Interoperability Quest: OTT Video, WebApps and CE
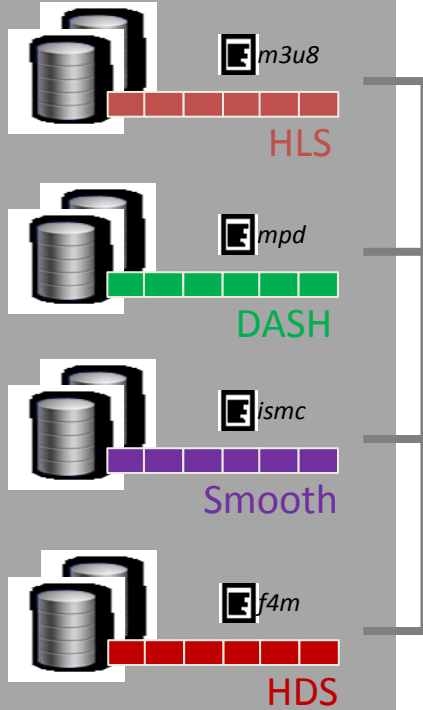
Commercial OTT Video Issues: Content Format Issues

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

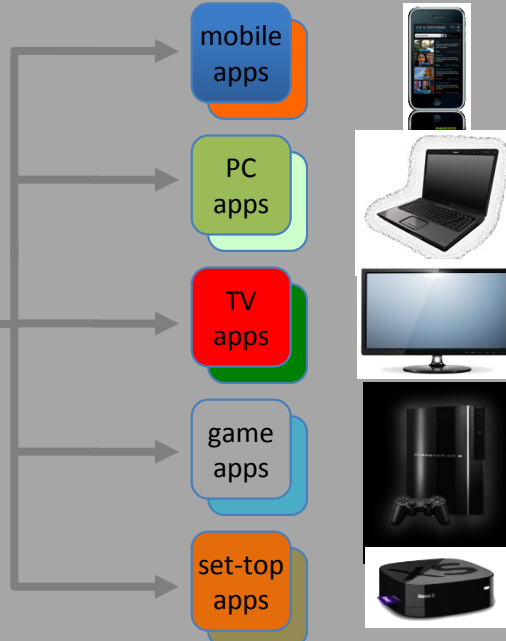# Commercial OTT Video Issues: Device Playback Issues

Content Format

- m3u8 — HLS
- mpd — DASH
- ismc — Smooth
- f4m — HDS

Device Playback

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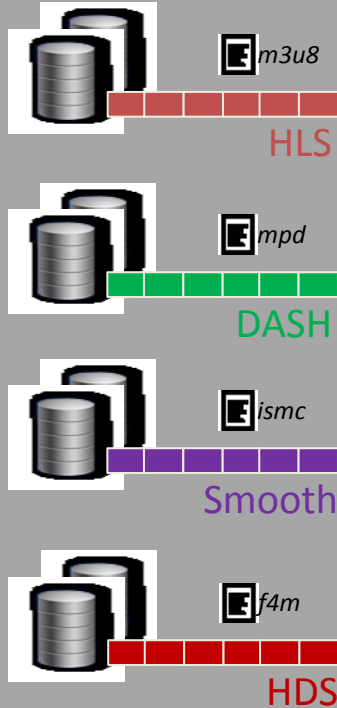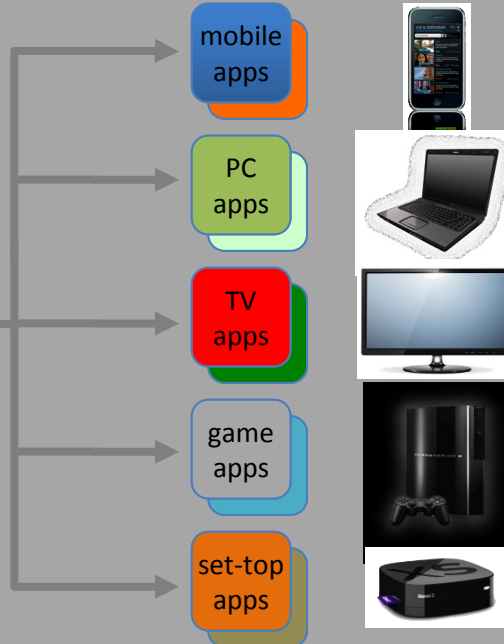
- Switching bitrate glitches
- Codec incompatibility
- Scaling display issues
- Partial profile support
- Long-term playback instability
- Audio discontinuities
- Request protocol deficiencies
- Memory problems
- CPU weakness
- Variable HDR support
- Unknown capabilities
- Ad splicing problems

