MPEG-DASH 6th Edition Features

DASH-IF Special Session, April 5, 2024

Editors of ISO/IEC 23009-1 6th edition

Alex Giladi, Comcast, Thomas Stockhammer, Qualcomm, Iraj Sodagar, Tencent

Agenda

Timeline and status

Recap of DASH – Principles and 5th edition

6th Edition

- Overview of Features
- L3D-DASH: Low-Latency Low-Delay Extensions
- Media Presentation Insertion
- Patterns in Segment Timeline
- Support for CMCD
- Support for Content Steering
- Addressable Resource Index Tracks

DASH-IF related impacts (IOP guidelines and reference tools)

Q&A

Editions, Parts and Editors

1	2011	ISO/IEC 23009-1 Media Presentation Description and Segment Formats	Thomas Stockhammer and Per Fröjdh
1	2012	ISO/IEC 23009-1:201x 2nd edition	Thomas Stockhammer, Per Fröjdh
1	2013	ISO/IEC 23009-1:2014 AMD 1 Extended profiles and time synchronization	Thomas Stockhammer, Alex Giladi
1	2014	23009-1:2014 AMD 2 Spatial Relationship Description, Generalized URL parameters and other extensions	Emmanuel Thomas, Sylvain Kervadec, Cyril Concolato
1	2014	23009-1:2014 AMD 3 Authentication, Access Control and multiple MPDs	Thomas Stockhammer, Alexander Giladi
1	2014	23009-1:2014 AMD 4 Segment Independent SAP Signalling, MPD chaining and other extensions	Thomas Stockhammer, Iraj Sodagar, Alex Giladi
1	2015	23009-1 3rd edition Media presentation description and segment formats	Thomas Stockhammer
1	2016	23009-1 3rd edition AMD 1 on device information and other extension	Ali C. Begen, Thomas Stockhammer
1	2019	23009-1 4th edition	
1	2020	23009-1 4th edition AMD 1 CMAF support, events processing model and other extensions	Iraj Sodagar, Thomas Stockhammer, Mike Dolan
1	**2022**	**23009-1 5th edition**	**Thomas Stockhammer, Mike Dolan**
2	2012	ISO/IEC 23009-2 DASH Conformance and reference software	Thomas Stockhammer and Christian Timmerer
2	2017	23009-2 2nd edition DASH Conformance and reference software	Christian Timmerer, Waqar Zia, Brendan Long
2	2017	23009-2 AMD 1 Conformance vectors and reference software for SRD, SAND and Server Push	Emmanuel Thomas
2	2020	23009-2 3rd edition	
3	2012	23009-3 DASH Implementation Guidelines	Yuriy Reznik, Kilroy Hughes, Thomas Stockhammer
3	2014	23009-3 2nd edition DASH Implementation Guidelines	Thomas Stockhammer, Alex Giladi
3	2014	23009-3 2nd edition AMD 1 DASH Implementation Guidelines	Iraj Sodagar
3	2015	23009-3 3rd edition DASH Implementation Guidelines	Ali C. Begen
4	2013	ISO/IEC 23009-4 Segment encryption and authentication	Alex Giladi
4	2018	23009-4 2nd edition Segment encryption and authentication	Alex Giladi and Yasser Syed
5	2017	23009-5 Server and Network Assisted DASH	Mary-Luc Champel, Emmanuel Thomas
5	2020	23009-5 AMD 1 Improvements on SAND messages	Mary-Luc Champel
6	2017	23009-6 DASH with Server Push and WebSockets	Viswanathan (Vishy) Swaminathan, Kevin Streeter, Imed Bouzazi, and Franck Denoual
7	2023	23009-7 Delivery of CMAF contents with DASH	Iraj Sodagar
8	2020	23009-8 Session based DASH operation	Ali C. Begen, Iraj Sodagar, Alex Giladi
8	2022	23009-8 AMD 1 URL customization other extensions	Iraj Sodagar

DASH
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5th Edition Extensions

DASH profiles for using Common Media Application Format (CMAF) are added;

the concept Resynchronization is added in order to identify stream access points in Segments;

MPD patching is updated to support explicit MPD updates of smaller size, not only as inband messages;

a client processing model for Event Streams and Timed Metadata tracks is introduced;

Extensions are added to content protection for efficient signalling and to support robustness levels.

A descriptor is added in order to describe the minimum required device output protection security.

More flexible bandwidth signalling is provided to signal variable bitrate encoding.

Status ISO/IEC 23009-1

Editors
- Dolan Michael Mr (Pearl TV)
- Giladi Alex Mr (Comcast)
- Higgs Paul (Huawei)
- Sodagar Iraj Dr (Tencent)
- Stockhammer Thomas Mr Dr. (Qualcomm)
- Wang Ye-Kui Dr (Bytedance)

- ISO/IEC 23009-1:2022 ed.5, Edition date 2022-08
  - http://standards.iso.org/ittf/PubliclyAvailableStandards

- ISO/IEC DIS 23009-1 ed.6
  - Revises (1)
    - ISO/IEC 23009-1:2022
  - Merge of (3)
    - ISO/IEC 23009-1:2022/DAmd 1
    - ISO/IEC 23009-1:2022/CD Amd 2
    - ISO/IEC 23009-1:2022/CD Amd 3
  - Timeline

|		
MDS23511	Text of ISO/IEC DIS 23009-1 6th edition Media presentation description and segment formats	MDS23511_WG03_N01144

WG03_N01144_23511Text of ISO/IEC DIS 23009-1 6th edition Media presentation description and segment formats.zip
Download(11.44 MB)

Description	Target date	Started
DIS registered	2024-04-30	2024-02-23
DIS ballot initiated	2024-04-26	
Close of voting	2024-07-19	
Final text received or FDIS registered for formal approval	2024-11-08	
International Standard published	2025-02-23	

Recap – core aspects of Live DASH

MPD work flow & Low-Latency DASH
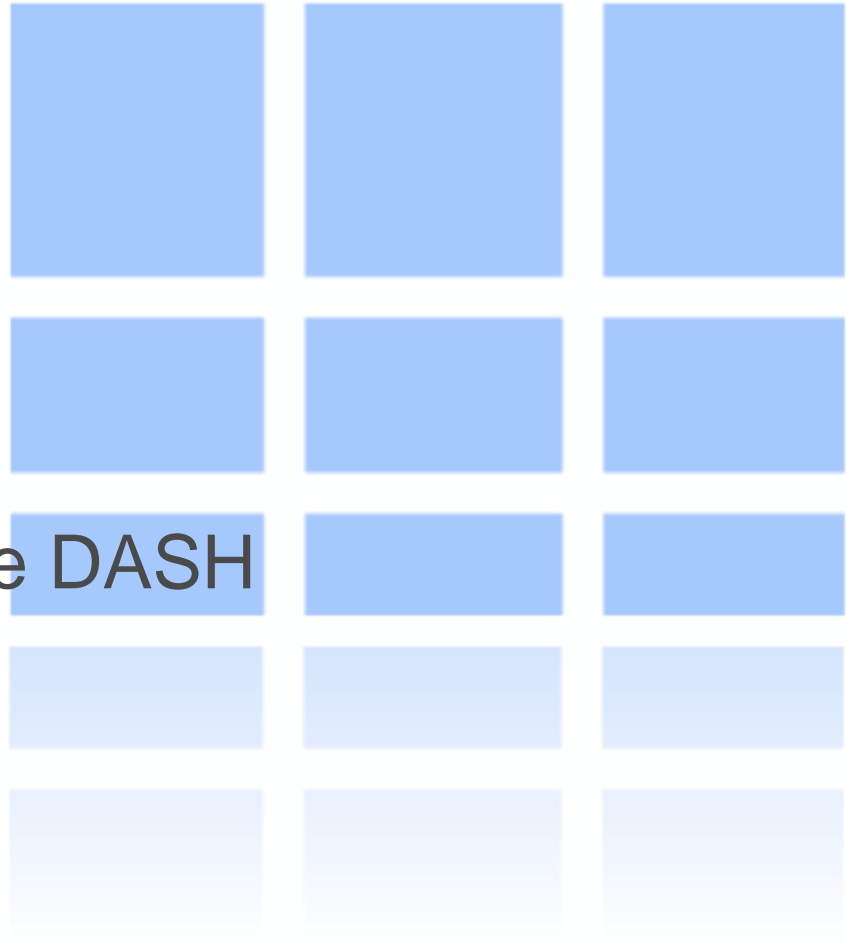
Core Principles of DASH

CDN and Cache friendly	Stateless Server	Client-driven
Low manifest traffic (small size and low update frequency)	Carrying ISO BMFF and CMAF	Late Binding
Works with HTML-5 and MSE	HLS Convergence	Live and On-Demand

DASH MANIFEST FOR LIVE

Key issue for reducing latency is the reduction of segment duration w/o losing scalability

HLS Manifest states what is available on the server and only provides information on the past, which results in the following

1. Client sending uplink requests for Manifest prior to each Segment request

2. A full new manifest needs to be delivered for each new Segment (which also grows over time, so short Segments and Late Binding are more difficult to realize)

3. The manifest needs to be parsed and processed by client for every request

4. For each new segment, a new Manifest needs to be written on the server

DASH MPD provides information of the past and permits promises for the future

- If used properly, several or all of the above can be mitigated or at least reduced

