed
  - Cooperate with partner groups
  - Avoid hard ‘forks’ of existing open source tests
  - Continue licensing agreements on existing projects
  - Currently using “free, open source” model

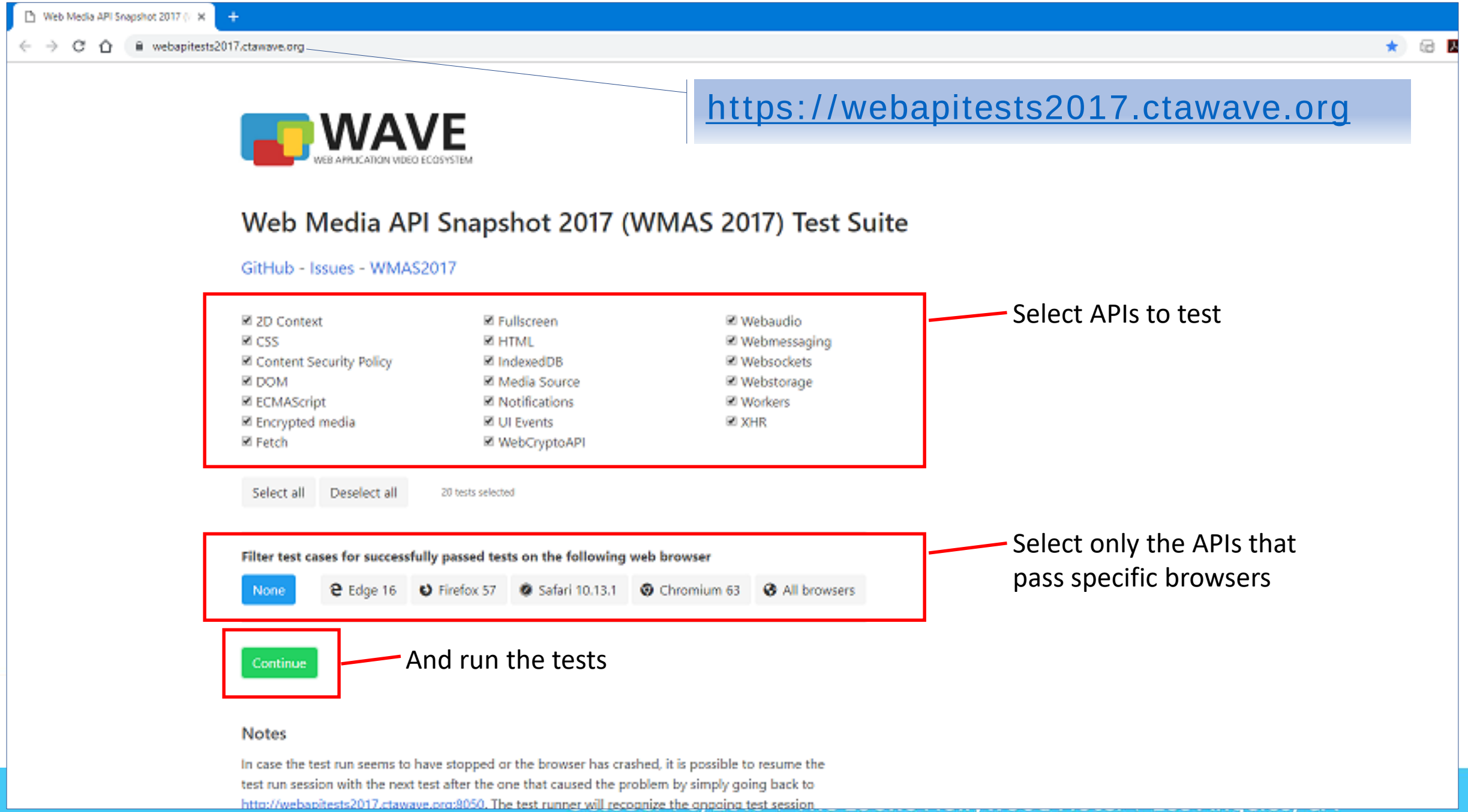
WAVE HTML5 API Test Suite



- Based on W3C Web Platform Tests under agreement with W3C
- Verifies API under certain assumptions
- Published and available now