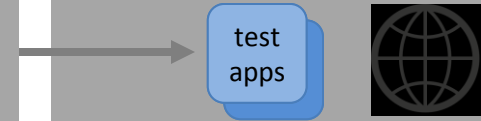# Commercial OTT Video Issues: Reference Platform Issues

- 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.

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.

WAVE Organization
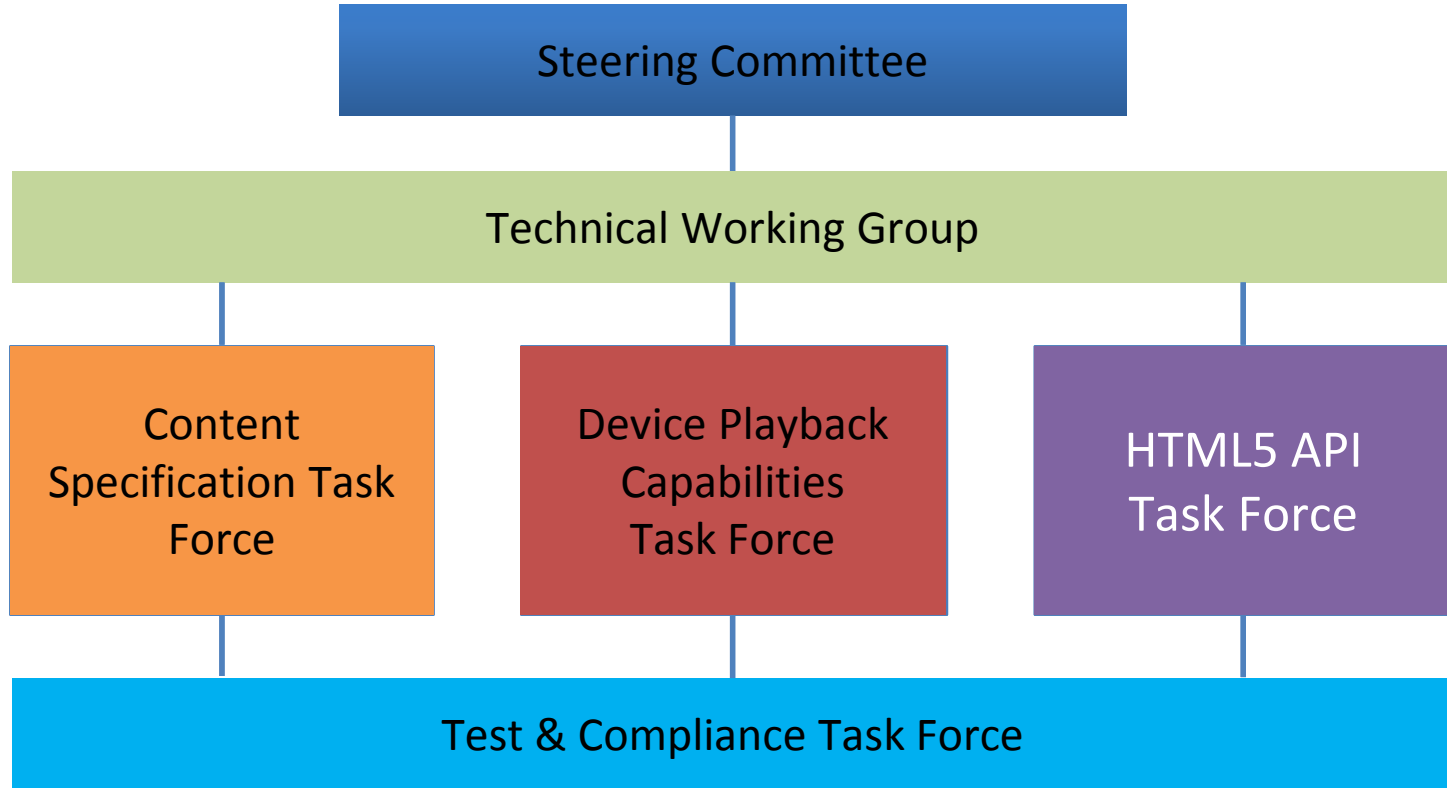
Current WAVE Membership

