Dynamic Adaptive Streaming over HTTP – Design Principles and Standards
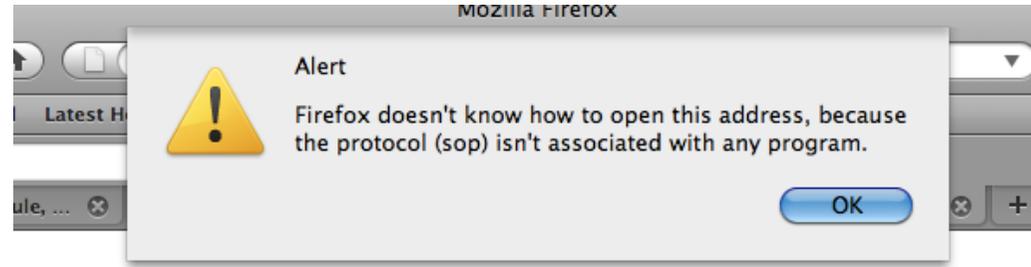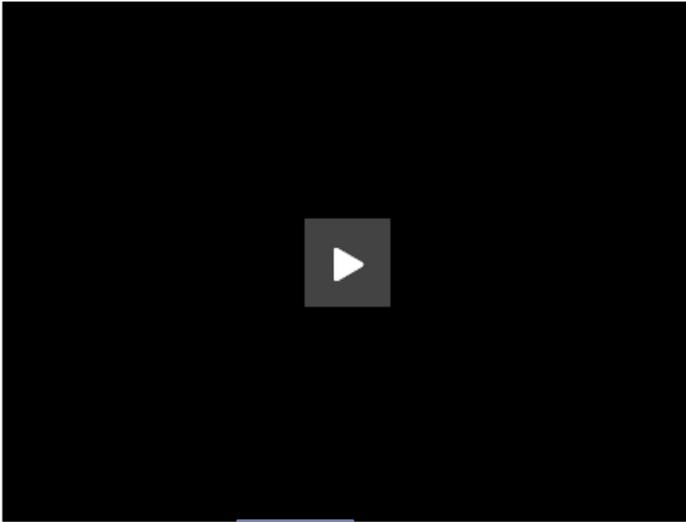
Thomas Stockhammer, Qualcomm

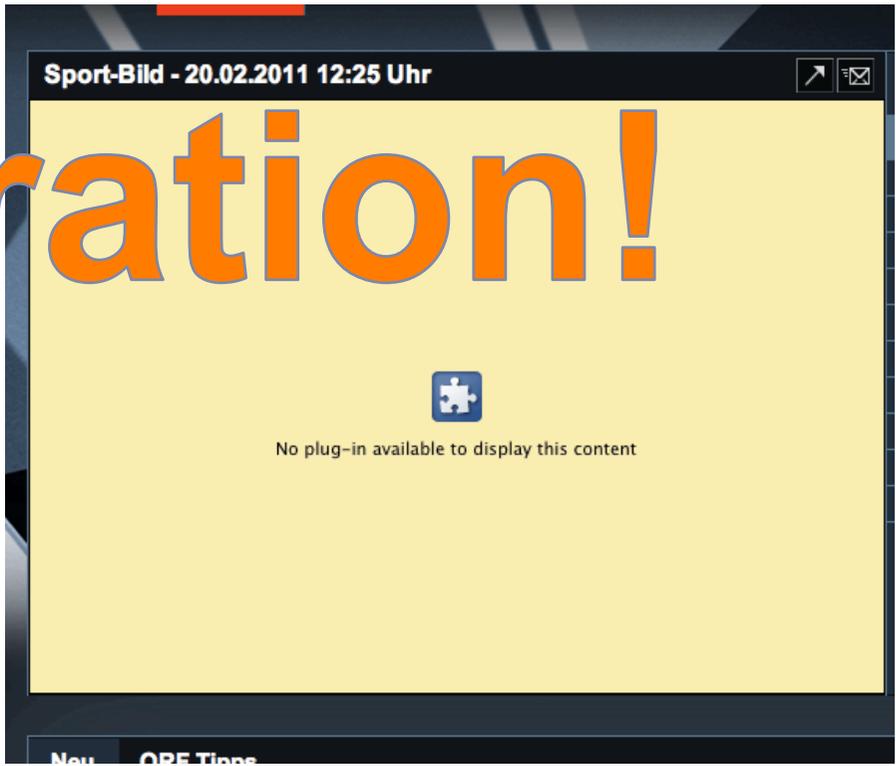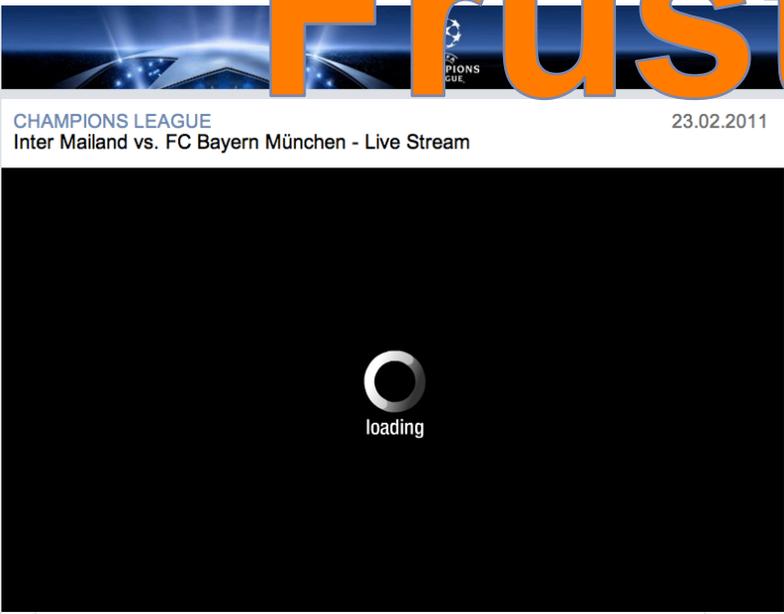Chocolate!