- Functions to support this:
  - Templates in URLs and predictive segment availability times ➔ small manifests and lower segment sizes
  - Flexible MPD validity expiration mechanisms ➔ MPD updates only when necessary
  - Time-synchronized server and client ➔ no requests are necessary

SEGMENT ADDRESSING

```
<Representation mimeType="video/mp4"                             List
                frameRate="24"
                bandwidth="1558322"
                codecs="avc1.4d401f" width="1277" height="544">
  <SegmentList duration="10">
    <Initialization sourceURL="http://cdn.bitmovin.net/bbb/video-1500/init.mp4"/>
    <SegmentURL media="http://cdn.bitmovin.net/bbb/video-1500/segment-0.m4s"/>
    <SegmentURL media="http://cdn.bitmovin.net/bbb/video-1500/segment-1.m4s"/>
    <SegmentURL media="http://cdn.bitmovin.net/bbb/video-1500/segment-2.m4s"/>
    <SegmentURL media="http://cdn.bitmovin.net/bbb/video-1500/segment-3.m4s"/>
    <SegmentURL media="http://cdn.bitmovin.net/bbb/video-1500/segment-4.m4s"/>
  </SegmentList>
</Representation>
```
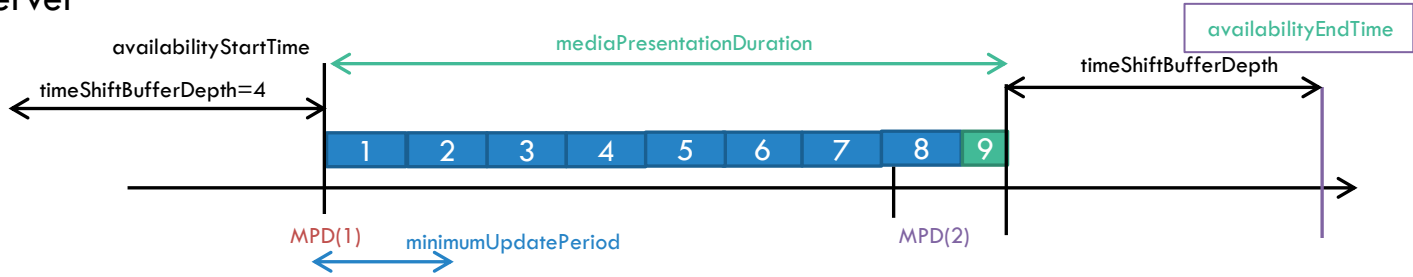
```
<Representation mimeType="video/mp4"
                frameRate="24"                     Number template
                bandwidth="1558322"
                codecs="avc1.4d401f" width="1277" height="544">
  <SegmentTemplate media="http://cdn.example.net/bbb/segment-$Number$.m4s"
                   initialization="http://cdn.example.net/bbb//init.mp4"
                   startNumber="0"
                   timescale="24"
                   duration="48"/>
</Representation>
```
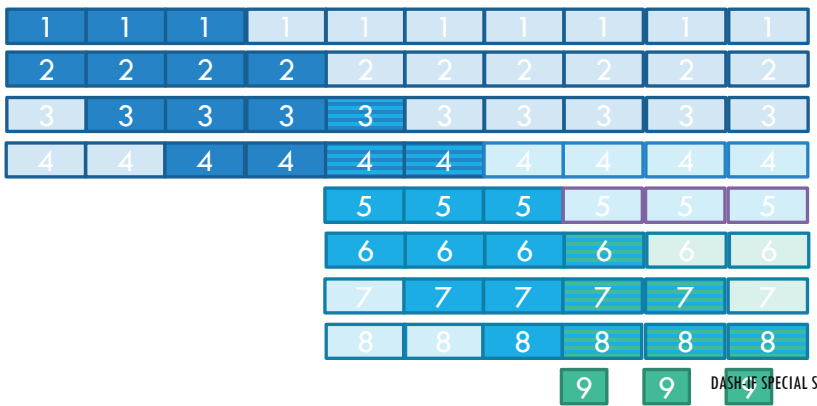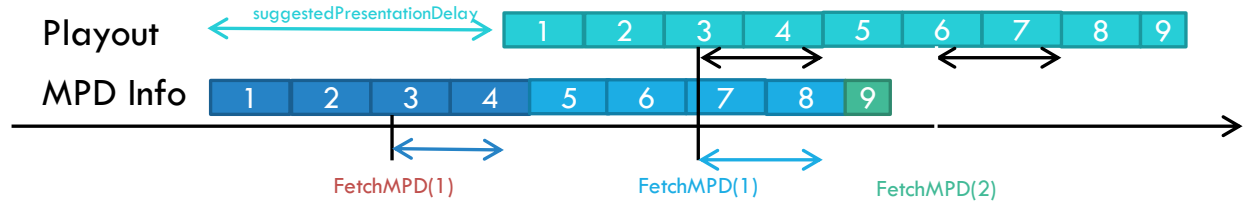
Segment-0
Segment-1
Segment-2
......

ADVANCED CLIENT

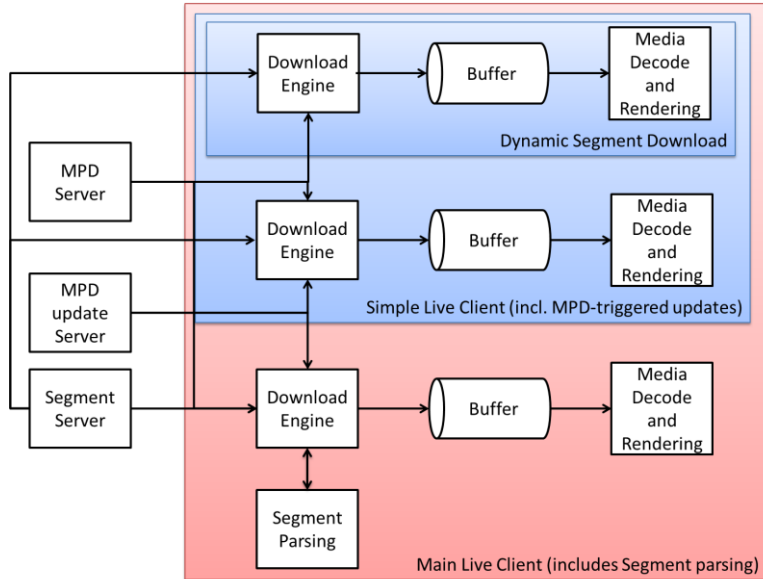\<InbandEventStream MPD Validity Expiration\>

```
<Representation mimeType="video/mp4"
                frameRate="24"
                bandwidth="1558322"
                codecs="avc1.4d401f" width="1277" height="544">
  <SegmentTemplate media="http://example.net/video/segment-$Time$.m4s"
                   initialization="http://example.net/video/segment-/init.mp4"
                   timescale="24">
    <SegmentTimeline>
    <S t="0" d="48" r="5"/>
    </SegmentTimeline>
  </SegmentTemplate >
</Representation>
```
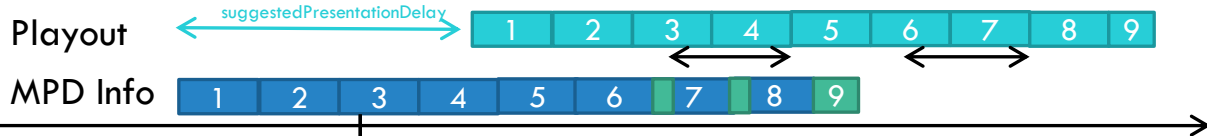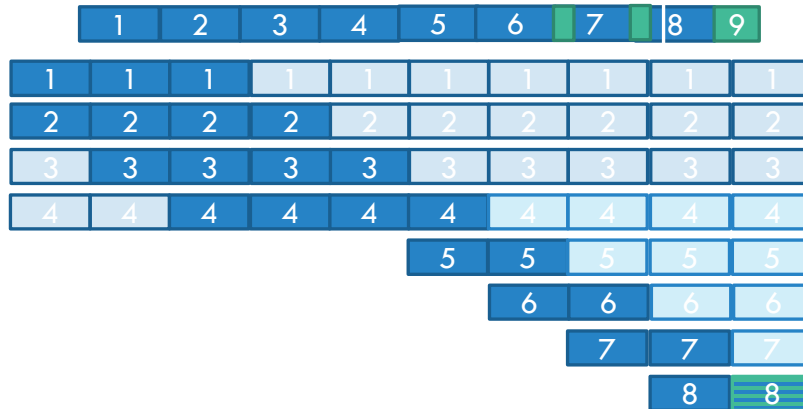
Segment-0
Segment-48
Segment-92
......

