Standards for Global OTT Video:
The WAVE Project

William Law
Vice-Chair, CTA WAVE Project
Steering Committee
Chair, WAVE Technical Working Group
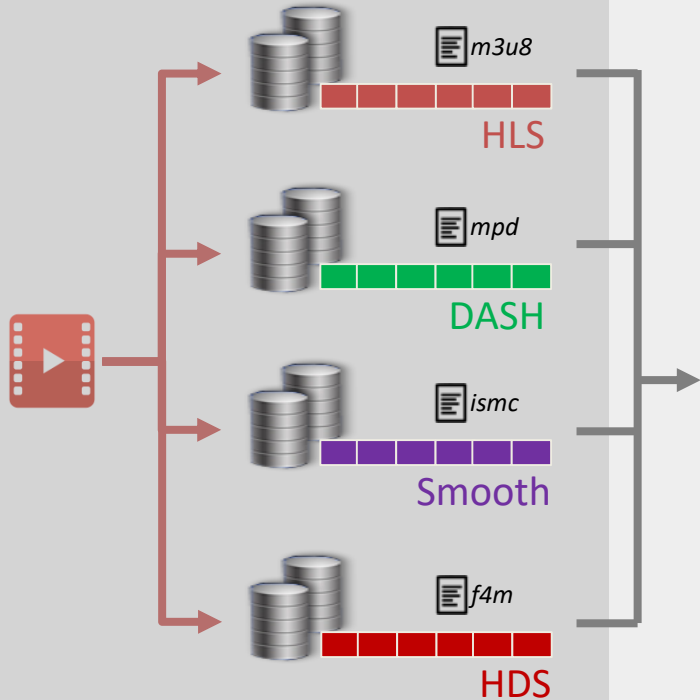Chief Architect, Media, Akamai

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Web Application Video Ecosystem

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Commercial OTT Video Issues: Content Format Issues

Content Format

HLS — m3u8

DASH — mpd

Smooth — ismc

HDS — f4m

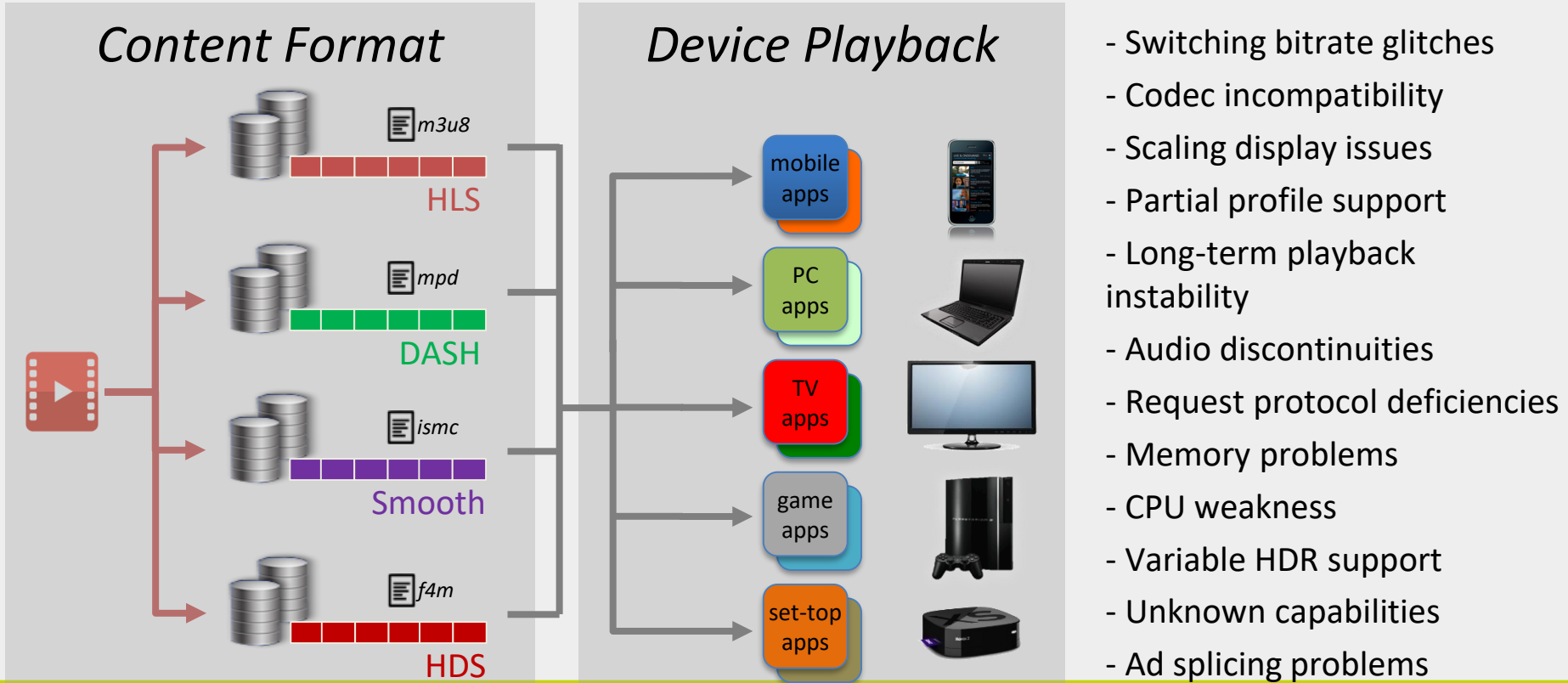Each "asset" copied to multiple media formats

