DASH FOR VIRTUAL REALITY
A DASH-IF PERSPECTIVE

Dr. Thomas Stockhammer
DASH-IF IOP Chair
Qualcomm Incorporated
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OUTLINE

What is DASH-IF?

What is DASH-IF doing?

What is DASH-IF doing in VR?

What is DASH-IF doing in VR to support the industry?

DASH-IF

CONTINUING TO SUPPORT DASH ADOPTION …

Founded in 2012 after MPEG-DASH completion, DASH-IF addresses

- Interoperability
- Promotion
- Supporting other SDOs and our members

for interoperable deployment of massively scalable Internet Streaming Services

Charter Members

Adobe, Akamai, cisco, COMCAST, DOLBY, ERICSSON, Microsoft, NETFLIX, QUALCOMM, SAMSUNG, XPERI

Associate Members

axinom!, BITMOVIN, broadpeak, DVEO, epic labs, erlab technology, eurofins, INI, INKA, JWPLAYER, mediamelon, movingIMAGE24, MUX, NEXSTREAMING, NIMBLE STREAMER, noimoir, THEOplayer, Packet Ship, Rebaca, ripple networks, Solekai Systems, sorenson media, SQUADEO, StreamOne, STREAMROOT, The Autism Channel, Unified Streaming, VisualOn, VUALTO

Contributor Members

ARRIS, brightcove, CableLabs, castLabs, Connected Home Academy, digital primates, EBU, edgeware, ELEMENTAL, EZDRM, Fraunhofer USA, Google, Haivision, harmonic, HUAWEI, hulu, intel, INTERDIGITAL, IIJ Internet Initiative Japan, irdeto, Kaltura open source video, LG, maxdome, MEDIAEXCEL, MEDIATEK, NAGRA KUDELSKI, NeuLion, NOKIA, SONY, SPB TV, technicolor, TNO, Turner, verimatrix, verizon digital media services, viaccess-orca, VIMOND, VUBIQUITY

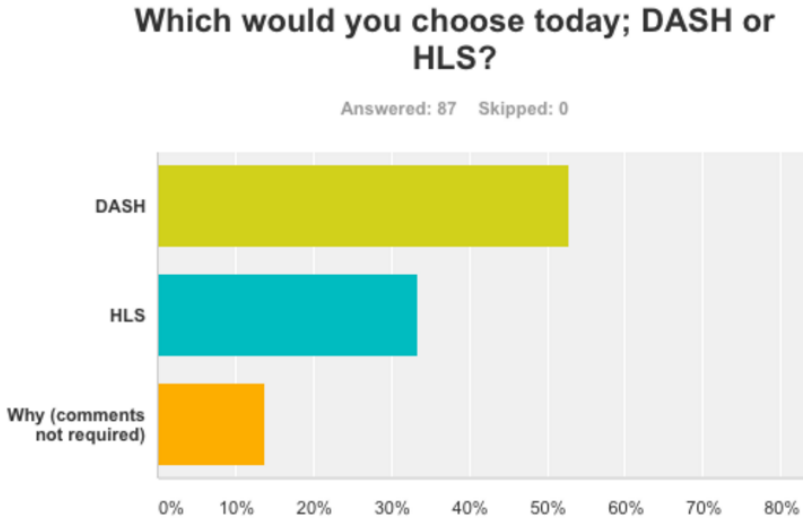
DASH MARKET ADOPTION

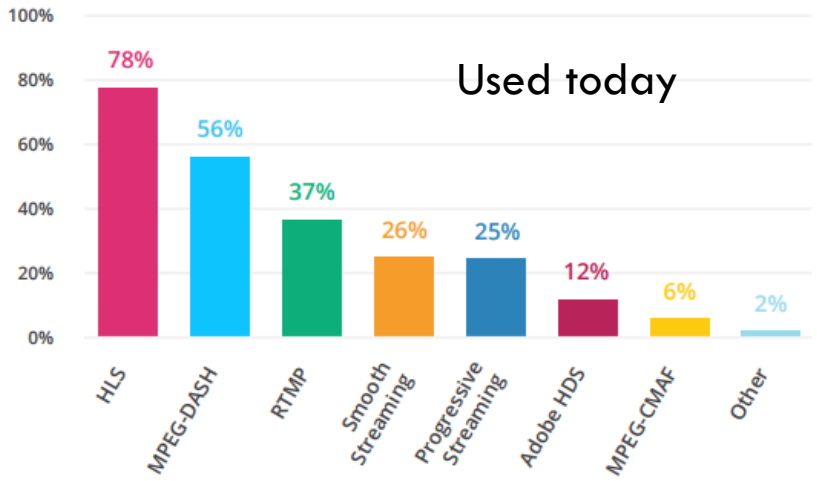
http://www.streaminglearningcenter.com/blogs/dash-or-hls-which-is-the-best-format-today.html

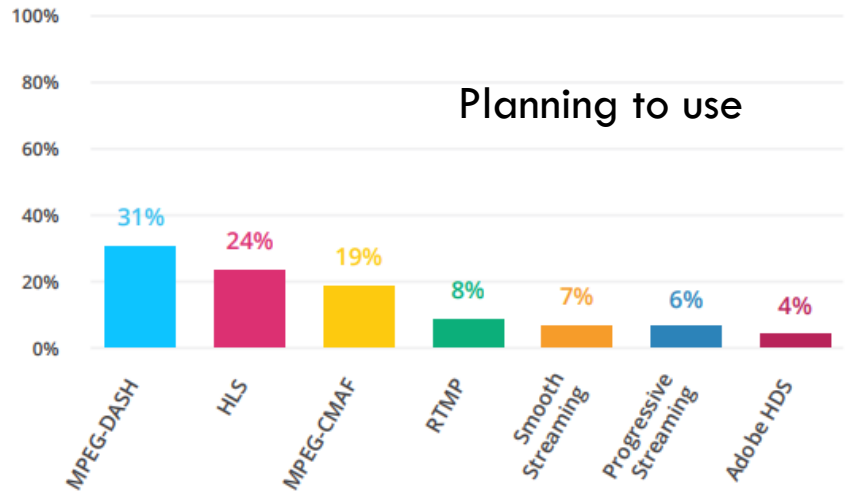
Jan Ozer (Streaming Media magazine) blog is about the HLS vs DASH format decision.