SEGMENT TIMELINE

```xml
<Representation id="3" width="1920" height="1080" frameRate="25/1" bandwidth="8000000" codecs="avc1.4D4028">
  <SegmentTemplate timescale="25" media="multiperiod_video_1_2_$Number$.mp4?m=1521455401" initialization=
  "multiperiod_video_1_2_init.mp4?m=1521455401" startNumber="19" presentationTimeOffset="51">
    <SegmentTimeline>
      <S t="901" d="50" r="14"/>
    </SegmentTimeline>
  </SegmentTemplate>
</Representation>
</AdaptationSet>
<AdaptationSet mimeType="audio/mp4" segmentAlignment="0" lang="eng">
  <Representation id="4" bandwidth="98605" audioSamplingRate="48000" codecs="mp4a.40.2">
    <SegmentTemplate timescale="48000" media="multiperiod_audio_1_5_$Number$.mp4?m=1521455401" initialization=
    "multiperiod_audio_1_5_init.mp4?m=1521455401" startNumber="19" presentationTimeOffset="96320">
      <SegmentTimeline>
        <S t="1730624" d="96256"/>
        <S t="1826880" d="95232"/>
        <S t="1922112" d="96256" r="2"/>
        <S t="2210880" d="95232"/>
        <S t="2306112" d="96256" r="2"/>
        <S t="2594880" d="95232"/>
        <S t="2690112" d="96256" r="2"/>
        <S t="2978880" d="95232"/>
        <S t="3074112" d="96256"/>
      </SegmentTimeline>
    </SegmentTemplate>
  </Representation>
```
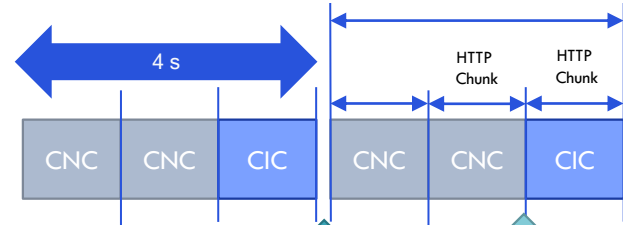
Low-Latency Streaming with Chunking

Encoder

CNC	CNC	CIC	CNC	CNC	CIC	CH

0.5 s

Service Description

DASH Packager

MPD

IS

CH = CMAF Header

CNC = CMAF non-initial chunk

CIC = CMAF initial chunk

Many technical details are in
DASH-IF IOP v5
http://www.dashif.org/guidelines

10s

Regular DASH Client

3s

Low-Latency DASH Client

4 s

DASH Segment

HTTP Chunk   HTTP Chunk

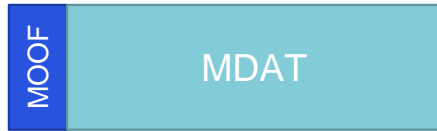| CNC	CNC	CIC	CNC	CNC	CIC

Segments

CDN stores Segments

Chunks
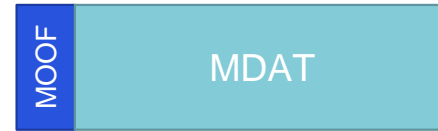
# Chunked Segment Distribution

ENCODER

CDN
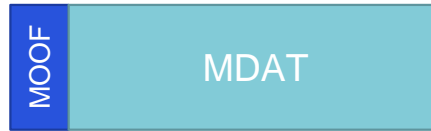
PLAYER

MPEG DASH supporting work

- As part of ISO/IEC 23009-1 4th and 5th edition

- Producer Reference Time in MPD and segments
  - Enables media encoding including wall-clock anchor times
  - Permits DASH client to determine, monitor and control latency.

- Service Description
  - Addresses service provider's influence on DASH client operation
  - Target Latencies, Playback Control

- Updates on Event Processing

- DASH Profile for CMAF Content

- Resynchronization
  - Enables chunk signaling
  - Enables fast downswitching and random access

CHANGE REQUEST					
DASH-IF IOP	**CR**		**rev**	**-**	**Current version:**	V4.3

Status:	Draft	Internal Review	X Community Review	Agreed

Title:	Low-latency Modes for DASH
Source:	Live TF
Supporting Companies:	Akamai, Amazon Elemental, castLabs, Comcast, Elemental Technologies, Ericsson, Frontier Communications Harmonic, Hulu, Qualcomm Incorporated, Sony, TNO, Unified Streaming,
Category:	A		Date:	2020-02-21
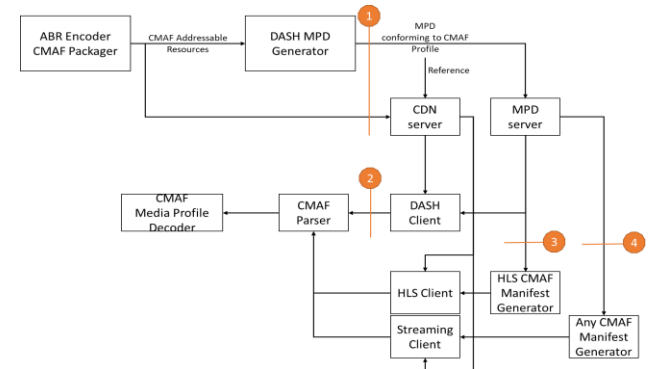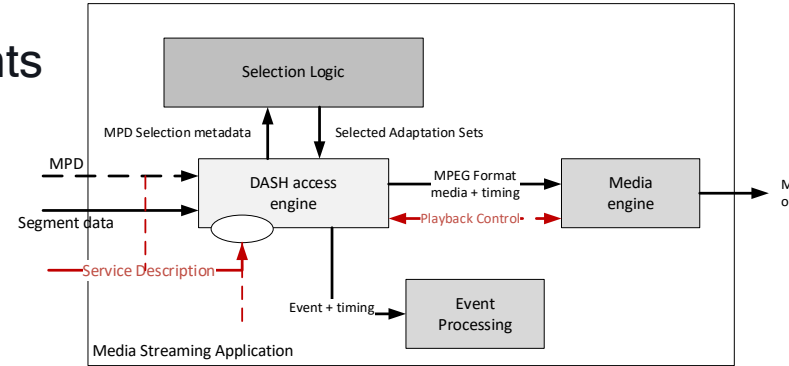
Advantages of Chunked Segments

- Legacy Player Support with the same content/infra

- CDN friendly: Cacheability and Scalability

- Decoupling of latency from segment duration

- Reuse or Automatic support of existing DVB-DASH
  - Codecs and formats
  - Common Encryption
  - Ad Insertion
  - Events

- Standards-based and promise for convergence

- Works also with ABR Multicast and Broadcast

6th edition extensions

Overview
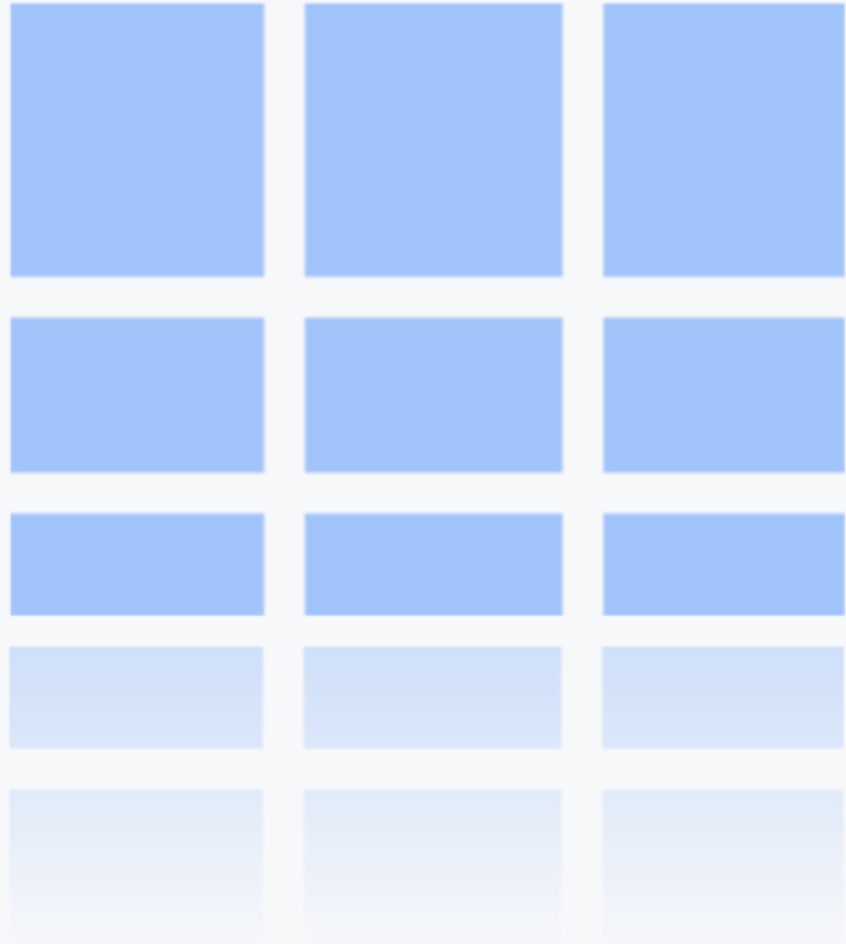
MPEG 6th Edition – Overview of Features

Amendment 1 – FDAM complete

- **Alternative MPD Events for Client Side/Server Guided Ad Insertion**
- Nonlinear playback
- **Addressable Resource Index Track**
- DASH Period Event

Amendment 2 Rolled into DIS 6th ed

- **Support for Content Steering**
- Support for extended dependent random access point representations
- Support for advanced Picture-in-Picture signaling (using VVC subpictures)
- Support for status in Event scheme