Adobe	**Comcast**	Google	Opera	Toshiba
AGP	Cisco	HBO	**Qualcomm**	**TP Vision**
Akamai	CTA	Intel	RKDE	UStudio
Amazon	Cox	JW Player	**Samsung**	Verance
Apple	Discovery	**LG**	Sharp	Verimatrix
AT&T	Disney	**Microsoft**	**Sky**	Verizon
AwoX	Dolby	**MLBAM**	SCTE	Viacom
BBC	DTS	MPAA	Solekai	Vizio
BitRouter	Ericsson	MovieLabs	**Sony**	W3C
Brightcove	Eurofins	Nagravision	**Starz**	**WWE**
CableLabs	Facebook	NAB	StreamRoot	
castLabs	Fraunhofer	Netflix	TBT	

[**Bold** = WAVE Steering Committee.]

Content Specification
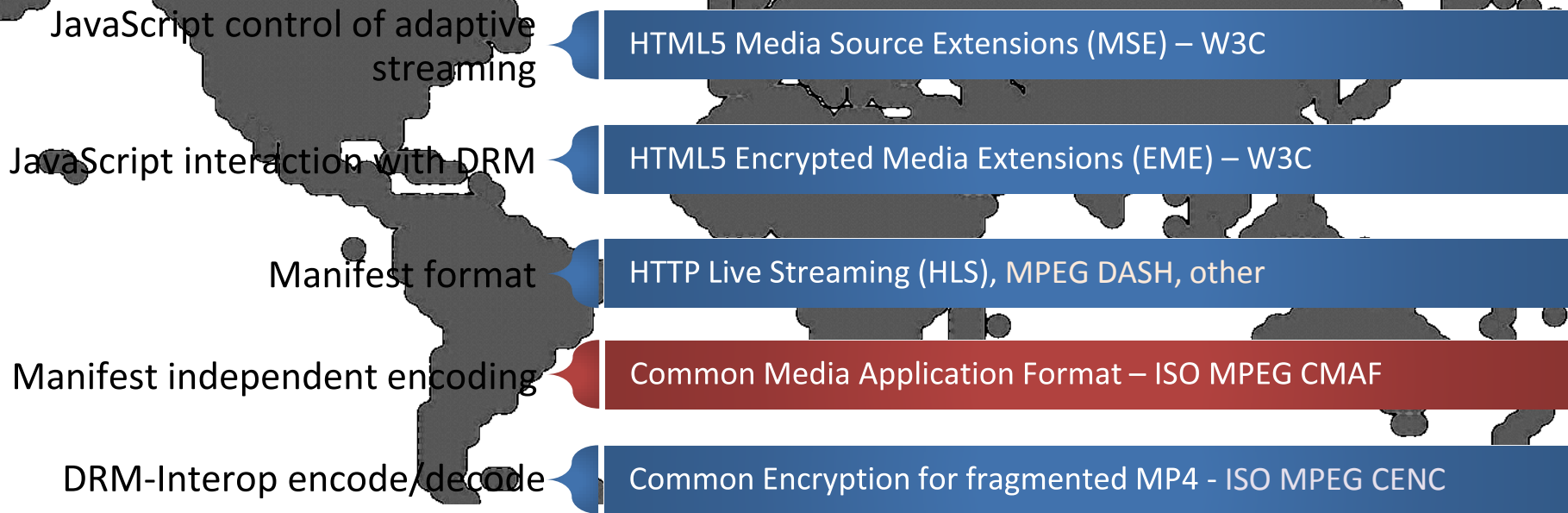
Device Playback Requirements