Many web producers are moving away from RTMP-based Dynamic Streaming, or even HDS, and must choose between HLS and DASH.

Twelve months ago, HLS was the clear best choice. Twelve months from now, DASH is probably in the driver's seat. But what about today?







https://bitmovin.com/whitepapers/Bitmovin-Developer-Survey.pdf

TOOLS CREATED AROUND DASH-IF IOPS

DASH–IF creates guidelines referred to as Interoperability Points (IOPs)

In order to support the deployment of DASH-IF IOPs, DASH-IF Interoperability Group maintains tools:

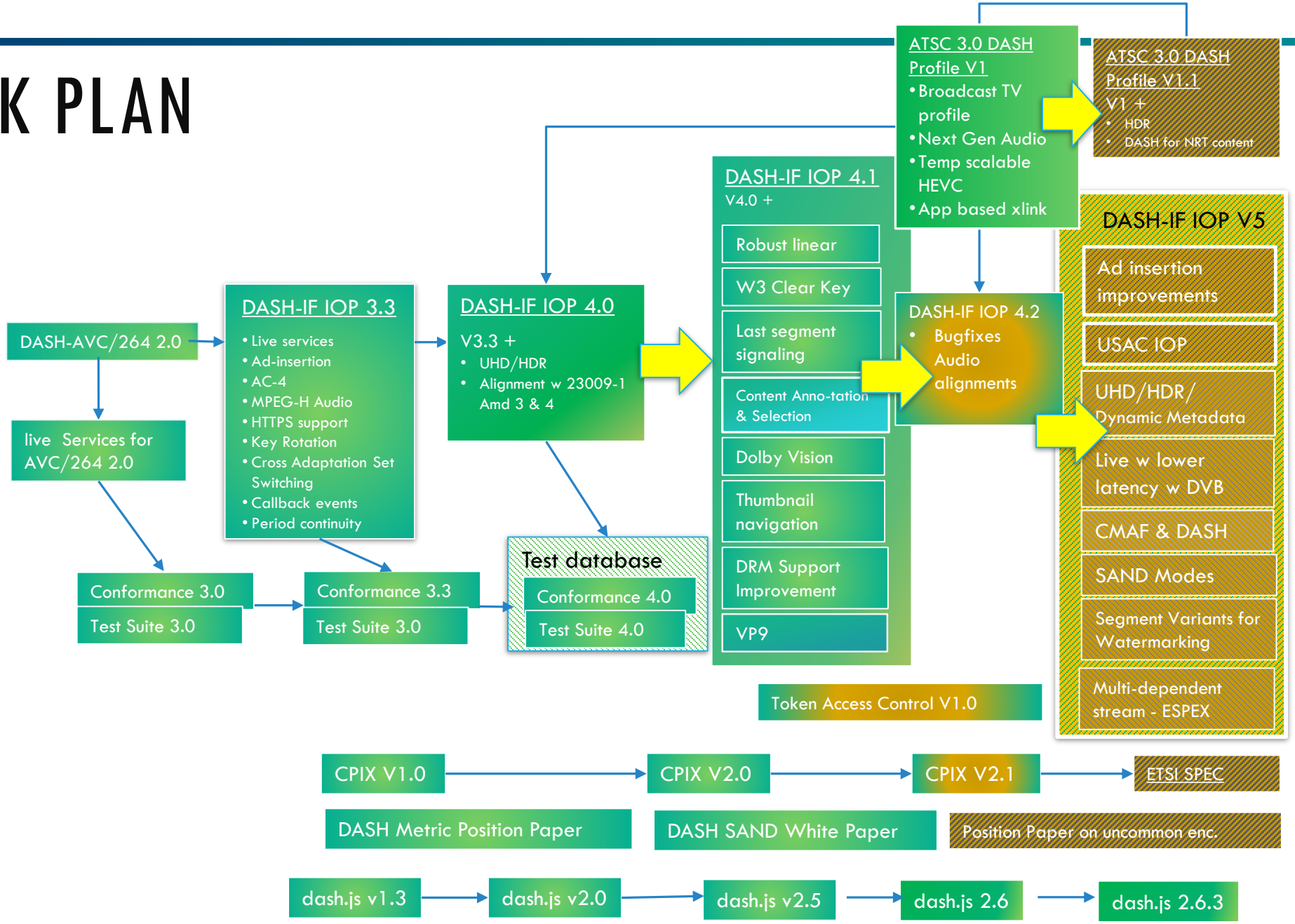
- Documentation of the Interoperability Points
- Test Cases backing the Interoperability Points
- Test Vectors for Test Cases hosted on DASH-IF and Akamai servers
- Conformance Software hosted on DASH-IF web site
- Reference Player delivered as open source player ➔ dash.js
- Open Source Work Flow for Content Generation
- DASH Identifiers Repository

Recent activity: Feature-based development supported by a data base of features, test cases and test vectors

All documentation and tools are publicly available and no fees are attached.