Amendment 3 Rolled into DIS 6th ed

- **Support for CMCD Signaling**
- **Segment Sequences for improved latency and switching**
- **Improvements to Segment Timeline for Patterns and tolerance**

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6th edition extensions

Extensions to Segment Signaling (Alex)
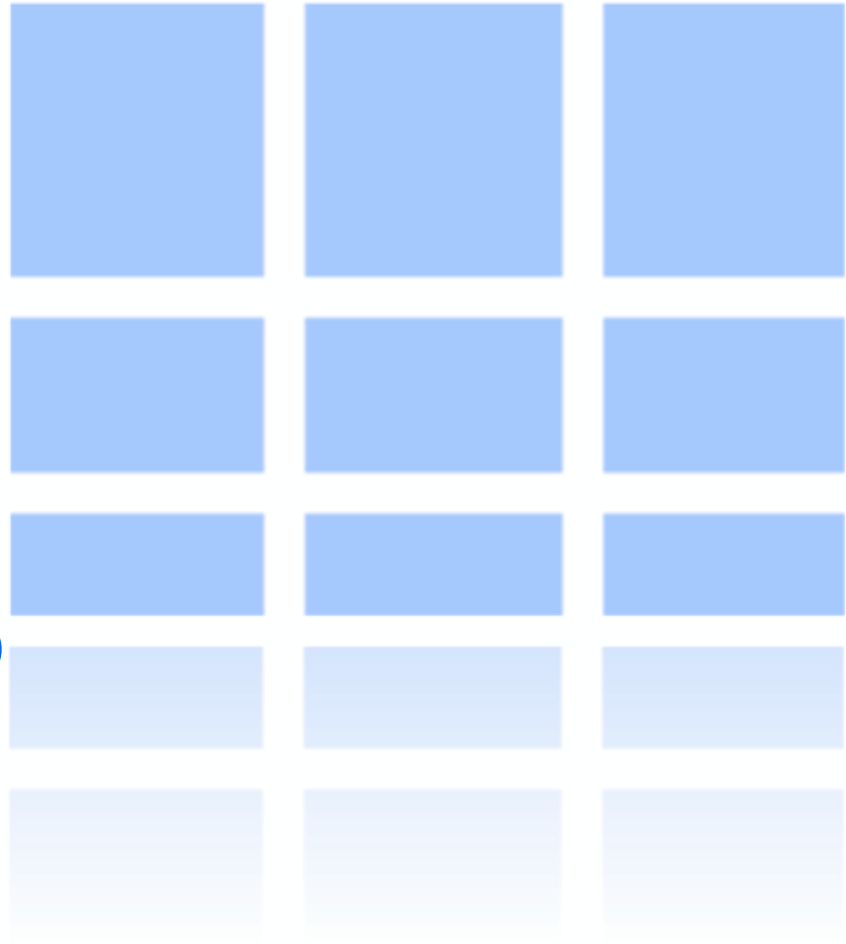
L3D-DASH: Low-Latency Low-Delay Extensions

Motivation

- Low-delay operation
  - Start playback faster – do not wait for up to 2 seconds
  - Faster switching to avoid buffering
  - Independency of joining latency, switching latency and segment duration

- Ad insertion w/o stream conditioning
  - Return from ad break to an arbitrary place – not necessarily an IDR

- LL-HLS compatibility
  - Reuse LL-HLS partial segments
  - Use DASH templates to keep same MPD update efficiency

Low-delay mode: theory of operation

- Partial Segments
    - Segment broken into sequence of partial segments ("segment sequence")
    - Partial segments start with IDR
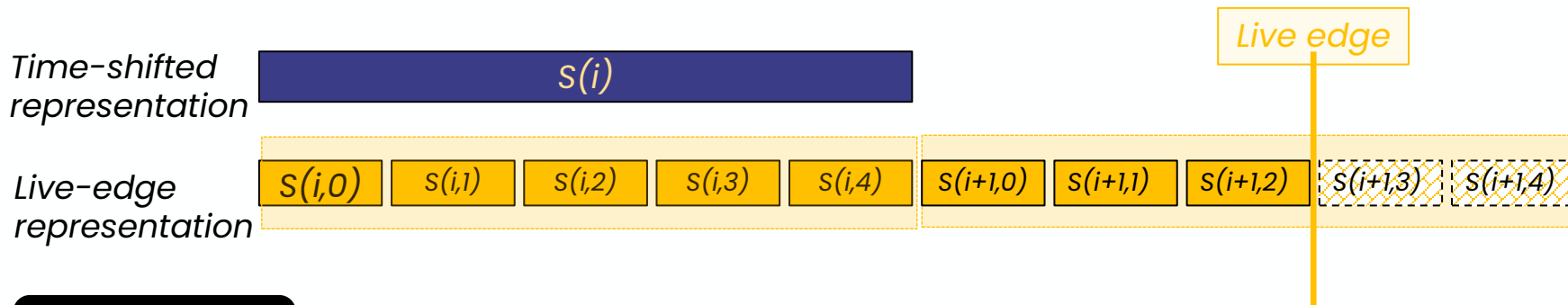   - Special-purpose representations for fine-grain random access

- Segment Sequences are templated
    - "this segment sequence contains *k* partial sequences"
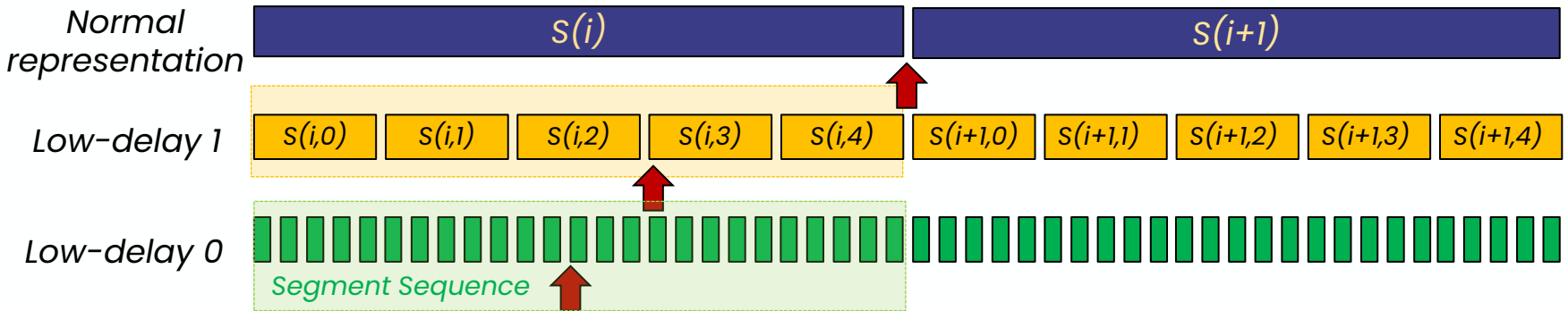
Low-latency mode: theory of operation

- Partial Segments
  - LL-HLS partial segments (no byte ranges)
  - Partial segments do not need to start with IDR
  - Partial segments may contain events

- Segment Sequences are templated
  - " Same MPD update frequency as in non-LL DASH

Live edge

Time-shifted representation

| $s(i)$ |

Live-edge representation

| $s(i,0)$ | $s(i,1)$ | $s(i,2)$ | $s(i,3)$ | $s(i,4)$ | $s(i+1,0)$ | $s(i+1,1)$ | $s(i+1,2)$ | $s(i+1,3)$ | $s(i+1,4)$ |

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L3D: Low-Latency Low-Delay DASH

Beyond low-latency and low-delay

- Efficient use of HTTP/3
  - Each HTTP/3 response is a QUIC stream
  - Parallelize transmission of extremely short partial segments
    … some of the MoQ goodness using ye aulde DASH

- Compression efficiency
  - Enables scene-boundary aligned segments
  - Mini-GOP-sized partial segments for random access and events