Frustration!

User Frustration in Internet Video

- Video not accessible
  - Behind a firewall
  - Plugin not available
  - Bandwidth not sufficient
  - Wrong/non-trusted device
  - Wrong format
- Fragmentation
  - Devices
  - Content Formats
  - DRMs

- Low quality of experience
  - Long start-up delay
  - Frequent Rebuffering
  - Low playback quality
  - No lip-sync
  - No DVD quality (language, subtitle)
- Expensive
  - Sucks my bandwidth
  - Need a dedicated device
  - Other costs …

CONFIDENCE

Delivery Platform
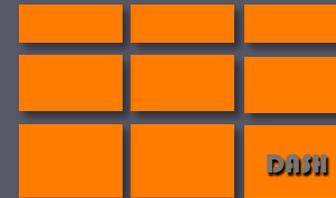
One way to build confidence - Open Standards
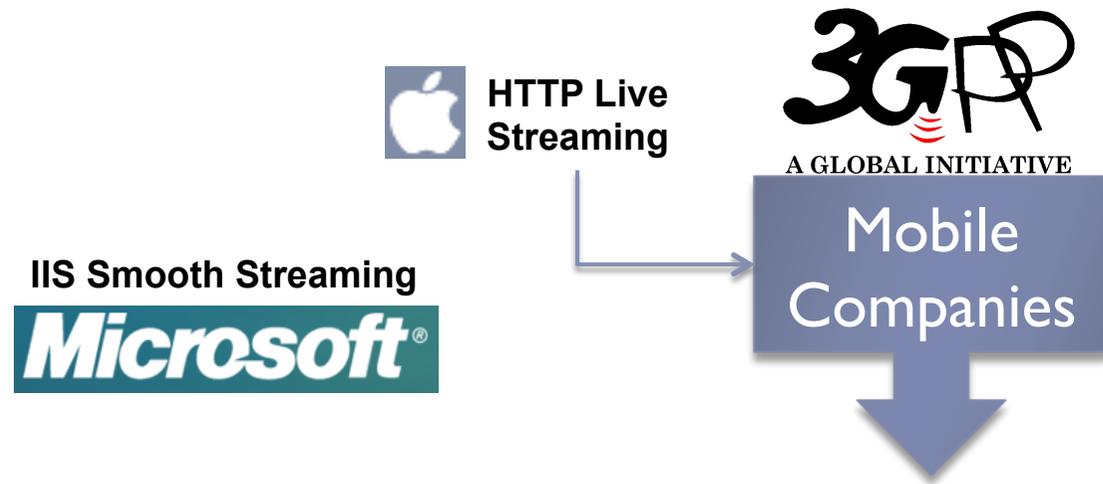
DASH:
Standardization History and Status