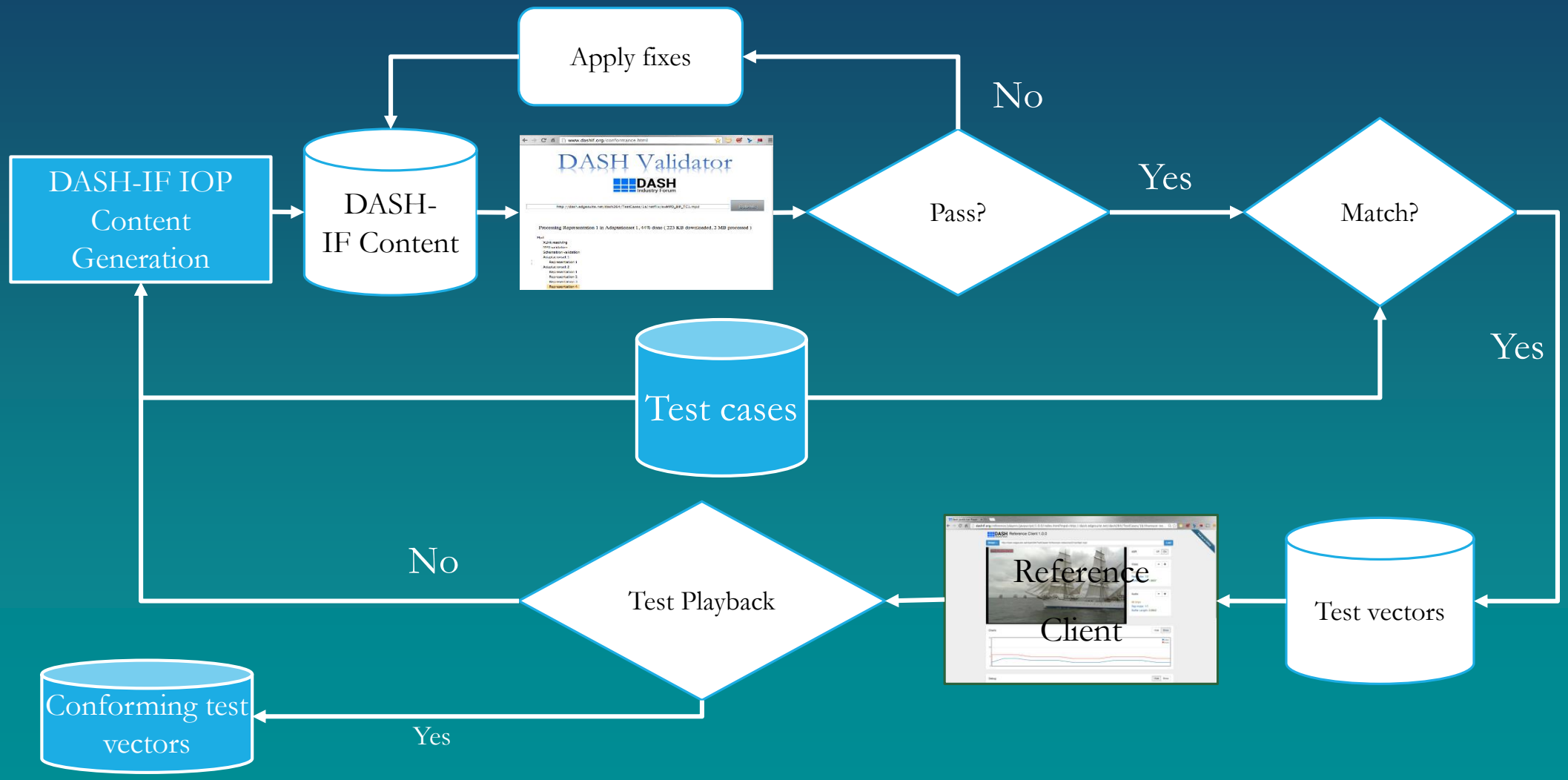
For details refer to http://dashif.org ➔ Interoperability

WORK PLAN


ATSC 3.0 DASH Profile V1
• Broadcast TV profile
• Next Gen Audio
• Temp scalable HEVC
• App based xlink
ATSC 3.0 DASH Profile V1.1
V1 +
• HDR
• DASH for NRT content
DASH-IF IOP 4.1
V4.0 +
Robust linear
W3 Clear Key
Last segment signaling
Content Anno-tation & Selection
Dolby Vision
Thumbnail navigation
DRM Support Improvement
VP9
DASH-IF IOP V5
Ad insertion improvements
USAC IOP
UHD/HDR/ Dynamic Metadata
Live w lower latency w DVB
CMAF & DASH
SAND Modes
Segment Variants for Watermarking
Multi-dependent stream - ESPEX
DASH-IF IOP 4.2
• Bugfixes
Audio alignments
DASH-IF IOP 3.3
• Live services
• Ad-insertion
• AC-4
• MPEG-H Audio
• HTTPS support
• Key Rotation
• Cross Adaptation Set Switching
• Callback events
• Period continuity
DASH-IF IOP 4.0
V3.3 +
• UHD/HDR
• Alignment w 23009-1 Amd 3 & 4
DASH-AVC/264 2.0
live Services for AVC/264 2.0
Conformance 3.0
Test Suite 3.0
Conformance 3.3
Test Suite 3.0
Test database
Conformance 4.0
Test Suite 4.0
Token Access Control V1.0
CPIX V1.0
CPIX V2.0
CPIX V2.1
ETSI SPEC
DASH Metric Position Paper
DASH SAND White Paper
Position Paper on uncommon enc.
dash.js v1.3
dash.js v2.0
dash.js v2.5
dash.js 2.6
dash.js 2.6.3