- different video codecs
- different audio codecs
- Regional frame rates

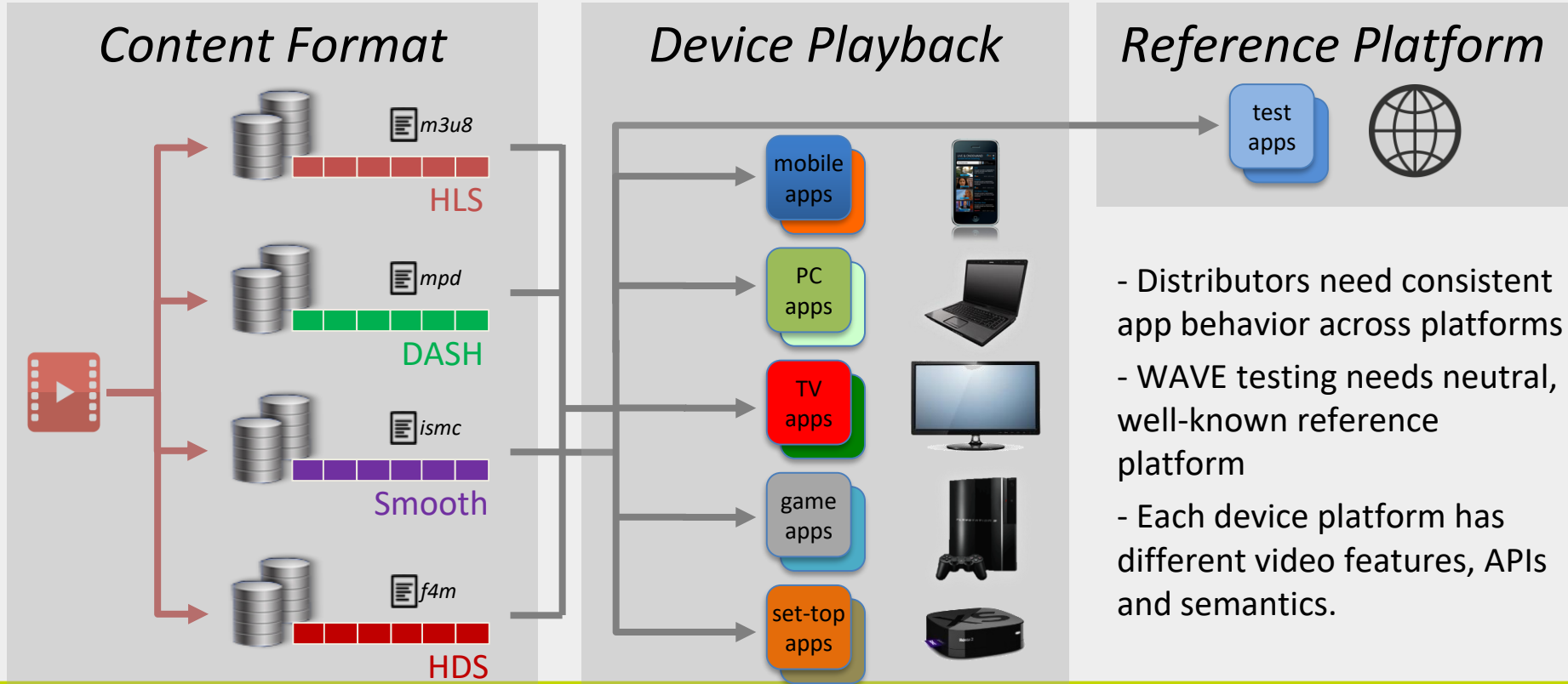Cost to content creators and distributors

Inefficiencies in content delivery networks (CDNs)

Storage costs

Commercial OTT Video Issues: Device Playback Issues

Content Format

m3u8 — HLS

mpd — DASH

ismc — Smooth

f4m — HDS

Device Playback

mobile apps

PC apps

TV apps

game apps

set-top apps

- Switching bitrate glitches
- Codec incompatibility
- Scaling display issues
- Partial profile support
- Long-term playback instability
- Audio discontinuities
- Request protocol deficiencies
- Memory problems
- CPU weakness
- Variable HDR support
- Unknown capabilities
- Ad splicing problems

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Commercial OTT Video Issues: Reference Platform Issues

Content Format

m3u8
HLS

mpd
DASH

ismc
Smooth

f4m
HDS

Device Playback

mobile apps

PC apps

TV apps

game apps

set-top apps

Reference Platform

test apps

- Distributors need consistent app behavior across platforms
- WAVE testing needs neutral, well-known reference platform
- Each device platform has different video features, APIs and semantics.

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Commercial OTT Video Issues: WAVE Solution

Content Specification

Device Playback Requirements

HTML5 Reference Platform

Content Specification based upcoming ISO MPEG Common Media Application Format (CMAF), compatible with DASH and HLS.

Testable requirements covering the most common device playback interoperability issues.

Reference application framework based on HTML5 providing functional guidelines for playback interoperability.