WMAS2017 Test Suite – Assumptions

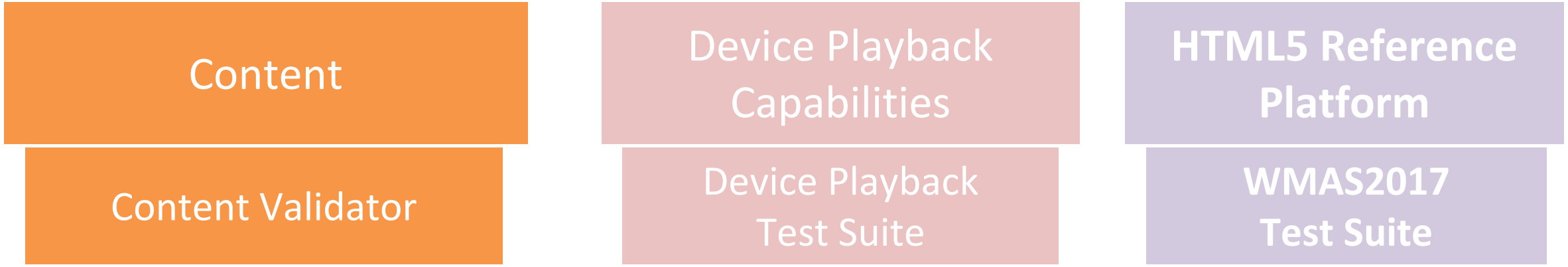
- Based on Web Media API Snapshot 2017 (WMAS2017) specification
- Modified to run on general-purpose *and* embedded systems
  - E.g., laptops/tablets/phones *and* smart TVs/media sticks/STBs
- Targets APIs that pass on the four main browser codebases (Chromium, Edge, Gecko, WebKit; using CanIUse.com)
- Verified on:
  - Downloadable browsers (cf. codebases)
  - Three embedded systems (smart TV, media stick, gaming console)


Web Media API Snapshot 2017
webapitests2017.ctawave.org
https://webapitests2017.ctawave.org
WAVE
WEB APPLICATION VIDEO ECOSYSTEM
Web Media API Snapshot 2017 (WMAS 2017) Test Suite
GitHub - Issues - WMAS2017
2D Context
CSS
Content Security Policy
DOM
ECMAScript
Encrypted media
Fetch
Fullscreen
HTML
IndexedDB
Media Source
Notifications
UI Events
WebCryptoAPI
Webaudio
Webmessaging
Websockets
Webstorage
Workers
XHR
Select APIs to test
Select all
Deselect all
20 tests selected
Filter test cases for successfully passed tests on the following web browser
None
Edge 16
Firefox 57
Safari 10.13.1
Chromium 63
All browsers
Select only the APIs that pass specific browsers
Continue
And run the tests
Notes
In case the test run seems to have stopped or the browser has crashed, it is possible to resume the test run session with the next test after the one that caused the problem by simply going back to
http://webapitests2017.ctawave.org:8050. The test runner will recognize the ongoing test session

WAVE Test Material – HTML5 API Reference Platform

- Web Media API Snapshot 2017 Test Suite
  - Test drive live (unblock port 8050)
    - https://webapitests2017.ctawave.org/
  - Open Source version (for porting to e.g. smart TVs)
    - https://github.com/cta-wave/WMAS2017
  - Issues list *(public—if you encounter a bug or need a feature)*
    - https://github.com/cta-wave/WMAS2017/issues