DASH-IF TOOLS AND PROCESSES

TEST VECTOR GENERATION HIGH-LEVEL FRAMEWORK AND DASH-IF ASSETS

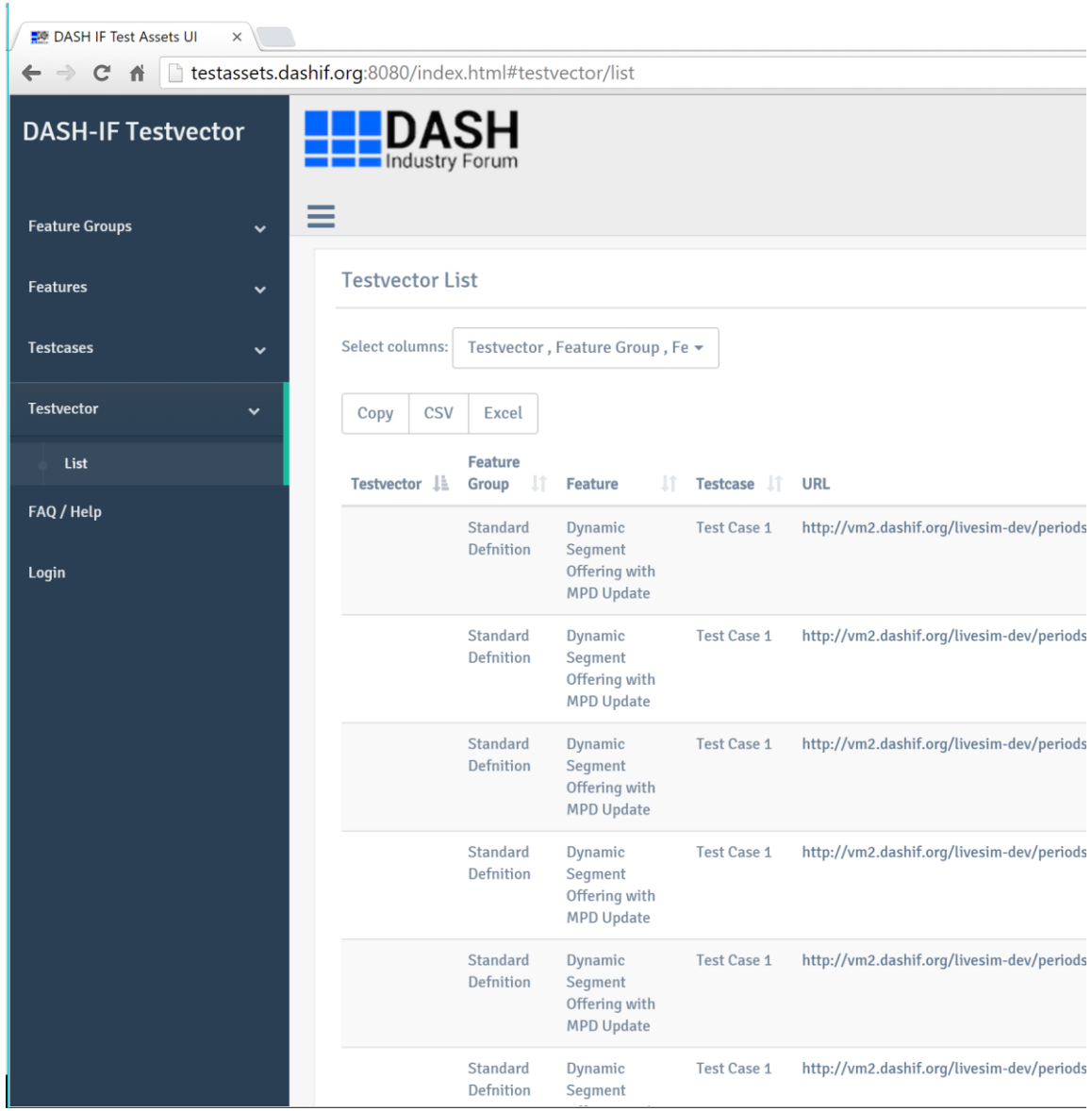


TO ADDRESS SCALABILITY: DASH-IF TEST ASSET DATA BASE

A database and UI hosted on an Amazon EC2 instance

Multiple levels of user authorization

- Public viewing of assets
- DASH-IF users for updating dataset
- Master-level user



CONFORMANCE

Validation of

- MPD
- Representations
- Interactions MPD/Representations

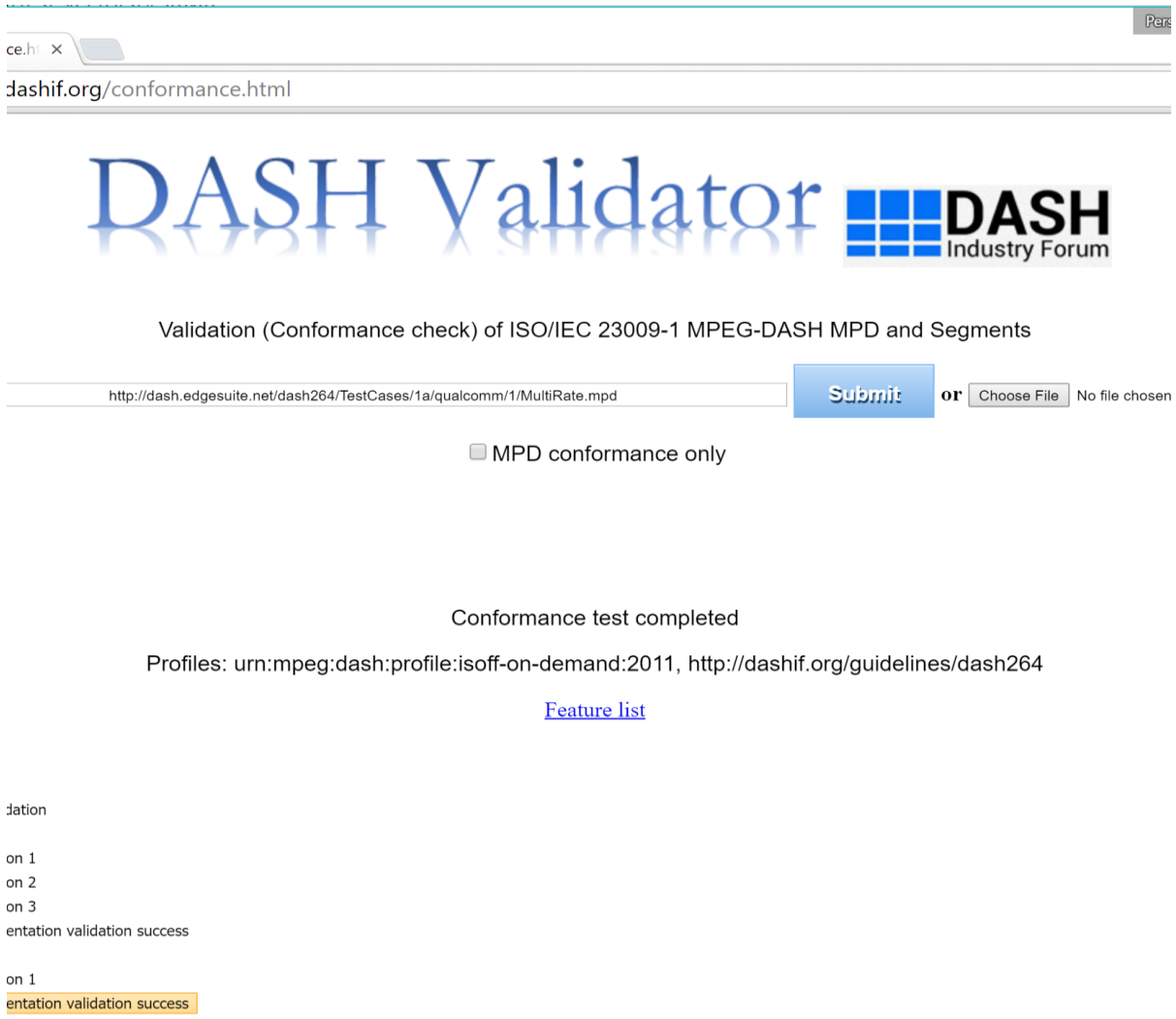
  According to ISO/IEC 23009-1 and DASH-IF IOP

  No elementary stream

Source Git

- Frontend: https://github.com/Dash-Industry-Forum/Conformance-Software
- Backend: https://github.com/Dash-Industry-Forum/Conformance-and-reference-source

http://dashif.org/conformance.html



WHAT IS THE REFERENCE CLIENT?