- Trick modes
  - Small partial segments can be used for smoother trick play

```xml
<?xml version="1.0" encoding="UTF-8"?>
<MPD xmlns="urn:mpeg:dash:schema:mpd:2011" type="dynamic" id="7399610060681366163" profiles="urn:mpeg:dash:profile:isoff-live:2011"
minBufferTime="PT2.000S" maxSegmentDuration="PT0H0M2.016S" minimumUpdatePeriod="PT0H0M2.002S" availabilityStartTime="1977-05-25T18:00:00.000Z"
timeShiftBufferDepth="PT0H0M30.000S" publishTime="2021-11-10T20:44:07.025Z">

  <ServiceDescription>
      <Latency min="750" max="4200" target="1250" referenceId="7"/>
      <PlaybackRate min="0.96" max="1.04"/>
  </ServiceDescription>

  <Period id="817467999" start="PT389761H2M15.535S">
    <ProducerReferenceTime id="7" wallClockTime="2019-08-06T13:44:12Z" presentationTime="158400"/>
    <AdaptationSet id="1" contentType="video" mimeType="video/mp4" segmentAlignment="true" startWithSAP="0">
      <Role schemeIdUri="urn:mpeg:dash:role:2011" value="main"/>
      <EssentialProperty schemeIdUri="urn:mpeg:dash:ssr:2023" />
      <!—Segment Sequence Representations where partial segments with subnumber > 1
          are not expected to have any kind of random access / bitstream switching
          The first partial segment starts with SAP = 1 -->
      <SegmentSequenceProperties>
          <SAP type="1"/>
      </SegmentSequenceProperties>

      <SegmentTemplate initialization="$RepresentationID$/init.mp4" media="$RepresentationID$/segment_$Number$_part_$SubNumber$.mp4"
                      timescale="90000" startNumber="817472154" presentationTimeOffset="135158">
        <SegmentTimeline>
          <!-- 1.92s segment with 6-frame partial segments, compatible with LL-HLS-->
          <S t="546975158" d="172800" r="14" k="16"/>
        </SegmentTimeline>
      </SegmentTemplate>
      <Representation id="l3d_540p"  bandwidth="1502000"  codecs="hvc1.2.4.L93.B0" width="960"  height="540"  frameRate="50"/>
      <Representation id="l3d_720p"  bandwidth="2166000"  codecs="hvc1.2.4.L93.B0" width="1280" height="720"  framerate="50"/>
      <Representation id="l3d_1080p" bandwidth="6202000"  codecs="hvc1.2.4.L123.B0" width="1920" height="1080" frameRate="50"/>
      <Representation id="l3d_1440p" bandwidth="12741200" codecs="hvc1.2.4.L153.B0" width="2560" height="1440" framerate="50"/>
      <Representation id="l3d_2160p" bandwidth="18667200" codecs="hvc1.2.4.H153.B0" width="3840" height="2160" frameRate="50"/>
    </AdaptationSet>
  </Period>
</MPD>
```

Patterns in Segment Timeline

Problem

- Align audio and video segment boundary
    - Audio and video may have different sample durations
    - Alignment math (for AAC): $\frac{x}{fps} = \frac{Y*1024}{48000}$
    - If fps=50, use 1.92s or 3.84s segments
    - US: fps=60000/1001, use ???

- US alternative: duration patterns
    - N-1 audio segments with X-1 samples, 1 segment with X samples
    - `SegmentTimeline`: 2 `S` elements to express every N elements
    - No `SegmentTimeline`: loss of precision (e.g. ±1s variation)

Segment duration patterns in 6th edition

- Increase precision
  - Explicit tolerance signaling (e.g. ± 1 sample)
  - *E.g., "this audio segment duration is between 1980ms and 2020ms".*

- Use duration pattern
  - Explicitly describe a pattern separately from individual segments
  - Signal pattern and entry point in SegmentTimeline.S element
 - Timing always precise

| s(i) | s(i+1) | s(i+2) | s(i+3) | s(i+4) | s(i+5) | s(i+6) | s(i+7) | s(i+8) | s(i+9) |

Pattern:
- *4 N-sample segments*
- *1 M-sample segment*

```xml
<?xml version="1.0" encoding="UTF-8"?>
<MPD xmlns="urn:mpeg:dash:schema:mpd:2011" type="dynamic" id="7399610060681366163" minBufferTime="PT2.000S"
maxSegmentDuration="PT0H0M2.016S" minimumUpdatePeriod="PT0H0M2.002S" timeShiftBufferDepth="PT0H0M30.000S" publishTime="2021-11-
10T20:44:07.025Z" availabilityStartTime="1977-05-25T18:00:00.000Z">
    <Period id="817467999" start="PT389761H2M15.535S">
        <AdaptationSet id="1" contentType="audio" mimeType="audio/mp4" segmentAlignment="true" startWithSAP="1"
audioSamplingRate="24000">
            <Role schemeIdUri="urn:mpeg:dash:role:2011" value="main"/>
            <EssentialProperty schemeIdUri="urn:mpeg:dash:pattern:2024"/>
            <SegmentTemplate initialization="$RepresentationID$/init.mp4" media="$RepresentationID$/segment_$Time$.mp4"
timescale="90000" startNumber="817472154" presentationTimeOffset="135158">
                <Pattern id="1">
                    <P d=" 180480" r="11"/>
                    <P d="176640"/>
                </Pattern>
                <SegmentTimeline>
                    <S t="546975158" r="164" p="1" pE="3"/>
                </SegmentTimeline>
            </SegmentTemplate>
            <Representation id="eng_2ch" bandwidth="112000" codecs="mp4a.40.5"/>
        </AdaptationSet>
    </Period>
</MPD>
```

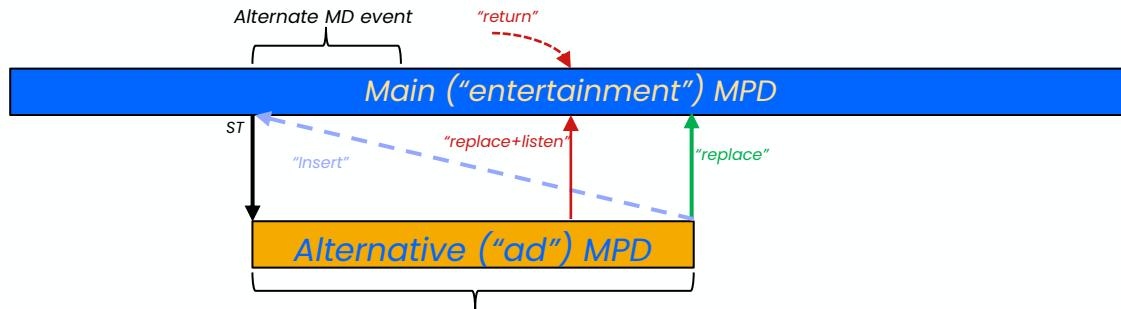# 6th edition extensions

Support for Advanced Ad Insertion (Alex)
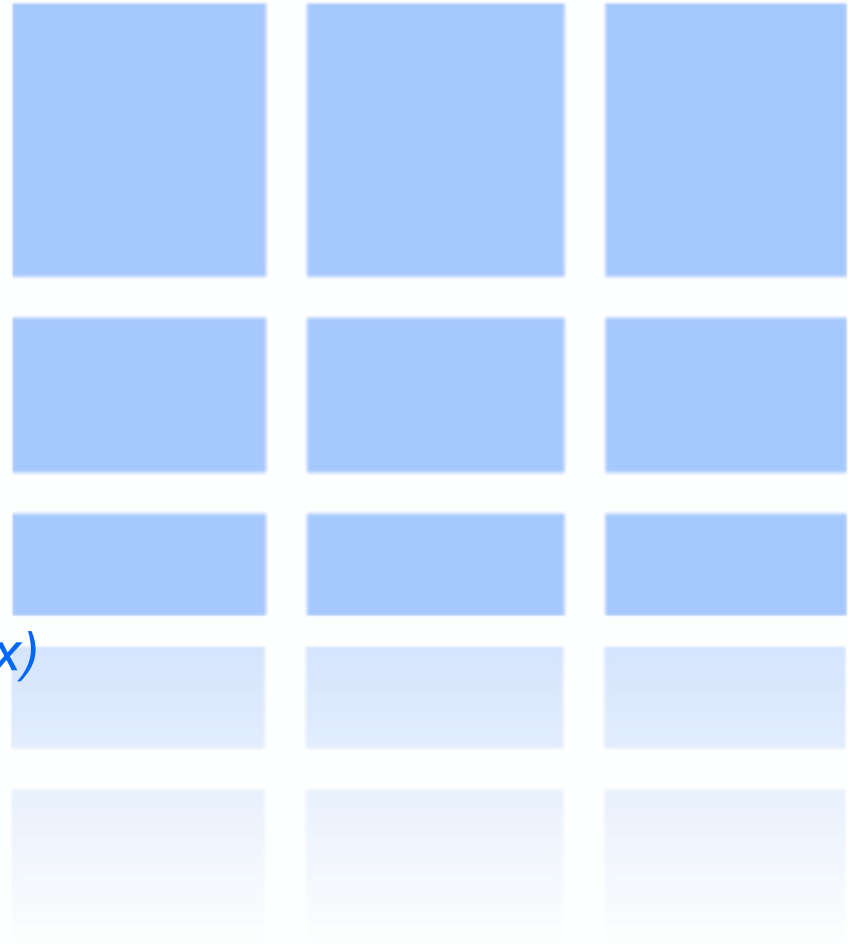
DASH-IF Ad Insertion Architecture: SSAI/SGAI
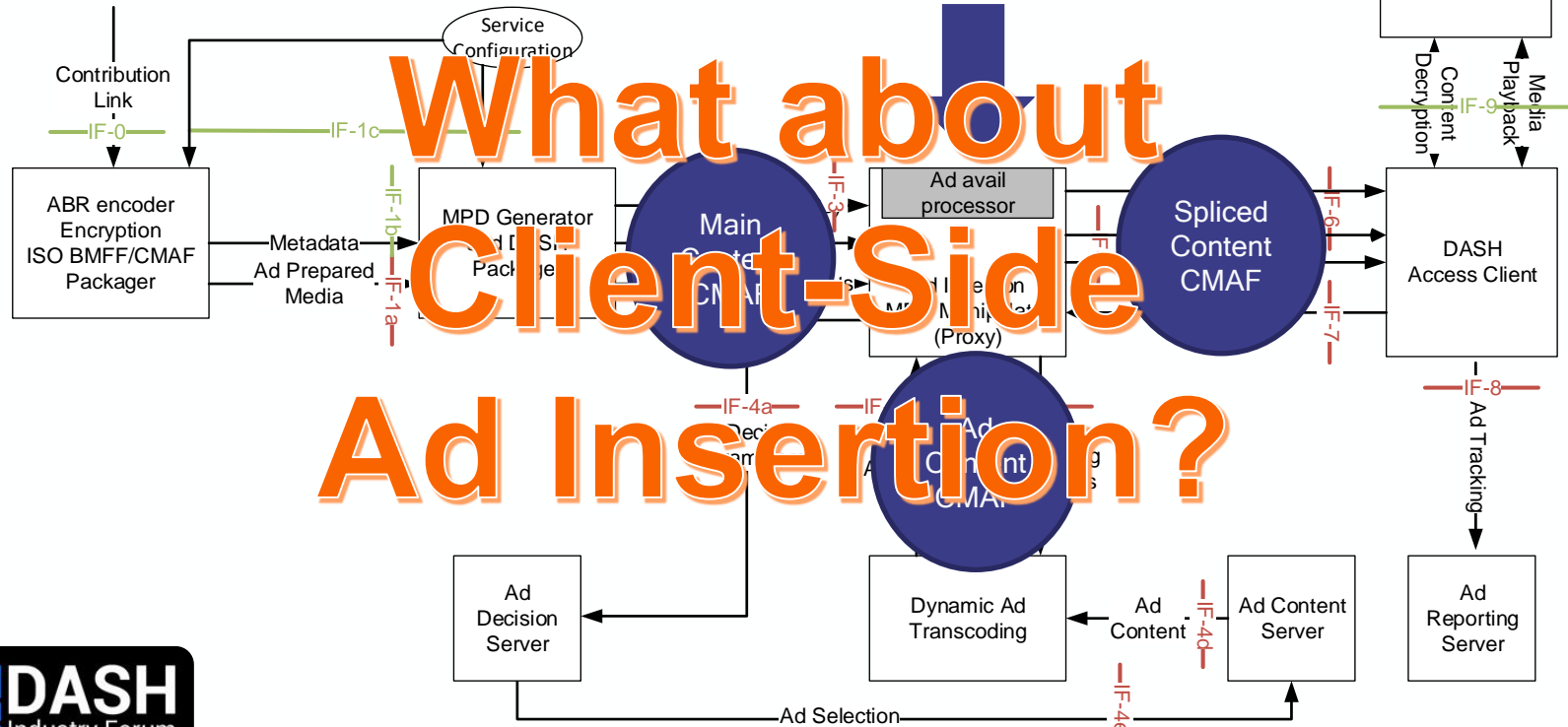
Media Presentation Insertion