HTML5 Reference Platform
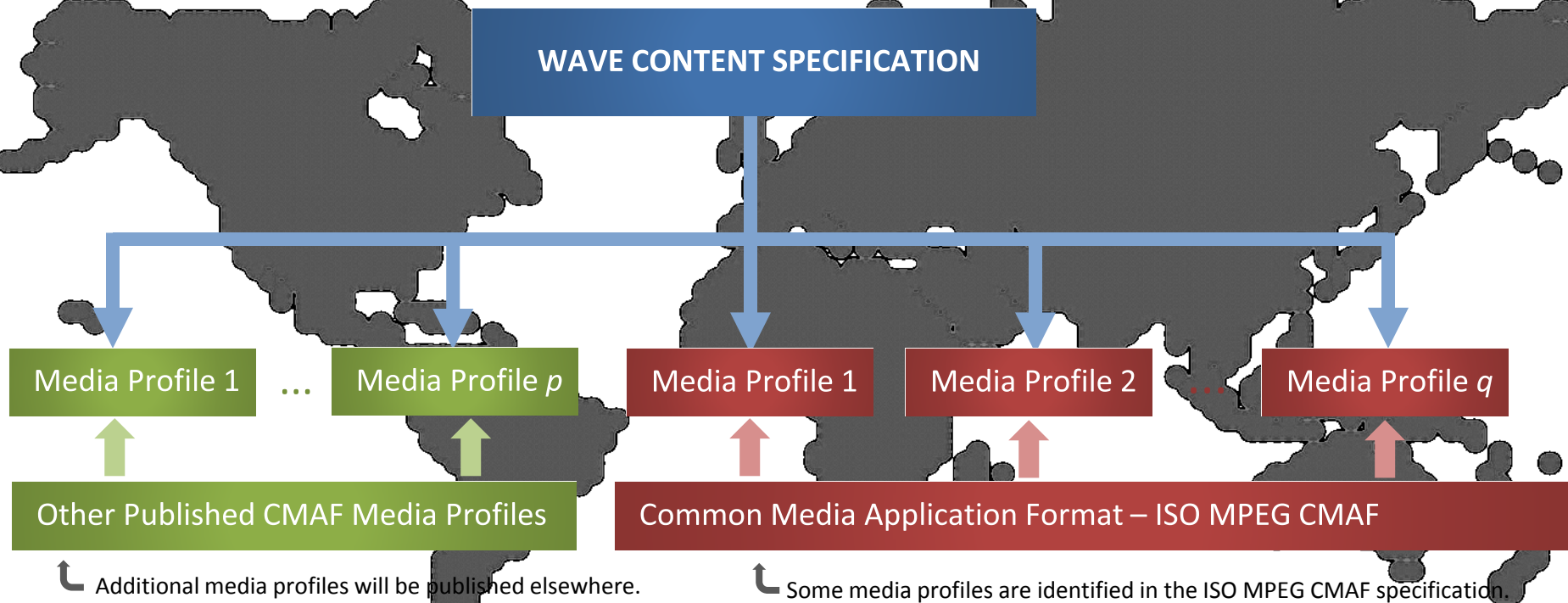
CONTENT SPECIFICATION TASK FORCE

Common Media Application Format

- First working draft of the Common Media Application Format (CMAF) was the outcome of a **two-year collaboration between Apple and Microsoft**.

- CMAF is a media segment format for the adaptive delivery of DRM-interoperable live, live linear and on-demand video with ad signaling, closed captioning and subtitles.