A player which can play back the DASH-IF IOP test vectors and which illustrates best practices in doing so.

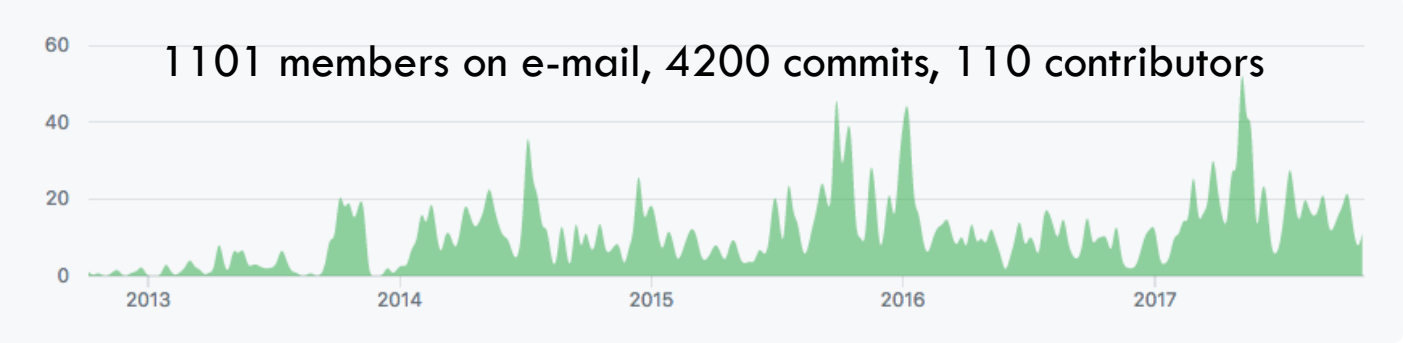
The client is written in JavaScript and makes use of the W3C Media Source Extensions and Encrypted Media Extensions to the VideoElement.

Current client works on Chrome v30+, IE11 under Win8.1, Edge under Win10, Safari under Yosemite, Firefox 39+.

It is an open-source project on Github - https://github.com/Dash-Industry-Forum/dash.js/

Project has been underway approximately four years.

There have been 80 different collaborators to the code to date.



ADDRESSING COMPLEXITY

- **Availability of open source tools to generate the test material**
  - DASH-IF supports the generation of open source tools
- **Availability of test content with proper licensing**
  - We decided to exclusively work with that Creative Common v4.,
- **Keeping the development of all test tools in sync**
  - decided to work based on features that are gradually added
  - Commitment by proponents
- **Hosting and size of data, reliability**
  - Rely on commercial hosting services: Akamai, Amazon EC2
  - Specific software developed to minimize impact
- **Handling of scalability/consistency of test material**
  - Database was generated that can be used to host
- **Coordination**
  - Commitment of supporting company
  - Divide and conquer such that individuals can contribute
  - Issues are tracked on github throughout
- **Test success**
  - We only define qualitative criteria at this point in time
  - We only test for interoperability for now, not for performance

SUMMARY

Common creative test content

Open Source

Web Tools for Development

Web Tools for providing the test services

Strict rules for submitting features to support the test process. Avoid that “agreements” are made w/o ensuring that someone does all the hard work

Do some stuff that is feasible, but enable to grow

DASH-IF AND VR

BACKGROUND AND HISTORY

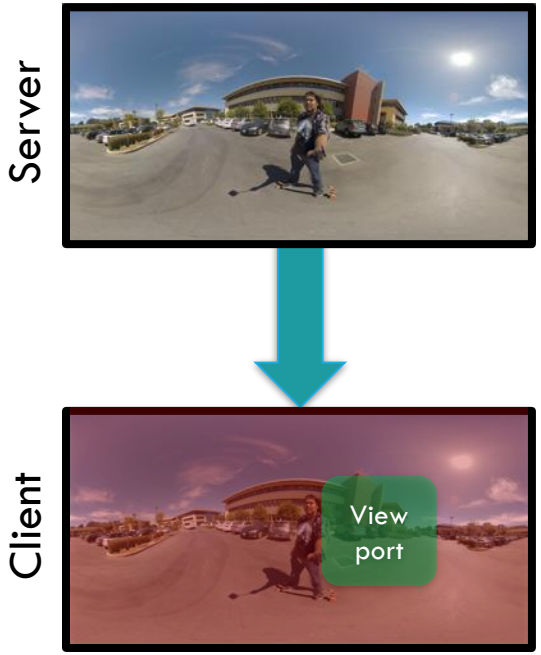
DASH-IF started an activity in May 2016 on VR with a dedicated workshop

We identified that structural changes in DASH are not expected to be necessary, but encouraged for input this matter to support the ecosystem

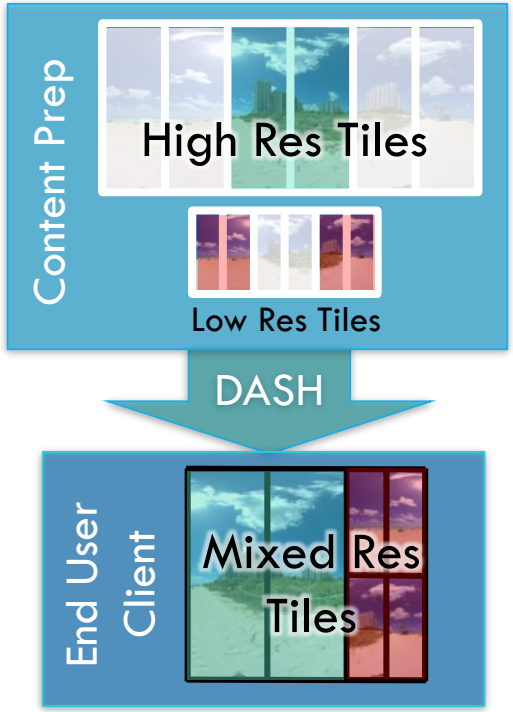
We organized a tutorial white paper for IBC that covered different streaming options with DASH

We support the industry to deploy VR services in scale, looking at functional enablers