WAVE Content Validator

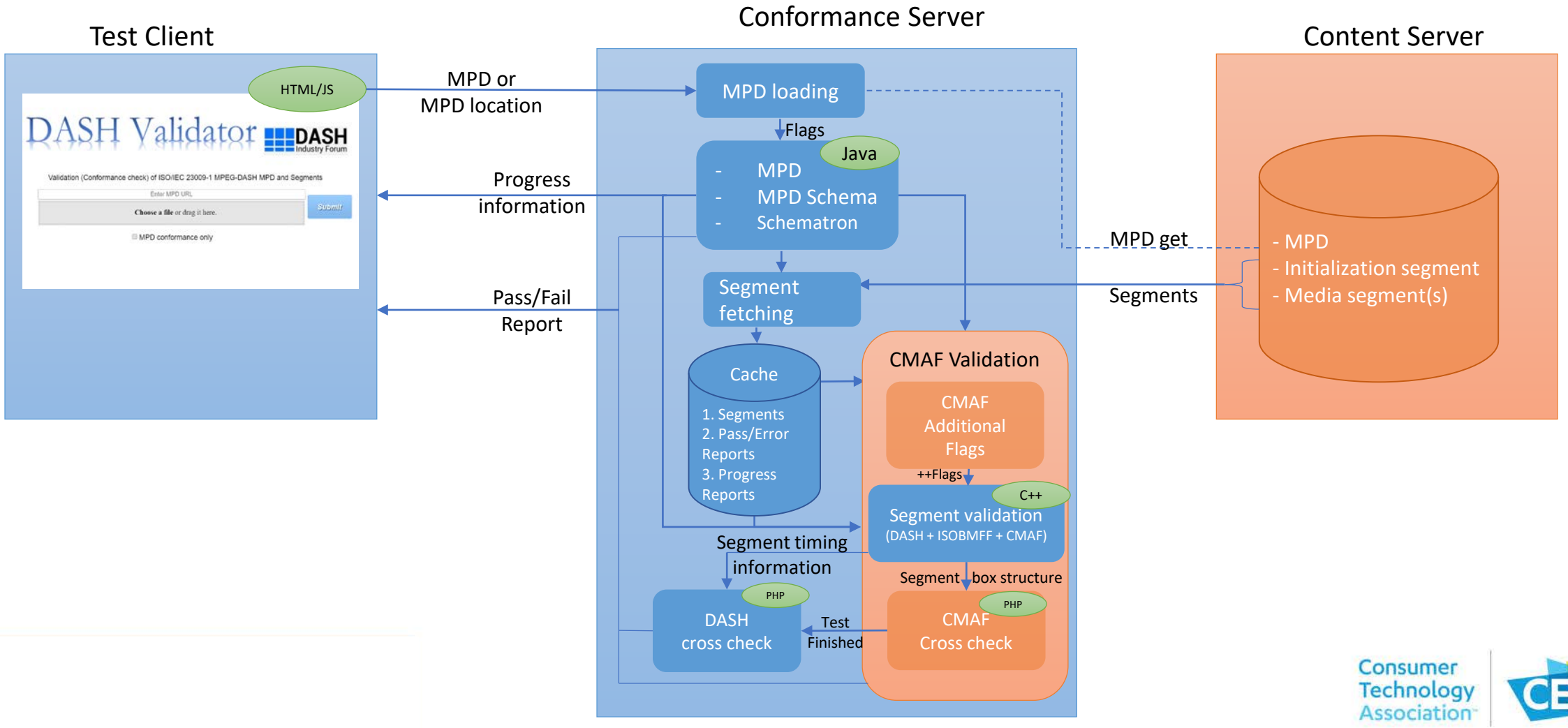


- Based on DASH-IF Content Validator under agreement with DASH-IF
- Verifies CMAF packaging of content
- Does not inspect elementary streams *inside* the CMAF packaged content
- Project under way; should publish Q1 2018

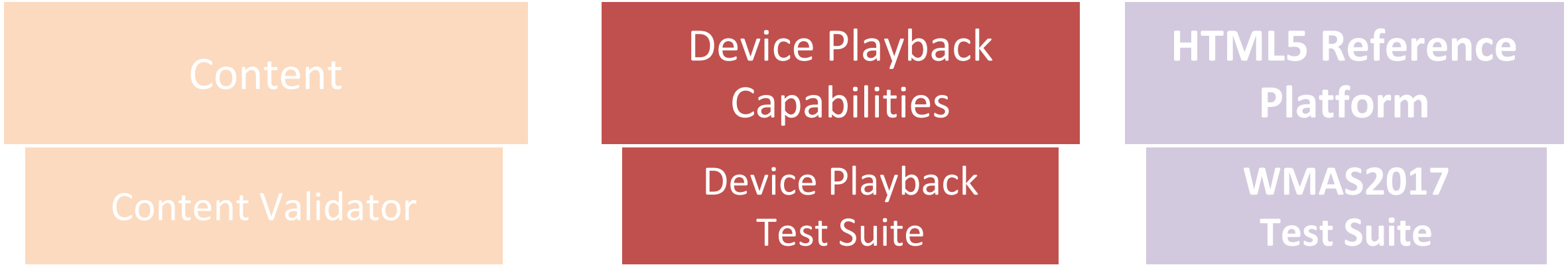
WAVE Content Conformance

- WAVE Content is CMAF Content
- Starting with MPEG-DASH conformance tool
  - “MPEG-DASH format” is *almost* “CMAF format”
- Validation against:
  - ISO-BMFF rules
  - General CMAF rules about segment boxes/CMAF Tracks and Addressable Resources
  - MPD information specific rules for segment boxes (MPD is assumed as manifest for CMAF Presentation)