Test Suite

WAVE Membership

- **Adobe Systems**
- AGP
- **Akamai**
- Amazon.com
- **Apple**
- AT&T
- AwoX
- BBC Research & Development
- BitRouter
- BrightCove
- Cable Television Labs
- castLabs
- **Comcast Cable**
- Consumer Technology Association
- Cox Communications

- Discovery Communications
- Disney/ABC/ESPN
- Dolby Laboratories
- DTS
- Ericsson
- Eurofins Digital Testing
- Facebook
- Fraunhofer
- **Google**
- Home Box Office (HBO)
- Intel Corporation
- JW Player
- **LG Electronics**
- **Microsoft Corporation**
- **MLBAM**
- Motion Picture Association of America
- Motion Picture Labs

- Nagravision
- National Association of Broadcasters
- Netflix
- Opera Software
- P Thomsen Consulting
- **Qualcomm Incorporated**
- RK Entertainment Technology Consulting
- **Samsung Electronics**
- Sharp Electronics Corporation
- **Sky**
- Society of Cable Telecommunications Engineers
- Solekai Systems
- **Sony Electronics**

- SpireSpark International
- **Starz**
- Streamroot
- TBT
- Toshiba
- **TP Vision Holding B.V.**
- Ustudio
- Verance Corporation
- Verimatrix
- Verizon
- Viacom
- Vizio
- WJR Consulting
- World Wide Web Consortium
- **WWE**

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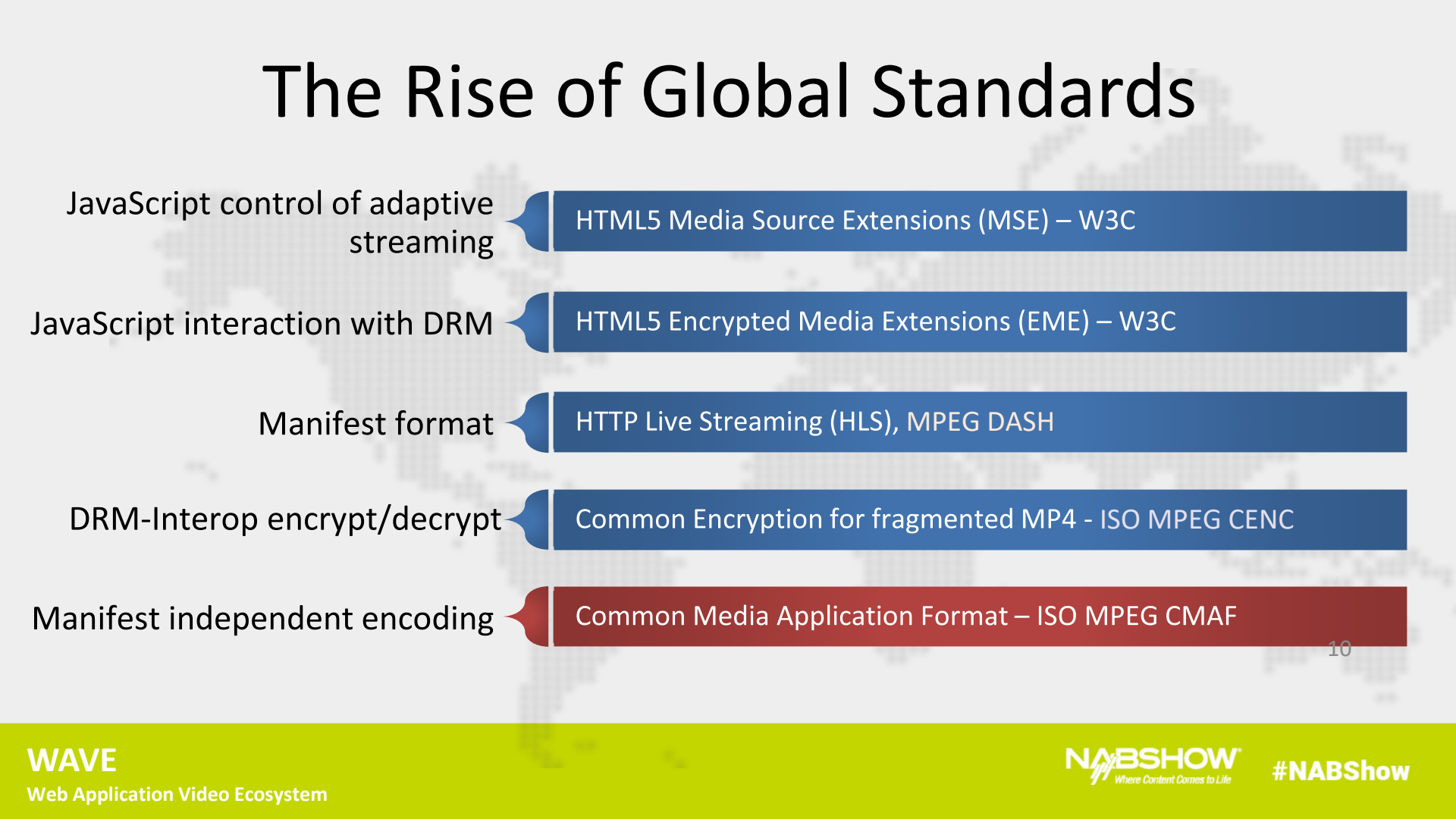*Company names in **bold** are members of the WAVE Steering Committee.*
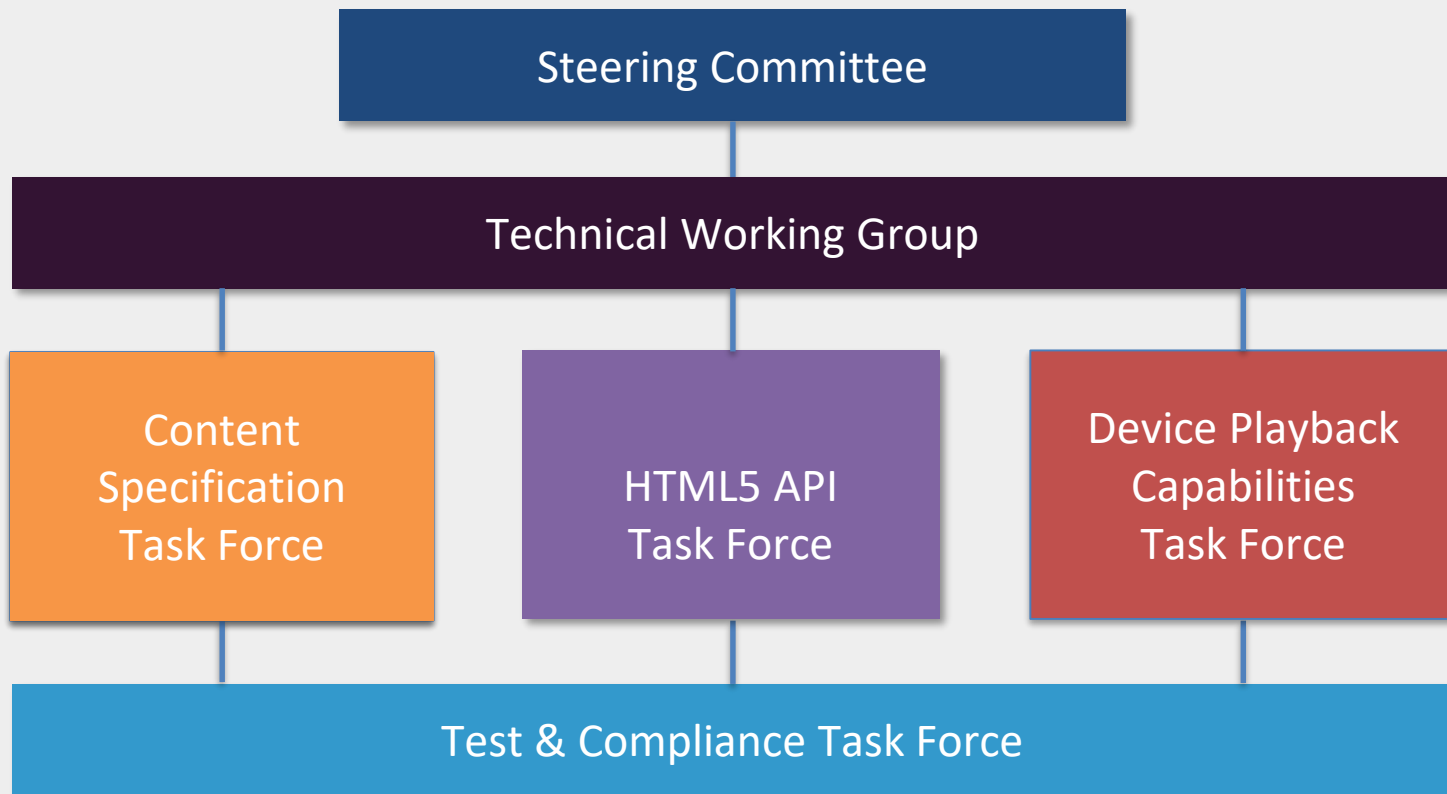
3 important facts about WAVE