Problem

- We have tens of thousands of "canned" ad MPDs
  - How do we reuse them in context of linear?
  - How do we interrupt them asynchronously (e.g., "breaking news")
    - "Return to network" in SCTE-speak

- Wasn't XLink supposed to solve these?
  - onRequest timing model is undefined
  - Re-resolution on every MPD update
  - Convoluted asynchronous termination
  - New solution simpler than another redesign

- Simple support for most alternate content problems
  - "Regular" ad ecosystem
  - Combination of ads and blackouts

D

Media Presentation Insertion

- "Start playing alternate MPD, come back when done"
  - Carries a URL of a new MPD
  - Event's start ST and duration define the time interval for switching to Alternate MPD
  - Play for the *actual* duration of alternate MPD duration D
    - If was alternative MPD was intended to run for 15s but ran for 5s then D=5.

- Modes
  - "insert": return to the starting point, timing shifting the original content
  - "replace": return to $ST+D$ replacing the original content
  - "replace+listen": same as "replace", but listen to events from the main presentation
  - "return" signals early termination, and immediate return to the main presentation

DASH Media Presentation Insertion vs HLS Interstitials

Feature	HLS	DASH
Opening new Media Presentation	`EXT-X-DATERANGE CLASS = "com.apple.hls.interstitial"`	Alternative MPD event (carried in MPD or segments)
Query Parameters	Named query parameters (Annex D.4)	Extended query parameters (Annex I.3)
Resumption point	`X-RESUME-OFFSET` 1. 0: resume at the same point 2. Absent: resume when interstitial terminates 3. T: resume in T seconds	`Event@value` 1. "insert": resume at the same point 2. "replace": resume when alternative presentation terminates 3. Custom duration via MPD Anchors (Annex C.4)
Termination	1. Interstitial duration 2. Stated duration	1. Alternative presentation duration 2. Stated duration 3. Asynchronous, e.g. early termination and more
Nesting	No	Yes

```xml
<?xml version="1.0" encoding="utf-8"?>
<MPD xmlns="urn:mpeg:dash:schema:mpd:2011" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:mpeg:dash:schema:mpd:2011 DASH-MPD.xsd" availabilityStartTime="1970-01-01T00:00:00Z"
maxSegmentDuration="PT6S" minBufferTime="PT2S" minimumUpdatePeriod="PT5M" profiles="urn:mpeg:dash:profile:isoff-live:2011"
publishTime="2019-03-12T01:17:30Z" timeShiftBufferDepth="PT8M20S" type="dynamic">
    <Period id="p0" start="PT0S">
        <EventStream schemeIdUri="urn:mpeg:dash:event:alternative:2022S" value="replace">
            <Event presentationTime="PT60S" duration="10000000">http://acmeadsertver.com/preroll.mpd</Event>
        </EventStream>
        <BaseURL>http://liveserver.com/live/live1/</BaseURL>
        <AdaptationSet contentType="video" maxHeight="1920" maxWidth="1080" mimeType="video/mp4" par="16:9"
segmentAlignment="true" startWithSAP="1">
            <SegmentTemplate duration="2" initialization="$RepresentationID$/init.mp4" media="$RepresentationID$/$Number$.m4s"
startNumber="0"/>
            <Representation id="V300" bandwidth="300000" codecs="avc1.64001e" frameRate="60/2"/>
            <Representation id="V600" bandwidth="600000" codecs="avc1.64001e" frameRate="60/2"/>
        </AdaptationSet>
    </Period>
</MPD>
```

Open questions

- Restrict trick play in a "canned" MPD
  - HLS Interstitials have a SKIP parameter passed to the alternative player

- Allow personalized beaconing while maintaining "canned" ad MPDs?
  - Beaconing may be application-specific (e.g. VAST) or Callback events

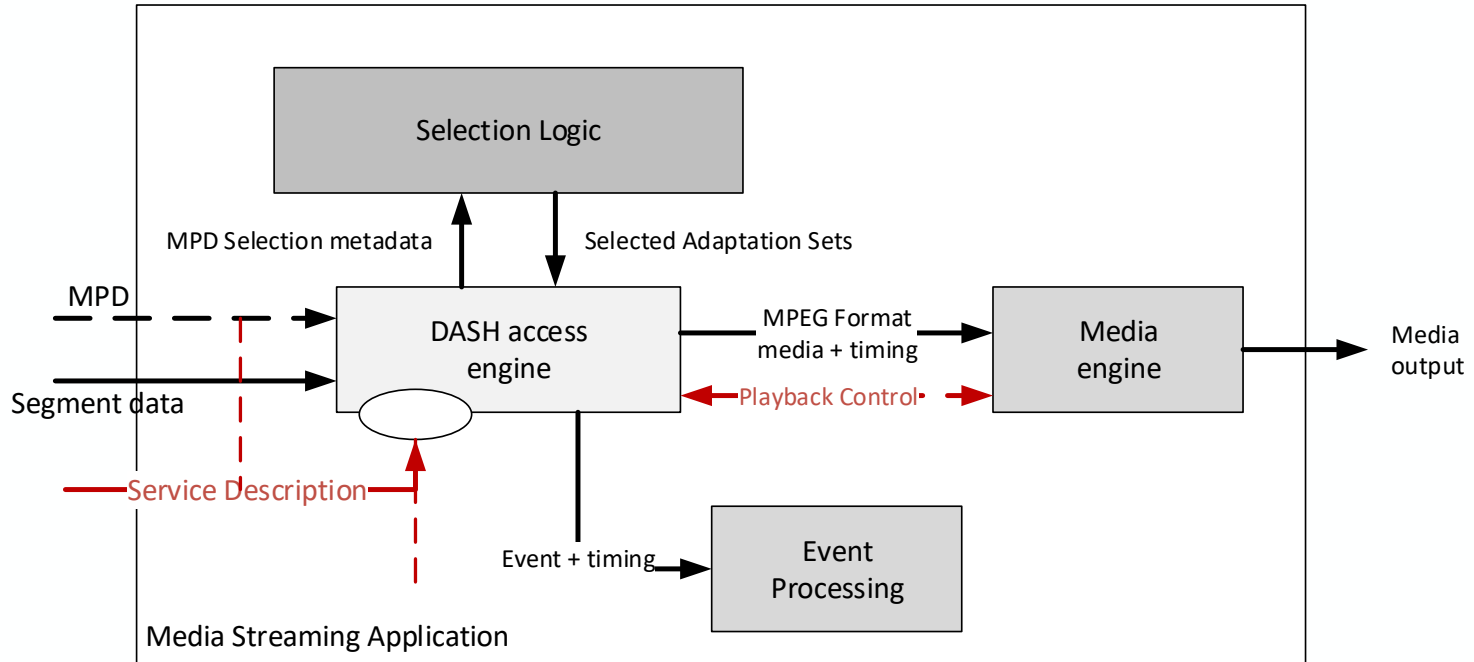- Prevent events from being triggered during rewind or when encountered for the 2nd time