- CMAF is compatible with both ISO MPEG Dynamic Adaptive Streaming over HTTP (DASH) and HTTP Live Streaming (HLS). CMAF addressable resources (segments, tracks, chunks) can be delivered by DASH or HLS without any manipulation in their format.

- CMAF encapsulation is compatible with HTML5 Media Source Extensions (MSE) and Encrypted Media Extensions (EME).

- CMAF standard activity **proposed to MPEG February 2016**, with support of Adobe, Akamai, Apple, BBC, Cisco, Comcast, DTG, Ericsson, Fraunhofer, iStreamPlanet, LG, Microsoft, MLB Advanced Media, Starz, Telecom Italia, Turner and Verimatrix.

- CMAF is now a Draft International Standard (DIS), anticipated to become a published **global standard in the first half of 2017**.
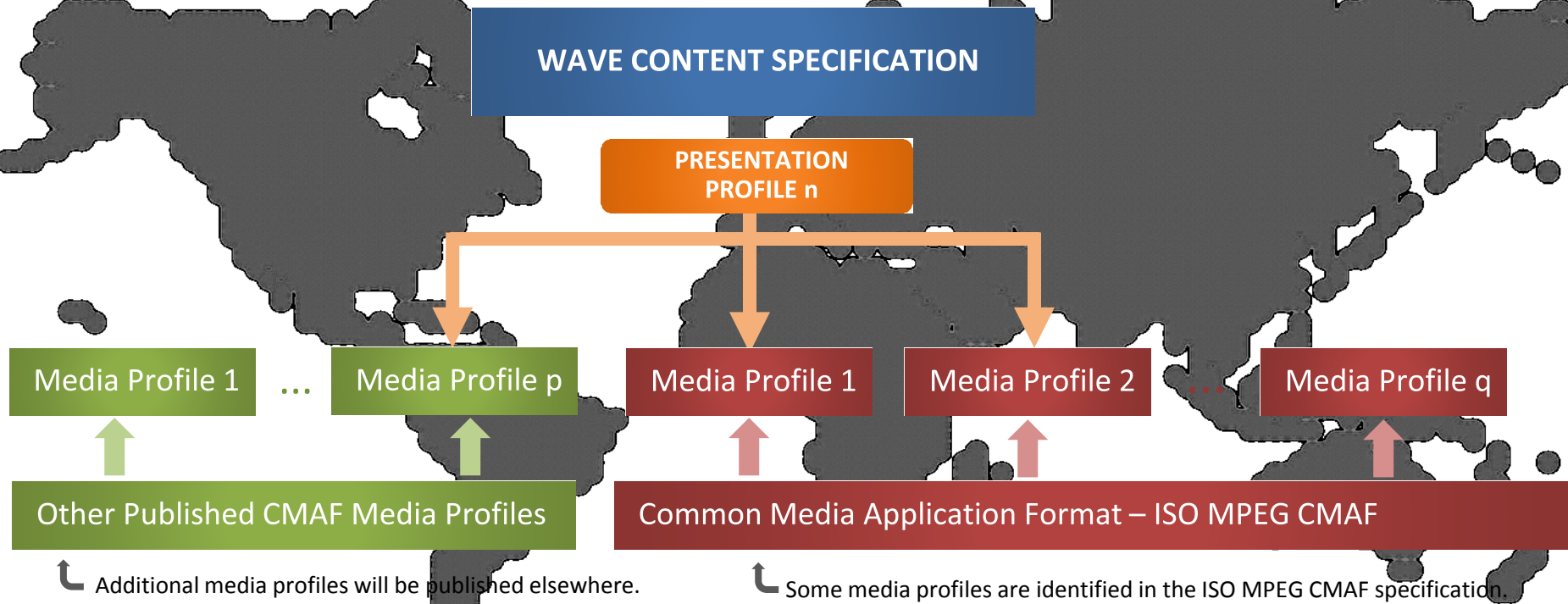
Common Media App Format in Context

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, other

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

DRM-Interop encode/decode
◀ Common Encryption for fragmented MP4 - ISO MPEG CENC

WAVE Content Specification and Referenced Media Profiles

WAVE CONTENT SPECIFICATION

| 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.