- WAVE is global in scope, not just North American. WAVE welcomes increased global participation.

- HTML5 APIs are the basis for the preferred common video application environment, but other environments are supported.

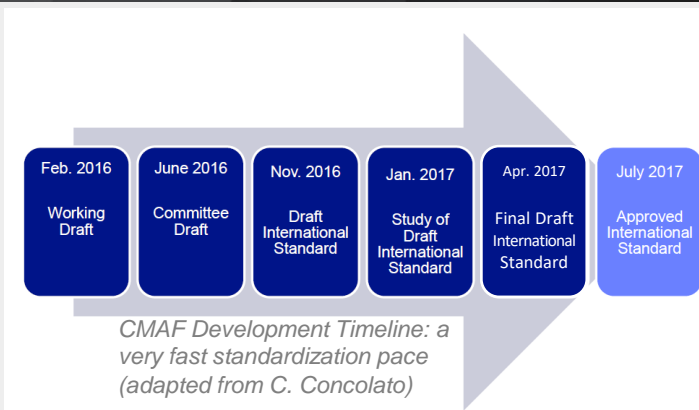- The MPEG Common Media Application Format (CMAF) is the basis for content preparation.

The Rise of Global Standards

JavaScript control of adaptive streaming — HTML5 Media Source Extensions (MSE) – W3C

JavaScript interaction with DRM — HTML5 Encrypted Media Extensions (EME) – W3C

Manifest format — HTTP Live Streaming (HLS), MPEG DASH

DRM-Interop encrypt/decrypt — Common Encryption for fragmented MP4 - ISO MPEG CENC

Manifest independent encoding — Common Media Application Format – ISO MPEG CMAF

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CMAF History and Roadmap

- In January 2015, **Microsoft and Apple** had private closed-door meetings with 8 companies and proposed a new media format which would be common between HLS and DASH.