6th edition extensions

DASH Support for CMCD, Content Steering and ARI Track

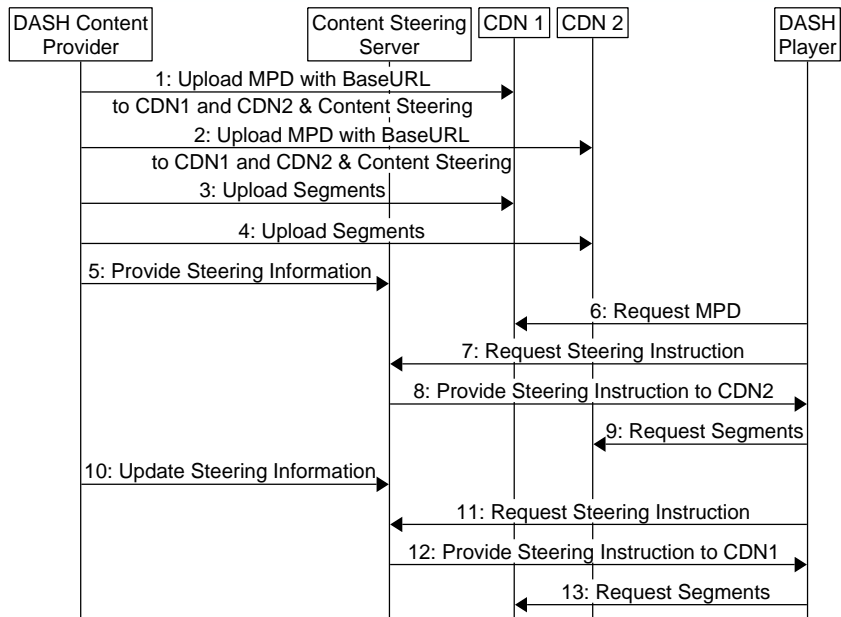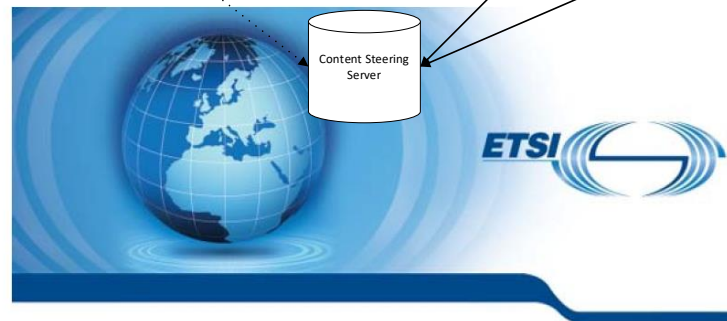# Service Description: Annex K of ISO/IEC 23009-1
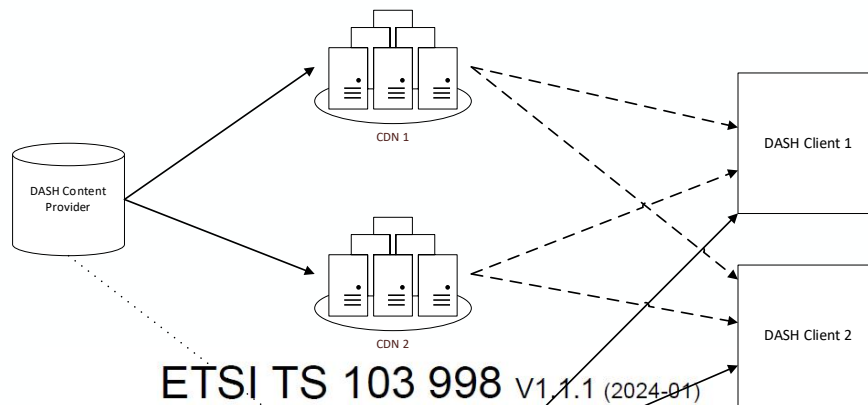## Sending client configuration information in MPD

What is Content Steering?

ETSI TS 103 998 V1.1.1 (2024-01)

Publicly Available Specification (PAS);
DASH-IF: Content Steering for DASH

Content Steering Signaling in DASH

- Definition of Service Location
  - collection of network resources that share commonalities and can be referred to by a common label

- Can be assigned to
  - Location
  - PatchLocation
  - BaseURL

- Can be referenced by external, including

Key	Type	Description
ContentSteeringServer	URI	A URL that can be used to access the Content Steering server. The URL shall reference to a DASH Content Steering Manifest (DCSM) as defined in ETSI TS 103 998. If the resolved resource is not a Content Steering Manifest (DCSM), the resource is ignored.
defaultServiceLocation	string	This attribute specifies a space-separated list of Service Locations as defined in subclause 5.6.6 that the client should use to access the selected resources, in case multiple access exist. This for example applies, when no content steering server is available, or before a valid response from a content steering server is available.
queryBeforeStart	Boolean	If true, indicates that the player is expected to resolve the response from the Steering Server prior to starting playback. Default value is false.
clientRequirement	Boolean	If true, indicates that the client, if it is in the context of the Service Description shall follow the content steering rules as defined in ETSI TS 103 998. If false, indicates to client that the DASH client is expected to either (i) ignore the Content Steering instructions, or (ii) follow the requirements as if this flag is set to TRUE. Default value is true.

Content Steering

```xml
<MPD xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="urn:mpeg:dash:schema:mpd:2011"
xsi:schemaLocation="urn:mpeg:dash:schema:mpd:2011 DASH-MPD.xsd" type="dynamic" minimumUpdatePeriod="PT30S"
timeShiftBufferDepth="PT30M" availabilityStartTime="2022-02-25T12:30:00" minBufferTime="PT4S"
profiles="urn:mpeg:dash:profile:isoff-live:2011">
        <Location serviceLocation="alpha">https://cdn1.example.com/newMPD.mpd</Location>
        <ServiceDescription>
                <Latency min="750" max="4200" target="1250" referenceId="7"/>
                <PlaybackRate min="0.96" max="1.04"/>
                <ContentSteering defaultServiceLocation="beta"
queryBeforeStart="true">https://steeringservice.com/app/instance12345</ContentSteering>
        </ServiceDescription>
        <BaseURL serviceLocation="alpha">https://cdn1.example.com/</BaseURL>
        <BaseURL serviceLocation="beta">https://cdn2.example.com/</BaseURL>
        <Period id="1">
                <AdaptationSet mimeType="video/mp4" codecs="avc1.4D401F" frameRate="30000/1001" segmentAlignment="true"
startWithSAP="1">
                        <BaseURL>video/</BaseURL>
        …
    </AdaptationSet>
        </Period>
</MPD>
```

```json
{
    "VERSION": 1,
    "TTL": 250,
    "RELOAD-URI": "https://steeringservice.com/instance12345?session=abc"
    "PATHWAY-PRIORITY": ["alpha","beta"]
}
```

What is CMCD?

- A defined set of structured key/value pairs communicating mutually beneficial media-related information from a player to a CDN via either
  - A set of custom headers
  - A query arg
  - A JSON object

- Common because the same data structure can be used across all players and all CDNs.

- Resources
  - Available for free at https://tinyurl.com/cta5004spec
  - DASH-IF Special Session available from Will Law

- Version 2 is happening as we speak

Consumer Technology Association™
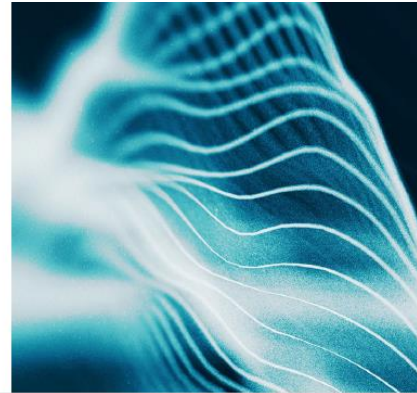
CTA Specification

Web Application Video Ecosystem - Common Media Client Data

CTA-5004

September 2020

CMCD Signaling in DASH

Key	Type	Description
serviceLocations	string	specifies a space-delimited list of Service Locations as defined in subclause 5.6.6 for which reporting is enabled. If the attribute is absent, then it applies to all Service Locations specified in the MPD.
adaptationSets	string	specifies a space-delimited list of identifiers @id of Adaptation Sets for which reporting is applied. If the attribute is absent, then it applies to all eligible Adaptation Sets. Note that Service Locations and Adaptation Sets filters are applied jointly addressing the intersection of the two.
ReportingSystem	descript or	Defines the reporting system and configuration to send back client data for the above Service Locations and and Adaptation Sets.