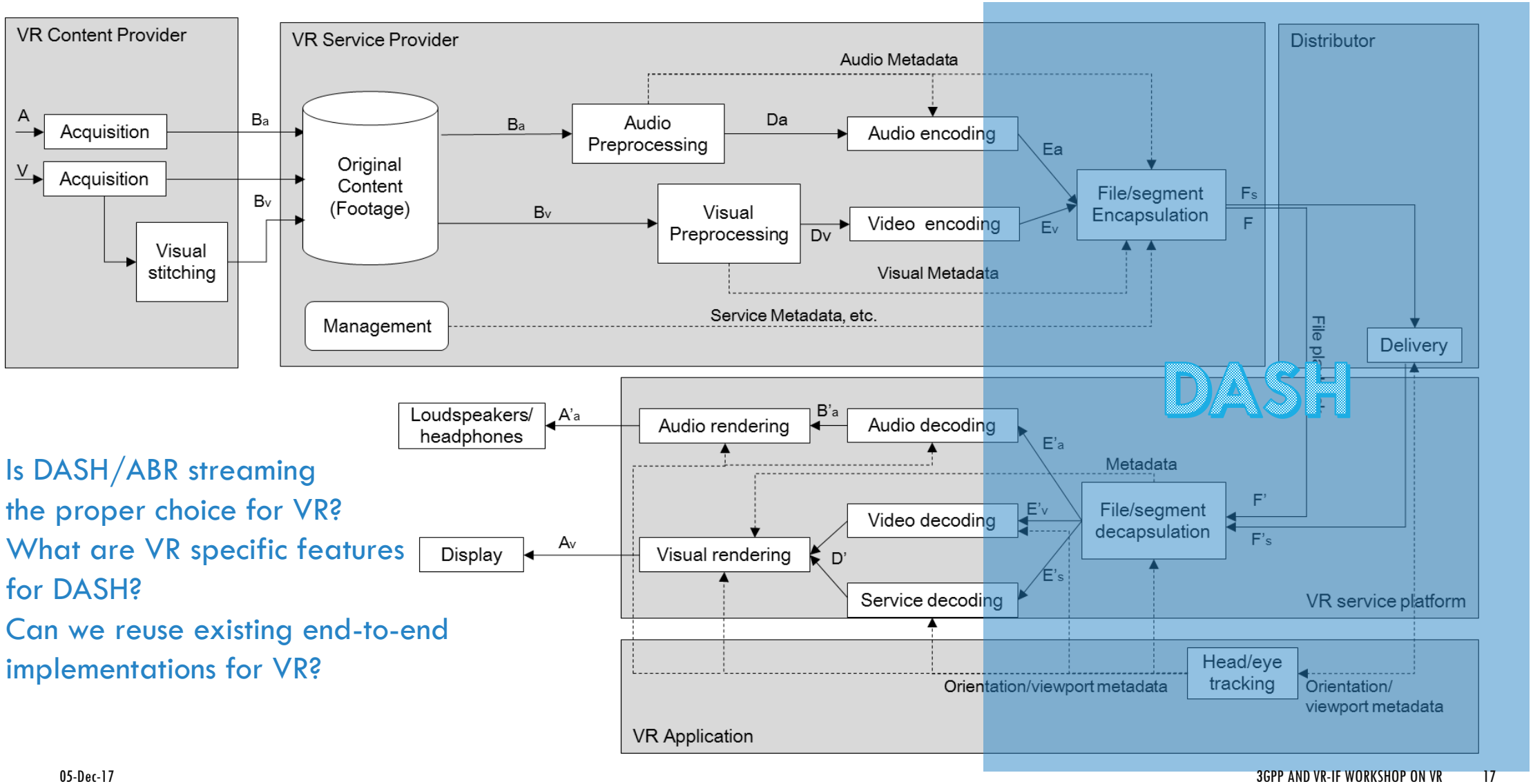
Viewport-agnostic streaming



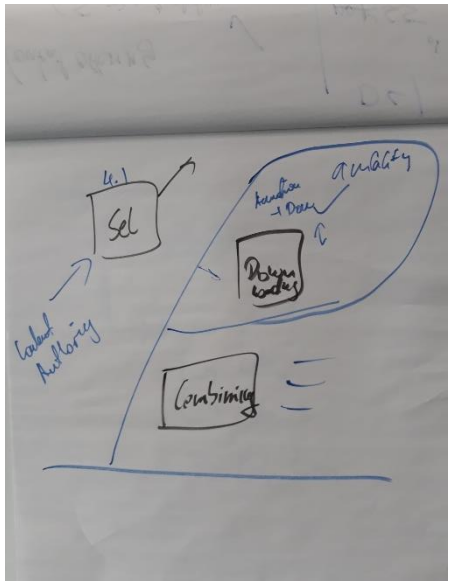
Viewport-dependent streaming

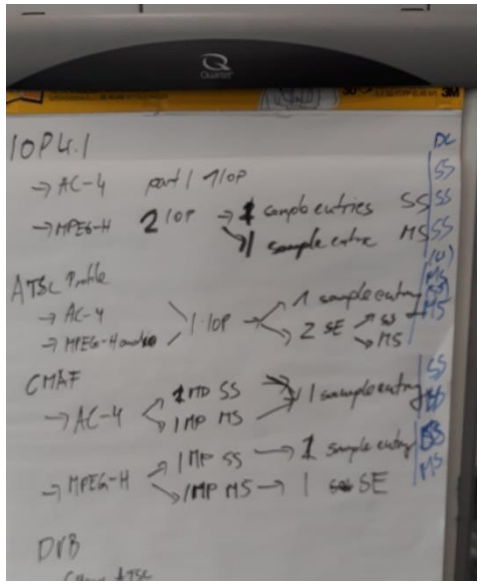


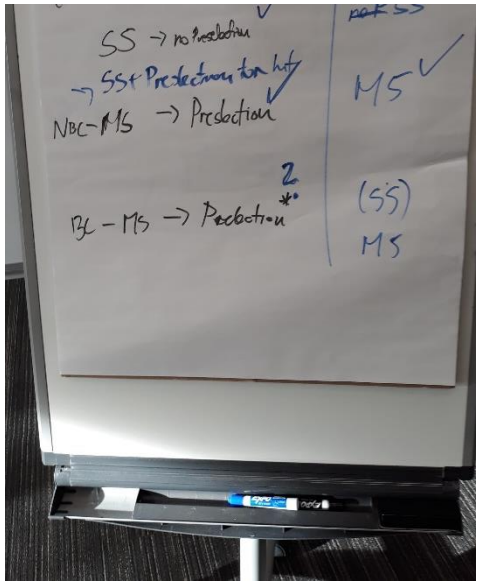
STREAMING ARCHITECTURE

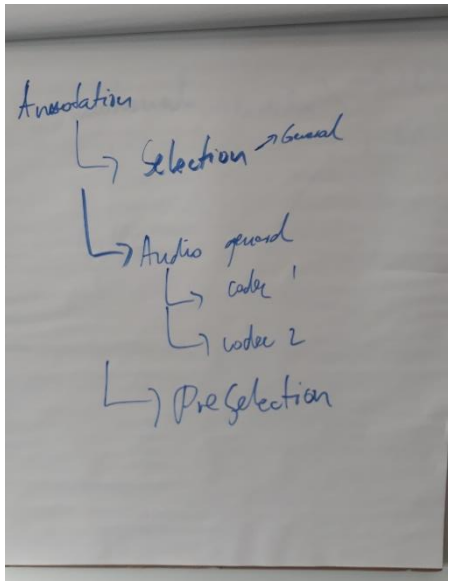


- Is DASH/ABR streaming the proper choice for VR?