- Held conf calls and meetings to discuss format.

- Proposed at MPEG's 114th meeting in San Diego in Feb 2016.

- Requirement proposal presented: 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: Apple, Microsoft, MLBAM, Cisco, Akamai and Comcast.

- MPEG approved the establishment of a new standard:

ISO/IEC 23000-19 - Common Media Application Format

Feb. 2016	June 2016	Nov. 2016	Jan. 2017	Apr. 2017	July 2017
Working Draft	Committee Draft	Draft International Standard	Study of Draft International Standard	Final Draft International Standard	Approved International Standard

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

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CMAF Presentation Profiles

urn:mpeg:cmaf:presentation_profile:cmfhd:2017

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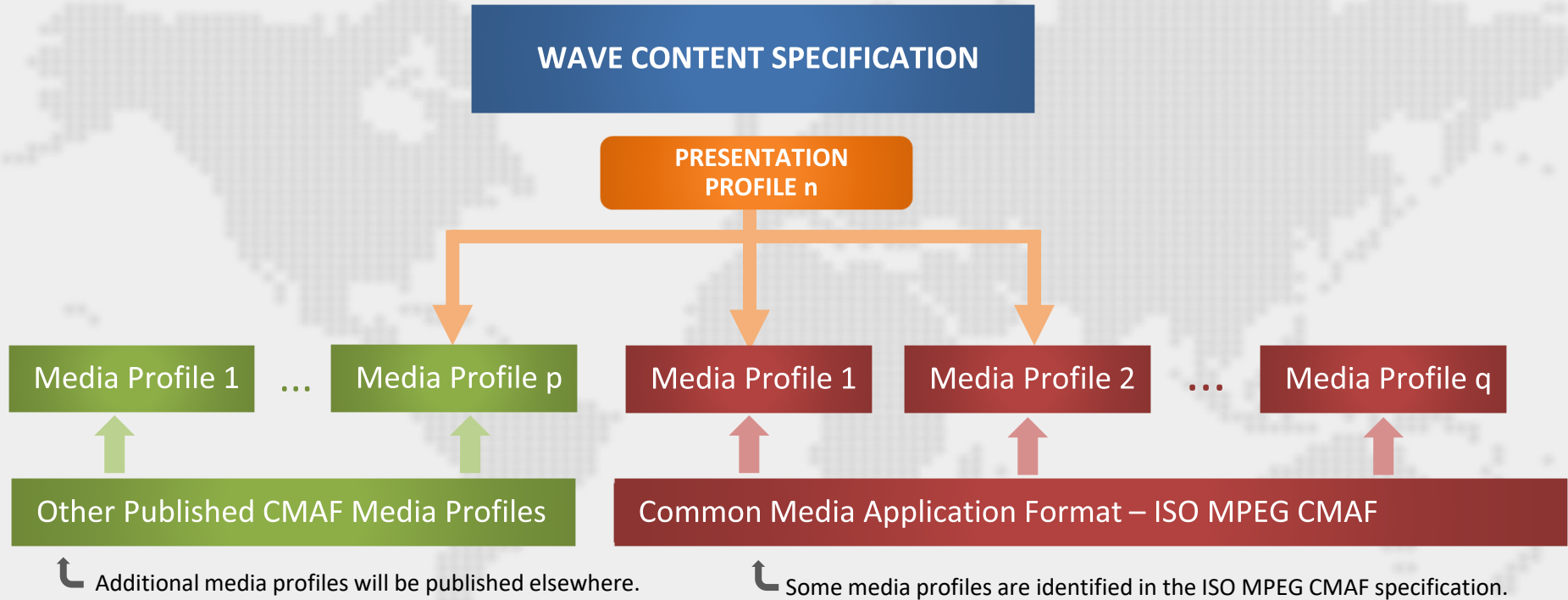- At least 'im1t' (IMSC1 Text subtitles)
- Not encrypted

urn:mpeg:cmaf:presentation_profile:cmfhdc:2017

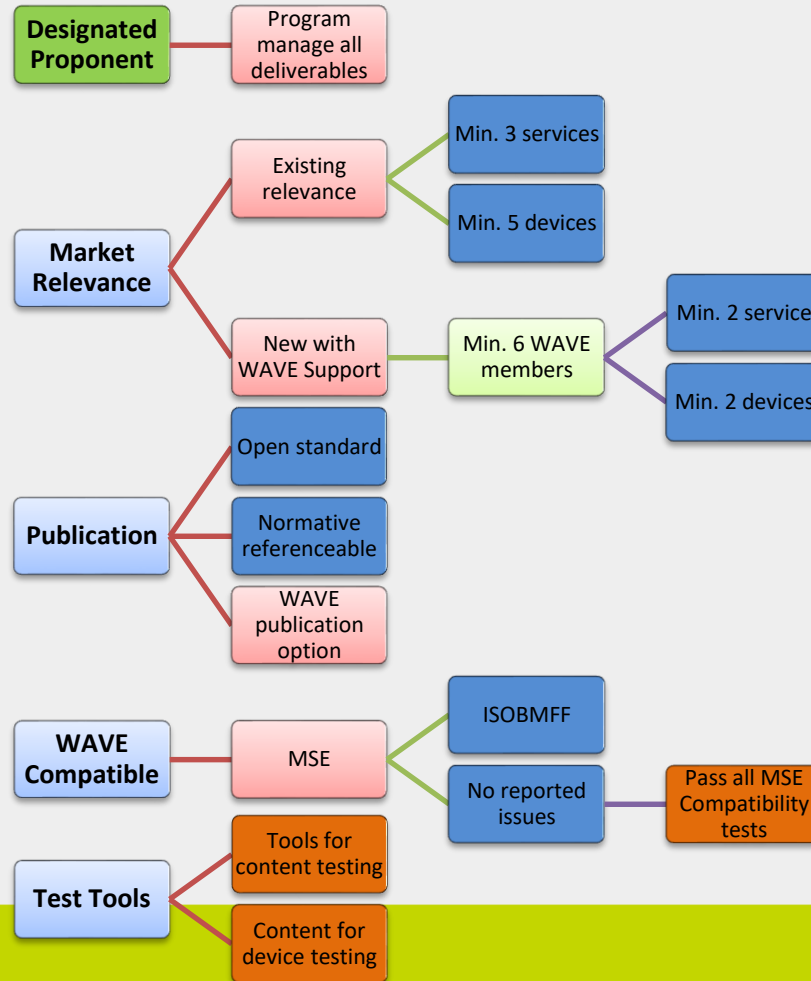- CMFHD but with at least one 'cenc' encrypted media