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.

Content Specification

Device Playback Requirements

HTML5 Reference Platform

DEVICE PLAYBACK CAPABILITIES TASK FORCE

OTT Device Performance Challenges

- Unknown codec capabilities
- Unknown rendering capabilities
- Request protocol deficiencies
- Partial profile support
- Codec incompatibility
- Audio discontinuities
- Ad splicing problems
- Glitches when switching bitrate
- Variable HDR support

- Scaling display issues
- Memory problems
- Limited processing power
- Long-term playback instability
- Late Binding Synchronization
- Long start-up delay
- Performance monitoring
- Regional profiles (50/60Hz)
- DRM support

Device Types

- WAVE includes different types of OTT clients, both HTML and Native

- Requirements apply universally, tests focused on HTML

App-driven players:

Native App Player

HTML5 App Player

JavaScript & MSE

Embedded players:

Native Platform Player

HTML5 Platform Player

video object

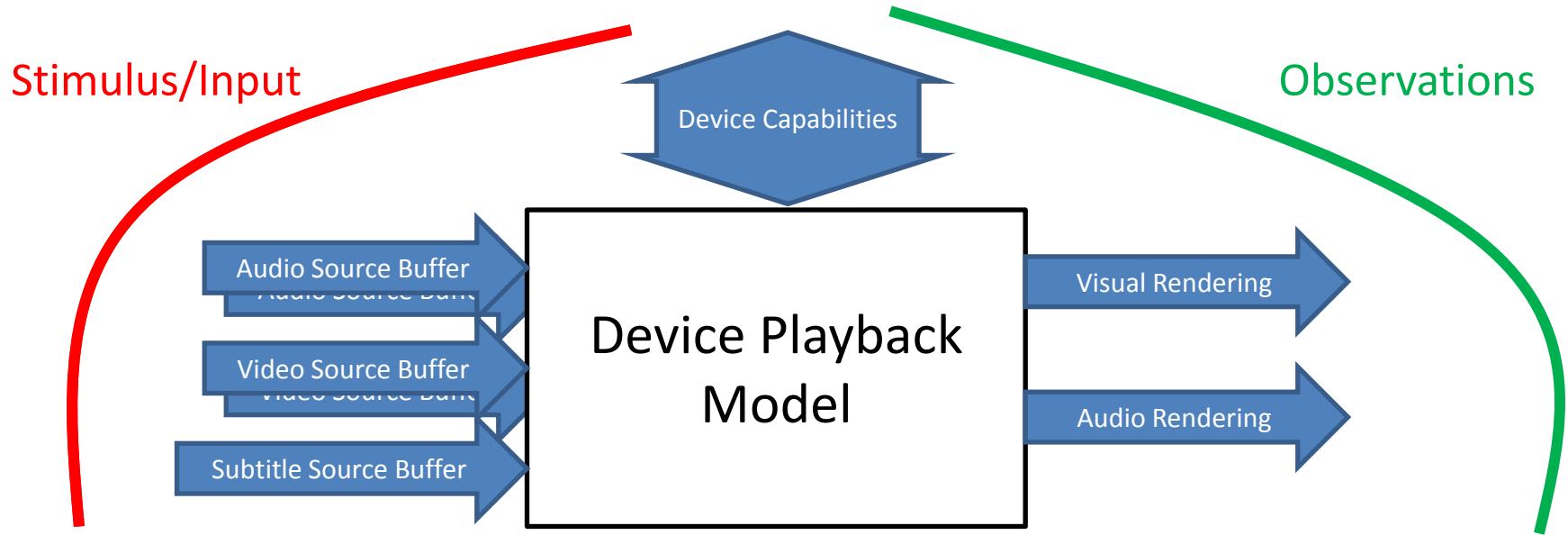Native App Devices

HTML5 App Devices

Connection to HTML5 & MSE
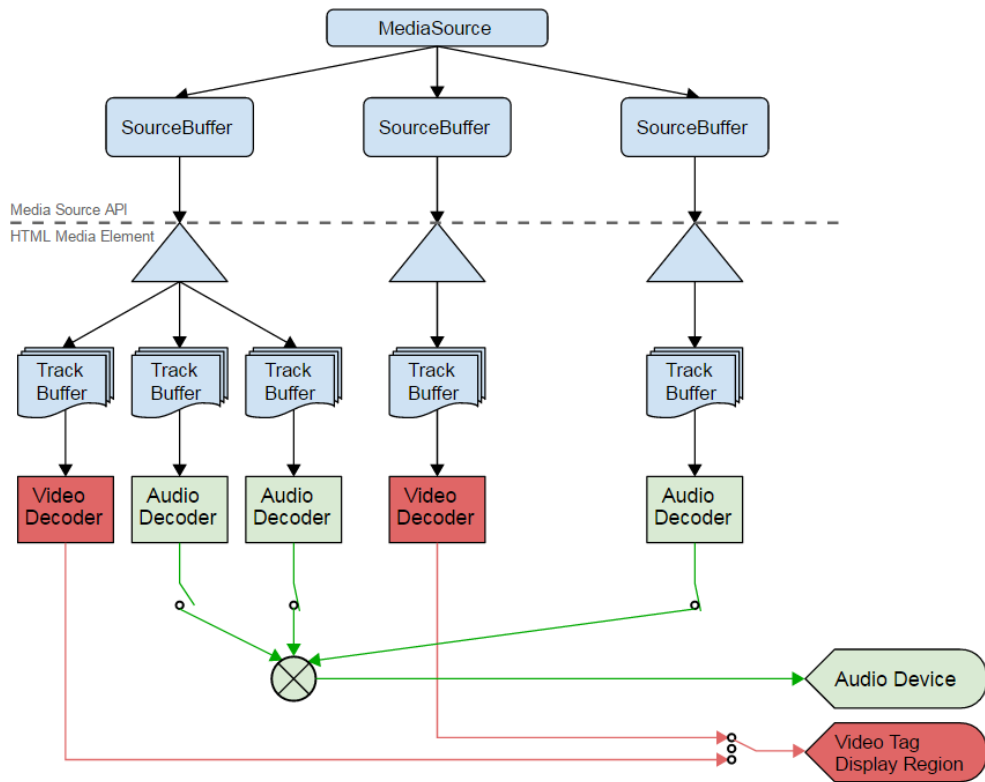
HTML5 and MSE

- 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

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

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

Content Specification

Device Playback Requirements

HTML5 Reference Platform

HTML5 API TASK FORCE

HTML5 API Task Force: Reference Platform

One Content Format...

...but multiple devices

Reference Platform

HTML5 tests

mobile apps

PC apps

TV apps

game apps

set-top apps

Write reference tests in HTML5...

... then port tests to device platforms.