- What are VR specific features for DASH?
- Can we reuse existing end-to-end implementations for VR?



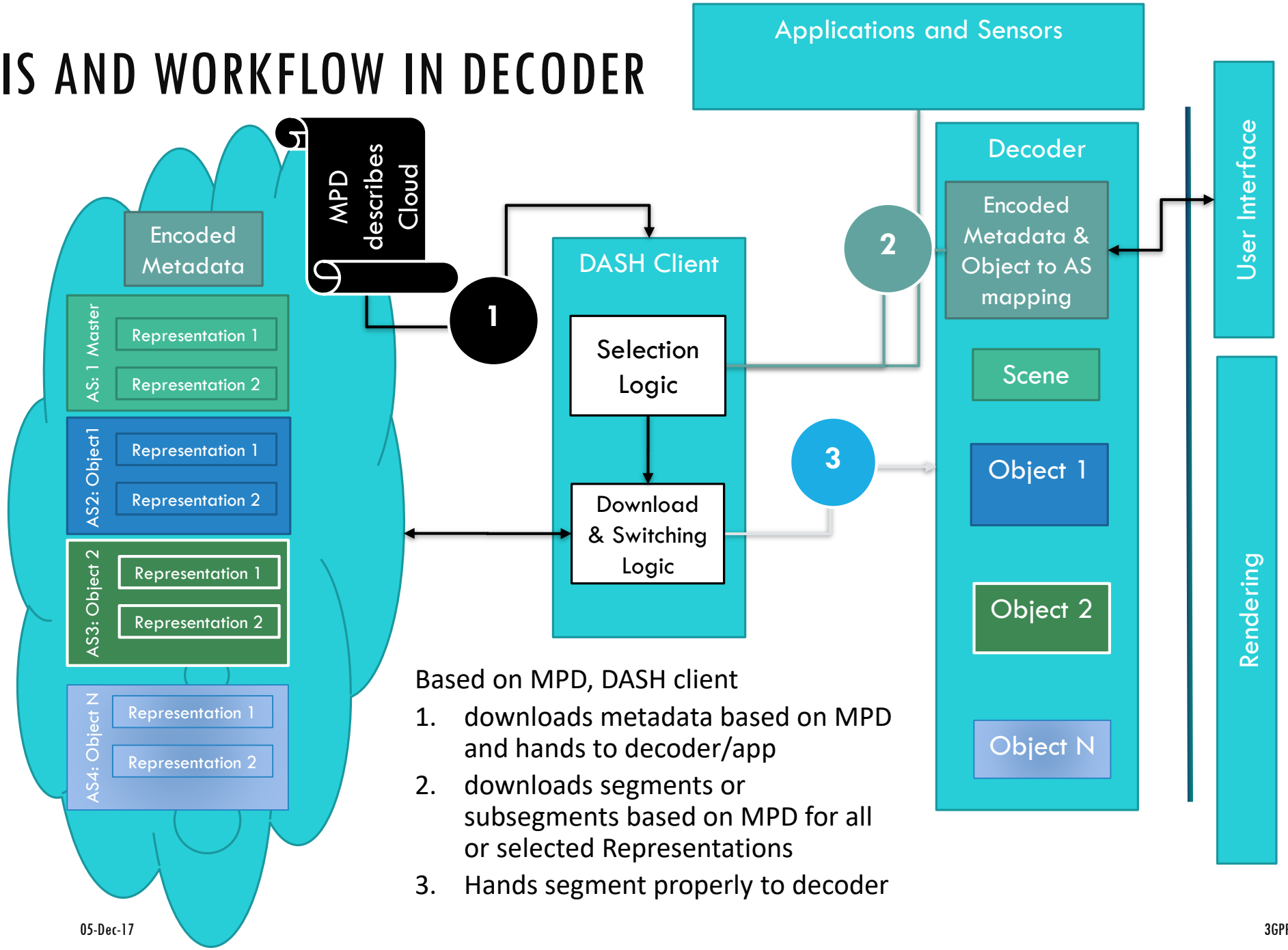






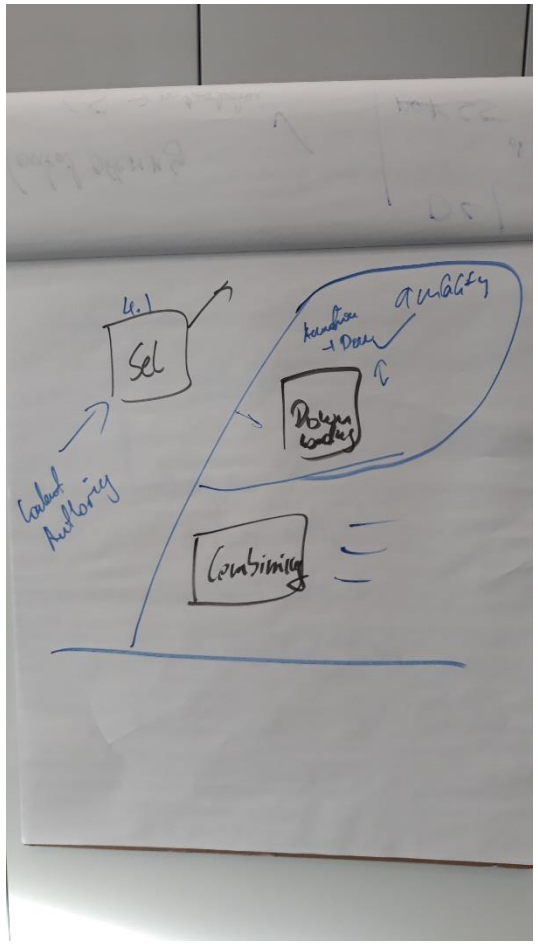
SOME DESIGN THOUGHTS FROM LAST WEEKS DASH-IF MEETING EFFICIENT STREAMING OF PERSONALIZED EXPERIENCES (ESPEX)