Architecture- Conformance Software

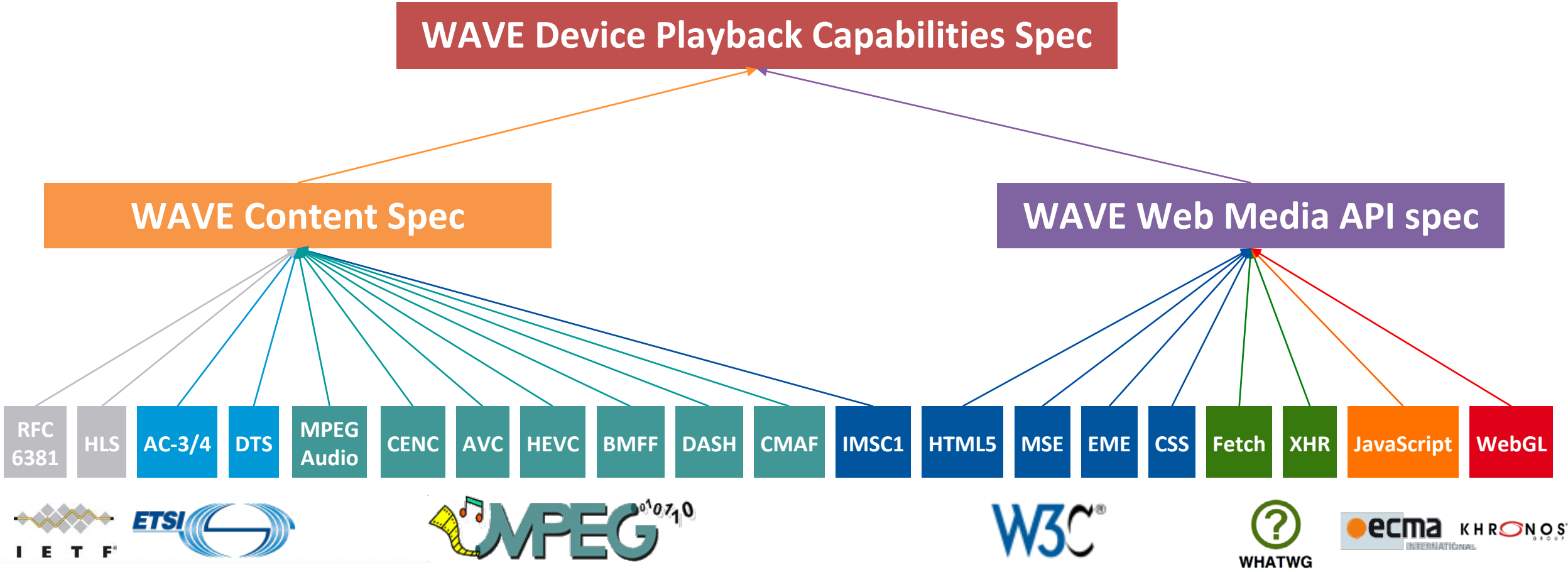


WAVE Device Playback Capabilities Test

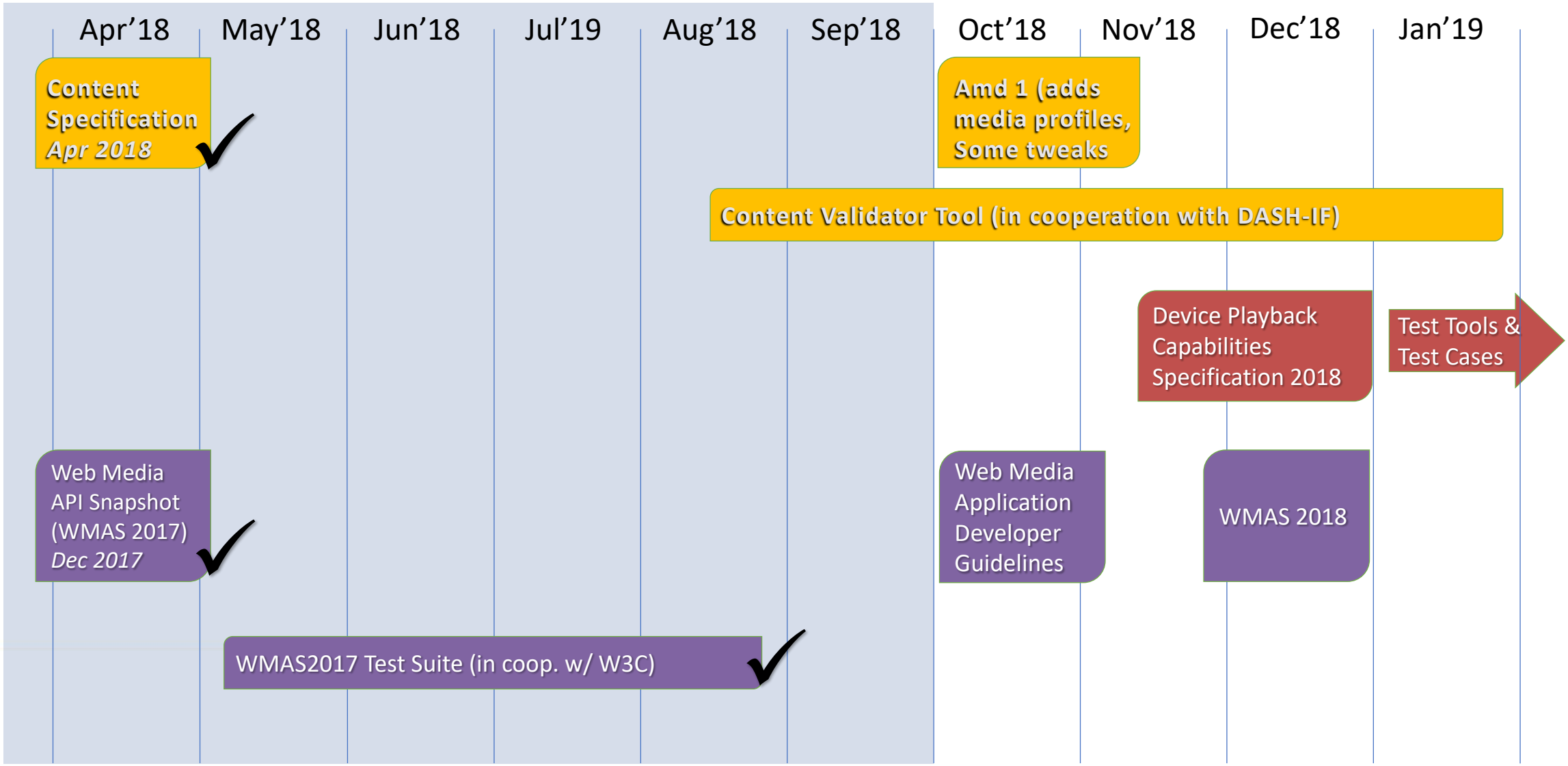


- Not based (yet) on existing test suites
- Downstream of specification release

Wrap-Up


WAVE Device Playback Capabilities Spec
WAVE Content Spec
WAVE Web Media API spec
RFC 6381
HLS
AC-3/4
DTS
MPEG Audio
CENC
AVC
HEVC
BMFF
DASH
CMAF
IMSC1
HTML5
MSE
EME
CSS
Fetch
XHR
JavaScript
WebGL
IETF
ETSI
MPEG
W3C
WHATWG
ecma
KHRONOS

WAVE Roadmap 2018



Key Take-Aways

- WAVE promotes interop for commercial OTT streaming
  - on laptops, phones, and tablets;
  - and on embedded systems like smart TVs, media sticks, gaming consoles, and STBs.
- Key specs are **MPEG-CMAF** and **MPEG CENC** (content preparation) over **HLS** and **MPEG-DASH** to a (preferred) environment based on **HTML5 APIs** incl. **MSE/EME**.
- The WAVE Content and HTML5 API specifications available now
- The HTML5 API test suite is available now; the Content Validator is due Q1 2019
- The DPCTF specification and test suite are coming soon
- WAVE is global in scope and welcomes increased global participation.

How to Get Involved

- WAVE Specifications – free PDF download at CTA.tech/WAVE
- This slide deck: CTA.tech/WAVE under Resources *(by Thursday 10/4/2018)*
- Join the WAVE Project:

standards@CTA.tech *Or:* Mike Bergman mbergman@CTA.tech