| Key	Type	Description
version	unsigned int	specifies the highest CMCD version as defined in CTA-5004 that is accepted by the reporting server.
mode	string	specifies the data transition mode how the media client shall send the media client data as defined in clause 2 of CTA-5004. The two options are "query" and "header". "header" refers to the mode defined in clause 2.1 of CTA-5004. "query" refers to the mode defined in clause 2.2 of CTA-5004.
includeInRequests	string	specifies which HTTP GET requests that shall include CMCD data. The semantics are identical to the @includeInRequests attribute in Table I.3.
keys	string	specifies a space-delimited list of the CMCD keys which shall be reported as a part of CMCD reporting. Values of the keys are listed in CTA-5004. Keys not defined in CTA-5004 should not be present. Unidentified key shall be ignored by the client.
contentID	string	specifies the value of the Content ID cid key in CMCD reporting, if cid is present in the keys attribute. The value shall be restricted to maximum of 64 characters.
sessionID	string	specifies the value of the Session ID sid key in CMCD reporting, if sid is present in the keys attribute. The value shall be restricted to maximum 64 characters.

```xml
<MPD xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="urn:mpeg:dash:schema:mpd:2011"
xsi:schemaLocation="urn:mpeg:dash:schema:mpd:2011 DASH-MPD.xsd" type="dynamic" minimumUpdatePeriod="PT30S"
timeShiftBufferDepth="PT30M" availabilityStartTime="2022-02-25T12:30:00" minBufferTime="PT4S" profiles="urn:mpeg:dash:profile:isoff-
live:2011">
    <ServiceDescription>
        <Latency min="750" max="4200" target="1250" referenceId="7"/>
        <PlaybackRate min="0.96" max="1.04"/>
        <ClientDataReporting scheme="urn:mpeg:dash:cta-5004:2023" serviceLocations="beta" adaptationSets="video">
            <CMCDParameters mode="header" includeInRequests="*" keys="br,bl,cid,dl,mtp,nor,ot,sf,v"/>
        </ClientDataReporting>
    </ServiceDescription>
    <BaseURL serviceLocation="alpha">https://cdn1.example.com/</BaseURL>
    <BaseURL serviceLocation="beta">https://cdn2.example.com/</BaseURL>
    <Period id="1">
        <AdaptationSet id="video" mimeType="video/mp4" codecs="avc1.4D401F" frameRate="30000/1001" segmentAlignment="true"
startWithSAP="1">
            <BaseURL>video/</BaseURL>
            …
        </AdaptationSet>
    </Period>
</MPD>
```

ARI Track - Motivation

- The following aspects are observed
— In several cases there is a desire that an adaptive streaming client has exact knowledge of the duration and size of addressable resources and possible a subset of those on the server.

— Addressable Resources are Track Files, Segments or Chunks in the CMAF context, but apply equally to DASH or HLS.

— For on-demand services, an exact map of this information may be provided by the Segment Index.

- Segment Index is not sufficient. Examples include:
— A solution is required for different operation modes: low-latency live, live, time-shifted, VoD

— The solution is expected to work for different target latency of the client

— The client and network address to operate in different network conditions

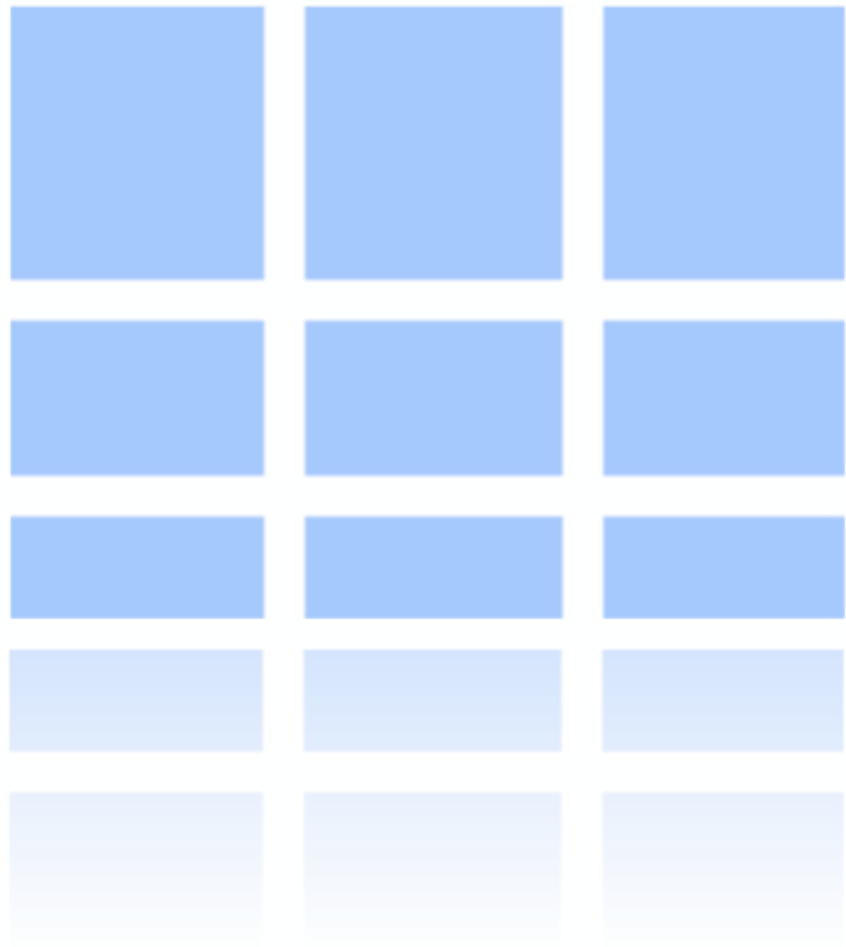— The message also includes information on the content quality

ARI Track in live mode
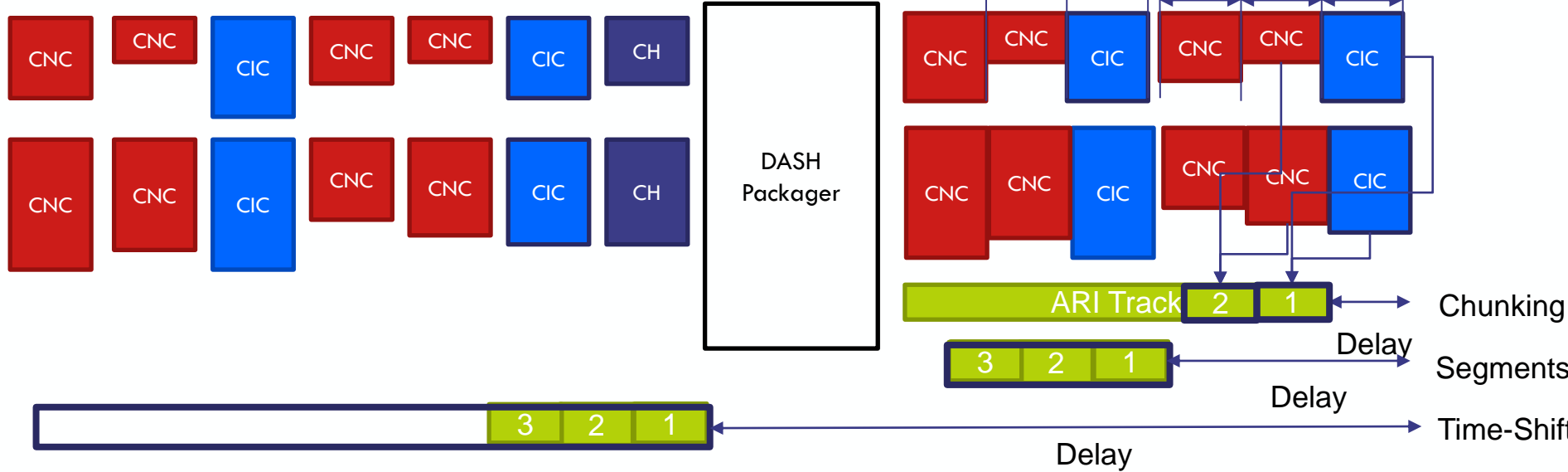
DASH-IF Impact

IOP Guidelines & dash.js

Overview of features and support in DASH-IF

Features (5th and 6th edition)	IOP Status	Dash.js status	Test/Live Sim status
CMAF Profile	Part of DASH-IF v5, part 2, 4, 5	Handled through MSE/browser	CTA WAVE Test content
Low-Latency DASH	Part of DASH-IF v5, part 4	Supported	Supported in live sim
MPD Patching	Not yet added	Supported	Initial version available, WIP
Event Streams	DASH-IF v5 part 10	Supported	Rudementary in Live sim, more work needed
Advanced Content Protection	Not yet in part 6	Not yet supported	Not yet supported
Alternative MPD Event	Considered for part 5, not yet started	No	no
Content Steering	ETSI spec, but not yet in IOP	Basic support Service description	Nothing available
CMCD	CTA spec, not yet in IOP	Supported in v1 MPD parsing in progress	Nothing available
L3D and Segment Sequences	In progress for v5.1 part 4	Not yet started	Not yet started
Pattern signaling	Not yet stated	Not yet stated	Not yet stated
ARI Track	Not yet stated	Not yet stated	Not yet stated

Next Steps

- MPEG
  - The next two meetings are dedicated to improve the features and do bug fixes
  - Expect a Revised DIS from MPEG#146 in April
  - Comments are collected through NBs and other orgs

- DASH-IF
  - Collect comments
  - Identify the relevant features for IOP
  - Initiate work in Test Tools

Thanks

Q&A