APIS AND WORKFLOW IN DECODER



Based on MPD, DASH client

1. downloads metadata based on MPD and hands to decoder/app
2. downloads segments or subsegments based on MPD for all or selected Representations
3. Hands segment properly to decoder



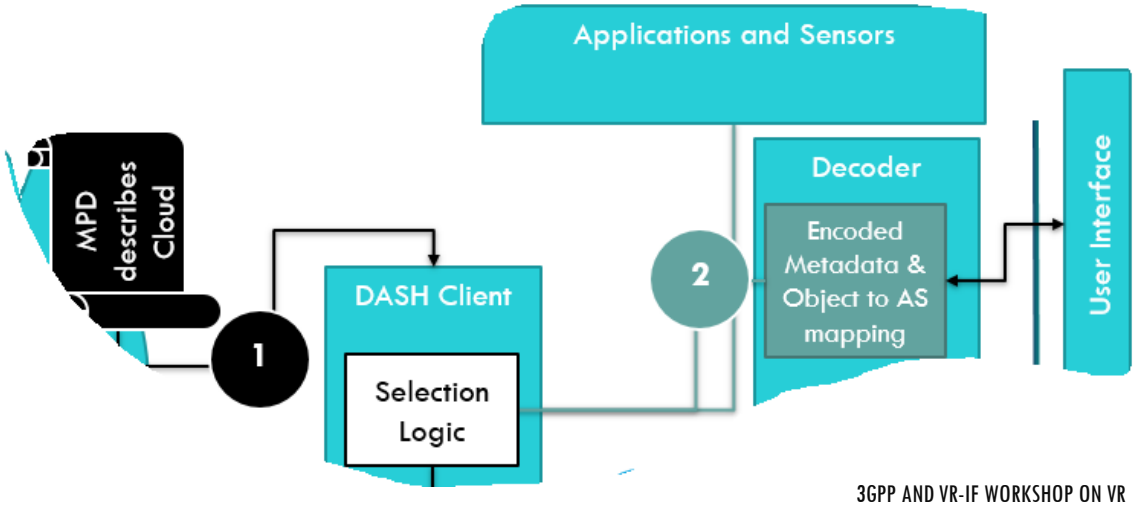
ANNOTATION AND SELECTION

What does DASH support today?

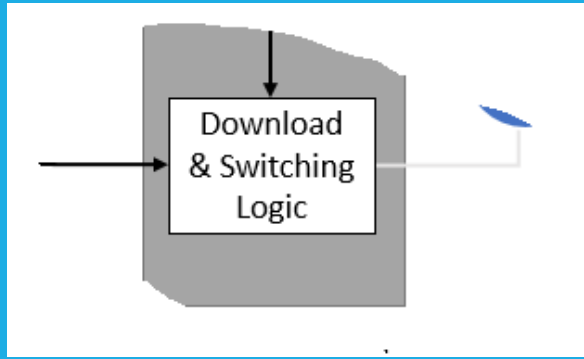
- We annotate for capabilities and experiences
- Experiences are viewports, languages, user selection
- We only permit to select experiences that you are capable to process
- Annotation and Selection is broadly addressed in v4.1 of our IOPs

For next generation immersive/personalized services:

- Is the annotation and selection in v4.1 sufficient?
- Do we need an API that provides "selection metadata" to app
- What are the impacts if the selection is highly dynamic/interactive?



DOWNLOAD AND SWITCHING



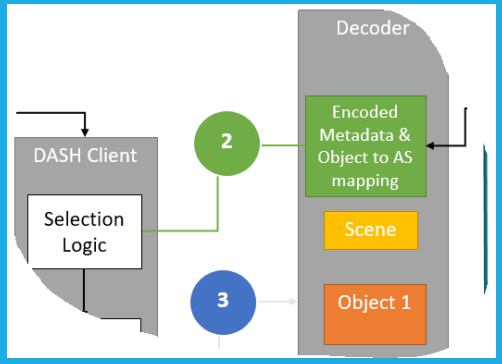
What does DASH support today

- We have in place a regular ABR logic for downloading and switching for stable service consumption
- We have started to work on lower-latency and on low “channel-switch” support
- We know how to do this for 1 Representation per media
- We have annotation for multiple Representation per media type/decoder

For next generation immersive/personalized services:

- How needs the Download and Switching logic be updated to address
  - multiple Representations per media for Preselection and dependencyId
  - To support the latencies and switch times that are required?
- What are the content annotation requirements for client to make this work

DASH CLIENT TO DECODER INTERFACE



What does DASH support today

- The DASH client can do selection and provide a “tag” to decoder on what is selected
- We know interface 3 for single stream per media very well, works with MSE and also is supported by encryption and so on
- We know that there are implementations for which “3” is done, but not MSE

For next generation immersive/personalized services:

- How are the interfaces/APIs supported in an “open“ environment, e.g. in MSE
- Are there requirements in content authoring for Adaptation Sets that are part of one “multistream“ setup?
- What are the encryption requirements?
- What is the processing model for the client to operate in this context?

DASH-IF AND VR SUPPORT FOR INDUSTRY

SUMMARY

DASH-IF is NOT working on an end-to-end VR streaming right now

DASH-IF supports the industry to enable

- standardized
- massively scalable
- Highest quality

streaming of new immersive experiences

Support includes

- Development of technologies to support VR
- Provision of processes and tools
- Introducing and harmonizing the ecosystem

HOW CAN YOU PARTICIPATE?

DASH Industry Forum

Participation and Supporters are welcome

http://dashif.org