urn:mpeg:cmaf:presentation_profile:cmfhds:2017

- CMFHD but with at least one 'cbcs' encrypted media

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- CMAF

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WAVE Content Specification and Presentation Profiles

WAVE CONTENT SPECIFICATION

PRESENTATION PROFILE n

| Media Profile 1 | ... | Media Profile p | | Media Profile 1 | Media Profile 2 | ... | Media Profile q |

Other Published CMAF Media Profiles

Common Media Application Format – ISO MPEG CMAF

⌐ Additional media profiles will be published elsewhere.

⌐ Some media profiles are identified in the ISO MPEG CMAF specification.

Media Profile Approval Process

Designated Proponent — Program manage all deliverables

Market Relevance
- Existing relevance
  - Min. 3 services
  - Min. 5 devices
- New with WAVE Support
  - Min. 6 WAVE members
    - Min. 2 service
    - Min. 2 devices

Publication
- Open standard
- Normative referenceable
- WAVE publication option

WAVE Compatible
- MSE
  - ISOBMFF
  - No reported issues
    - Pass all MSE Compatibility tests

Test Tools
- Tools for content testing
- Content for device testing

Required to Start

Provisional Requirement

Final Requirement

Details and exceptions can found in the WAVE Content Specification.

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https://github.com/cta-wave/content-specification-task-force/wiki

Media Profile	Designated Proponent	Status
AC-3, Enhanced AC-3 - 'ceac'	Brian Link (Dolby)	0 - Steering Committee Approved
CMAF AAC Core- 'caac'	Matteo Agnelli (Fraunhofer IIS)	0 - Steering Committee Approved
CMAF AAC multichannel - 'camc'	Matteo Agnelli (Fraunhofer IIS)	0 - Steering Committee Approved
CMAF HEVC HLG10 - 'clg1'	Chris Poole (BBC)	0 - Steering Committee Approved
CMAF AVC HD - 'cfhd'	John Simmons (Microsoft)	0 - Steering Committee Approved
CMAF IMSC1 Text - 'im1t'	Chris Poole (BBC)	0 - Steering Committee Approved
AC-4 single stream – 'ca4s'	Brian Link (Dolby)	0 - Steering Committee Approved
DTS-HD - 'dts1'	Phillip Maness (DTS)	1 - Steering Committee Publication Decision – Paused (binding)
CMAF HEVC HHD10 – 'chh1'	Thomas Stockhammer (Qualcomm)	1 - Steering Committee Publication Decision – Paused (subset)
CMAF HEVC UHD10 – 'cud1'	Thomas Stockhammer (Qualcomm)	1 - Steering Committee Publication Decision – Paused (constant luminance)
CMAF HEVC HDR10 - 'chd1'	Thomas Stockhammer (Qualcomm)	1 - Steering Committee Publication Decision – Paused (constant luminance)
CMAF TTML IMSC1 Image – 'im1i'	Pierre-Anthony Lemieux (MovieLabs)	2 – TWG Review ends - 11:59 PM ET November 8, 2017
CMAF VP9 UHD HDR10 - 'vp9D'	Jai Krishnan (Google)	3 - CSTF Submission – Pending Issue Resolution (CMAF binding)
Dolby Vision – 'cv10'	Brian Link (Dolby)	3 - CSTF Submission
CMAF MPEG-H Audio – 'cmhm'	Matteo Agnelli (Fraunhofer IIS)	3 - CSTF Submission
AC-4 – 'ca4m'	Brian Link (Dolby)	4 - Pending – Issue Resolution (multi-stream)
CMAF AAC Adaptive – 'caaa'	Matteo Agnelli (Fraunhofer IIS)	4 - Pending
CMAF Multichannel AAC Adaptive – 'cama'	Matteo Agnelli (Fraunhofer IIS)	4 - Pending
Opus – '????'	Jai Krishnan (Google)	4 - Pending

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HTML5 API
Task Force

WAVE Organization

HATF HTML5 API Task Force

- Developing an *HTML5 API* Specification and *Web Media Developer Guidelines*
  - ...by working inside a W3C Community Group
- HTML5 video playback is not required for WAVE compliance
  - Specification and Guidelines are guidance for HTML5 platforms and players
  - Also part of a reference platform for the test suite