(HTML5 platforms run tests directly.)
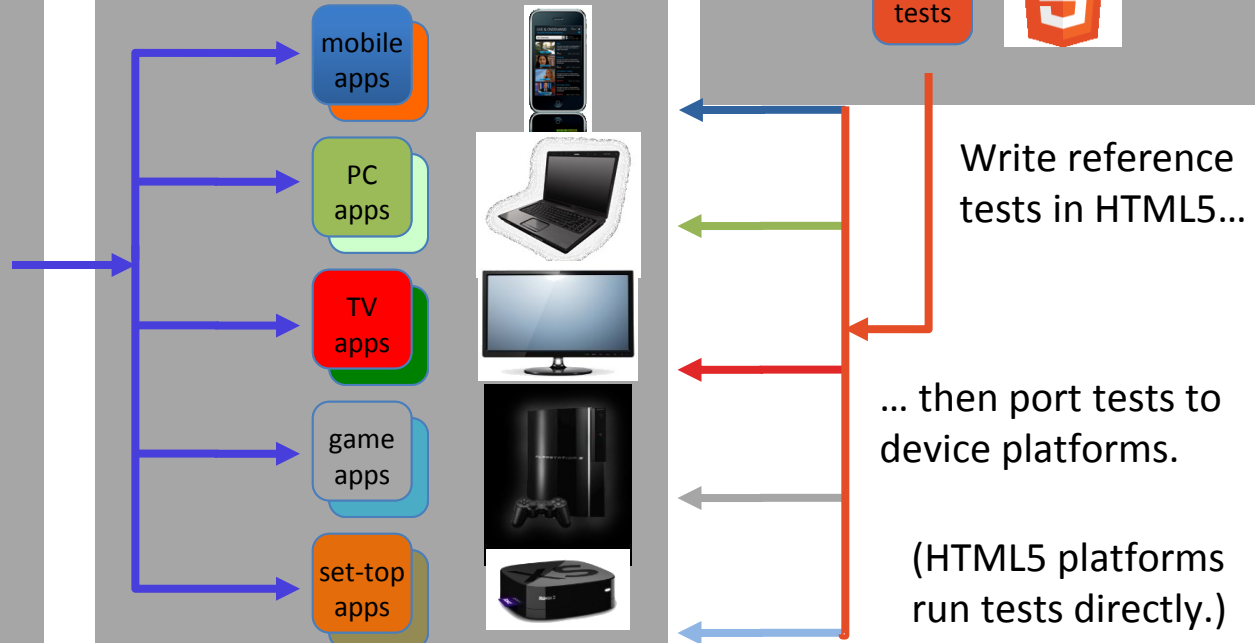
HTM5 API Task Force: Work Plan

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. **Guidelines for device makers**

4. **Identify gaps in current web APIs**

    work with W3C Working Groups to update web standards.

TEST AND COMPLIANCE

Verification (Test & Conformance)

Task:

- Testing for compliance with the Content, HTML5 API and Device playback specs.

Problems/Solutions:

- Timing
- Practicality

Timing:

- Test & Conformance necessarily follows specification development to some extent
    - Working with Technology Task Forces to identify at the earliest key use cases and test requirements, as well as prioritization

Verification (Test & Conformance)

- **Practicality:**
  - Very large number of tests could be identified
    - Working with Technology Task Forces to identify and prioritize use cases and test requirements
  - Potentially large number of test instruments (test procedures, materials, test tool/s harnesses) could be needed
    - Seeking to leverage test instruments developed by others (e.g., MPEG, W3C, DASH-IF IOP, HDMI, etc.) to the extent possible
    - Will develop purpose-built instruments, as needed
  - Implementation
    - Defining how the necessary tests should be done (self-test, 3rd-party testing; test only or full certification)
    - Developing, maintaining, and providing access to test materials, etc.

2016 WAVE Highlights

- WAVE now includes over 60 companies, with broad, influential ecosystem representation – device makers, content and media companies, infrastructure and technology providers.

- Completed scope analysis, defining deliverables to address OTT fragmentation.

- Established that the content spec will be based on the Common Media Application Format spec (ISO MPEG CMAF), creating a liaison with MPEG to influence the completion of CMAF.

- Established objective guidelines for incorporating MPEG and non-MPEG CMAF media profiles into the WAVE content specification.

- Worked closely with the W3C: W3C joined WAVE, WAVE created the W3C Web Media API Community Group for publishing web specs, helped finance the test infrastructure critical to Encrypted Media Extensions becoming a W3C Candidate Recommendation and contributed use cases for new HTML5 video features.

- In June WAVE members Microsoft and Comcast briefed the FCC on the importance of WAVE to the future of commercial video delivery.

2017 Deliverables

- WAVE Content Specification, v. 1
- Web Media APIs 2017 specification
- Guidelines for video web app authors
- WAVE-compliant device specification, v. 1
- Final set of testing requirements and use cases
- Definition of WAVE testing process and environment (tools and infrastructure required to run the tests) whether WAVE administered or via self certification/3rd parties
- Body of test cases for Content, Device, and Application and test materials and tools/infrastructure needed

Questions?

Join WAVE by emailing

standards@CTA.tech