Steering Committee

Technical Working Group

HTML5 API Task Force

Device Playback Capabilities Task Force

Test & Compliance Task Force
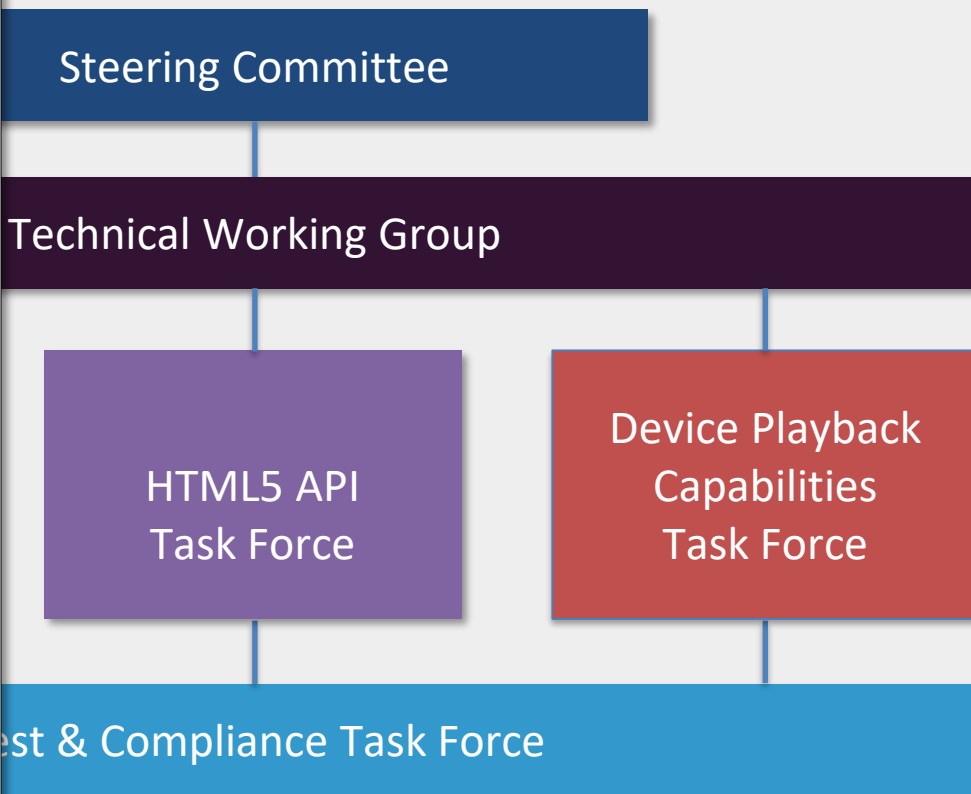
HTML5 API Task Force: Reference Platform

One Content Format...

WAVE/CMAF

...but multiple devices

- mobile apps
- PC apps
- TV apps
- game apps
- set-top apps

Reference Platform

HTML5 tests

HTML 5

Write reference tests in HTML5...

... then port tests to device platforms.

(HTML5 platforms run tests directly.)

Web Media API Community Group

- Media web application developers want to deploy their content on a wide and heterogeneous range of devices and platforms, e.g. televisions, set-top boxes, and mobile devices.

- To ensure a smooth user experience across devices, these user agents need to support a minimum set of Web technologies that developers can rely on being supported.

- This Community Group plans to specify such a set of Web technologies and additionally plans to provide guidance for developers and implementers e.g. on performance constraints and portability issues.

Three public documents and work spaces

1. Web Media APIs 2017 - this specification details the Web APIs that should be included in device implementations to support media web apps in 2017. Check the specification's issue tracker on github to provide feedback and track progress.
https://www.w3.org/community/webmediaapi/

2. Web Media Application Developer Guidelines – these guidelines are a companion guide to the Web Media API spec. This specification will outline best practices and developer guidance for implementing web media apps. Check the specification's issue tracker on github to provide feedback and track progress
https://w3c.github.io/webmediaguidelines/

3. Web Media User Agent Integration - the Web Media User Agent Integration specification details HTML user agent (browser) integration requirements that should be followed in device implementations to support media web apps. Check the specification's issue tracker on GitHub to provide feedback and track progress.

Akamai Contacts   2016 Tech Week ...   Cracker   Etherpad   Shared with me - ...   DASH-264 JavaSc...   WAVE Project   WebRTC P2P - De...   Elemental Encoder   Google News   Akamai Contac

COMMUNITY & BUSINESS GROUPS

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CURRENT GROUPS   **REPORTS**   **ABOUT**

Home / Web Media API Community Group

WEB MEDIA API COMMUNITY GROUP

Media web application developers want to deploy their content on a wide and heterogeneous range of devices and platforms, e.g. televisions, set-top boxes, and mobile devices. To ensure a smooth user experience across devices, these user agents need to support a minimum set of Web technologies that developers can rely on being supported. This Community Group plans to specify such a set of Web technologies and additionally plans to provide guidance for developers and implementers e.g. on performance constraints and portability issues.

See the CG charter for more information.

Note: Community Groups are proposed and run by the community. Although W3C hosts these conversations, the groups do not necessarily represent the views of the W3C Membership or staff.

No Reports Yet Published ⓘ

Tools for this group ⓘ

✉ Mailing List

💬 IRC

⬡ GitHub

🔗 RSS

✉ Contact This Group

Get involved ⓘ

Anyone may join this Community Group. All participants in this group have signed the W3C Community Contributor License Agreement.

Web Media Application Developer Guidelines 2017

Draft Community Group Report 02 November 2017

Latest editor's draft:
http://w3c.github.io/webmediaguidelines

Editors:
Jeff Burtoft, Microsoft
Thasso Griebel, CastLabs
Joel Korpi

Abstract

This specification is a companion guide to the Web Media API spec. While the Web Media API spec is targeted at device implementations to support media web apps in 2017, this specification will outline best practices and developer guidance for implementing web media apps. This specification should be updated at least annually to keep pace with the evolving Web platform. 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.

Status of This Document

This specification was published by the Web Media API Community Group. It is not a W3C Standard nor is it on the W3C Standards Track. Please note that under the W3C Community Contributor License Agreement (CLA) there is a limited opt-out and other conditions apply. Learn more about W3C Community and Business Groups.
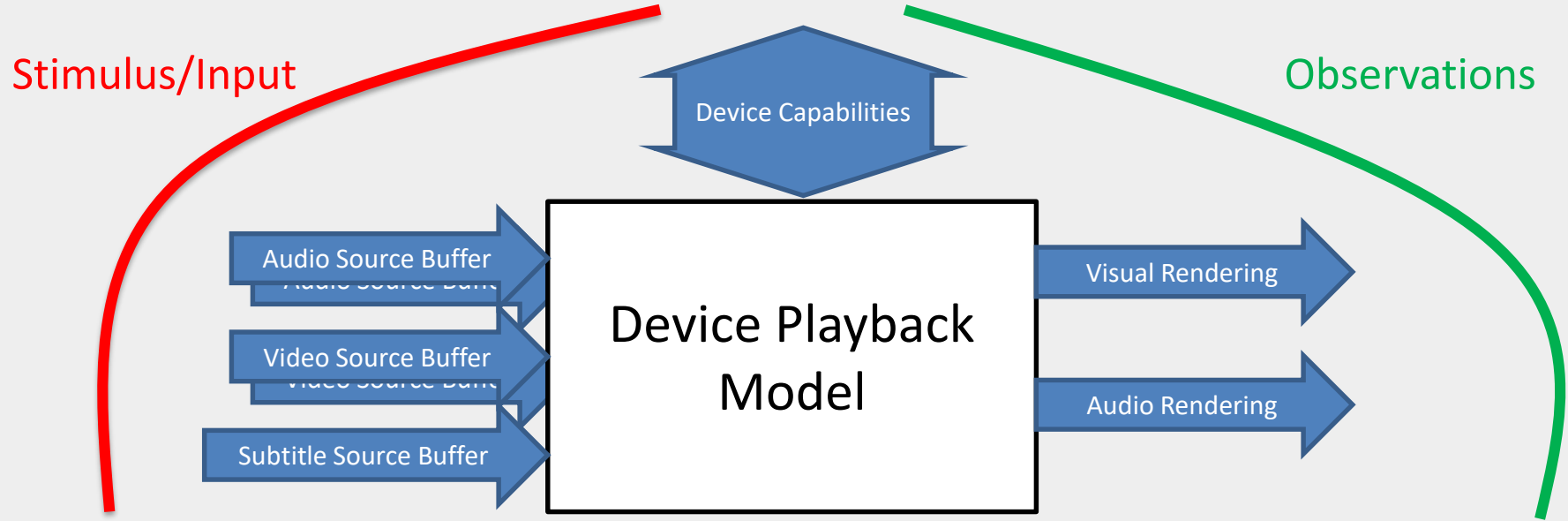
Device Playback Capabilities Task Force

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

Abstracted Device Playback Model

Stimulus/Input

Observations

Device Capabilities

Audio Source Buffer

Video Source Buffer

Subtitle Source Buffer

Device Playback Model

Visual Rendering

Audio Rendering

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

DPCTF Specification Objectives

- Provide testable requirements for device performance challenges

- Provide capability code points for WAVE content

- Enable the qualification of existing platforms for their WAVE content playback capabilities

- Generate a forward-looking specification for advanced media playback requirements, including new codecs and experiences

- Prioritize challenges and address the highest priority items first

Device Playback Focus

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

Capability Discovery Consensus

1. Specification expected to support
   a) Media Profile query
   b) Media Capability query ➔ alignment with W3C Media Capability API sought
   c) Device type (brand, etc.)
   d) Possible combinations of the above
2. Support of a data base to collected media capabilities of device types, expected to be hosted by CTA

Test and Compliance Task Force

WAVE Organization

Steering Committee

Technical Working Group

TCTF Test & Compliance Task Force
- Developing a *Test Suite and Test Materials*
  - Will support self-test by content and device companies
  - Materials will be suitable for compliance or certification programs
- Using existing test materials where possible

Test & Compliance Task Force

WAVE Approach to Test

- Compliance program (not certification or "logo" program)
- Assuming some test cases voluntarily submitted by members (e.g. Apple is volunteering some part of their HLS test suite, members will probably submit various sample files)
- Assuming some test cases / tools reused (with permission) from existing regimes (e.g. DASH-IF, W3C, MPEG)
- Some test cases created by WAVE
- Test case repository (combination of member contributions and WAVE funded test cases) managed by WAVE

Join WAVE by emailing

standards@CTA.tech