HTTP Live Streaming

IIS Smooth Streaming

Microsoft®

3GPP
A GLOBAL INITIATIVE

Mobile Companies

Why in 3GPP?
The Mobile Video Streaming Challenge

▸ <u>The mobile video landscape</u>

- Mobile Internet use is dramatically expanding

- Video traffic is growing exponentially & is a large fraction of the usage

▸ <u>The challenges</u>

- Mobile users expect high quality video **experience**

- Network operators need to offer quality experience affordably

39 times growth of mobile data

66% mobile video by 2014

TB per Month

108% CAGR 2009-2014

3,600,000

1,800,000

0

2009   2010   2011   2012   2013   2014

4% ■ Mobile VoIP
5% ■ Mobile Gaming
8% ■ Mobile P2P
17% ■ Mobile Web/Data
66% ■ Mobile Video
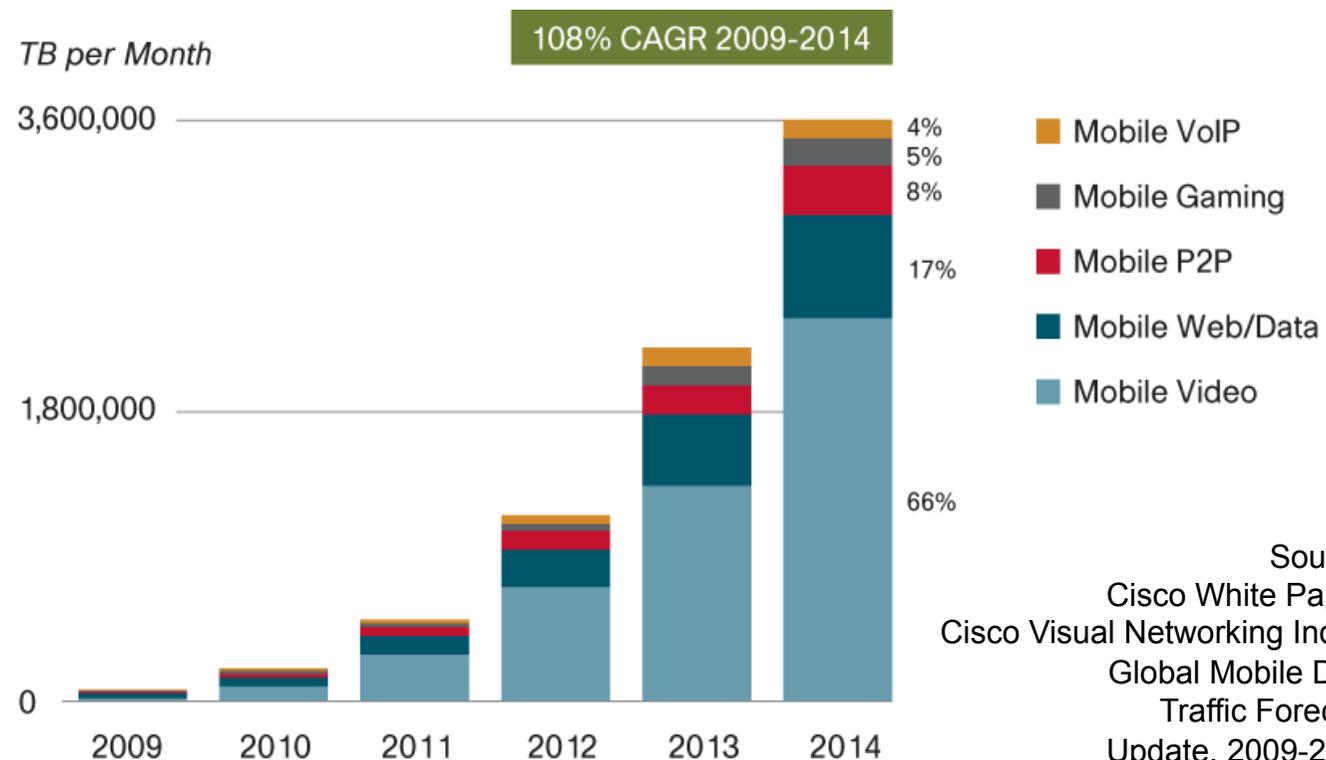
Source: Cisco VNI Mobile, 2010

Standardization History and Status

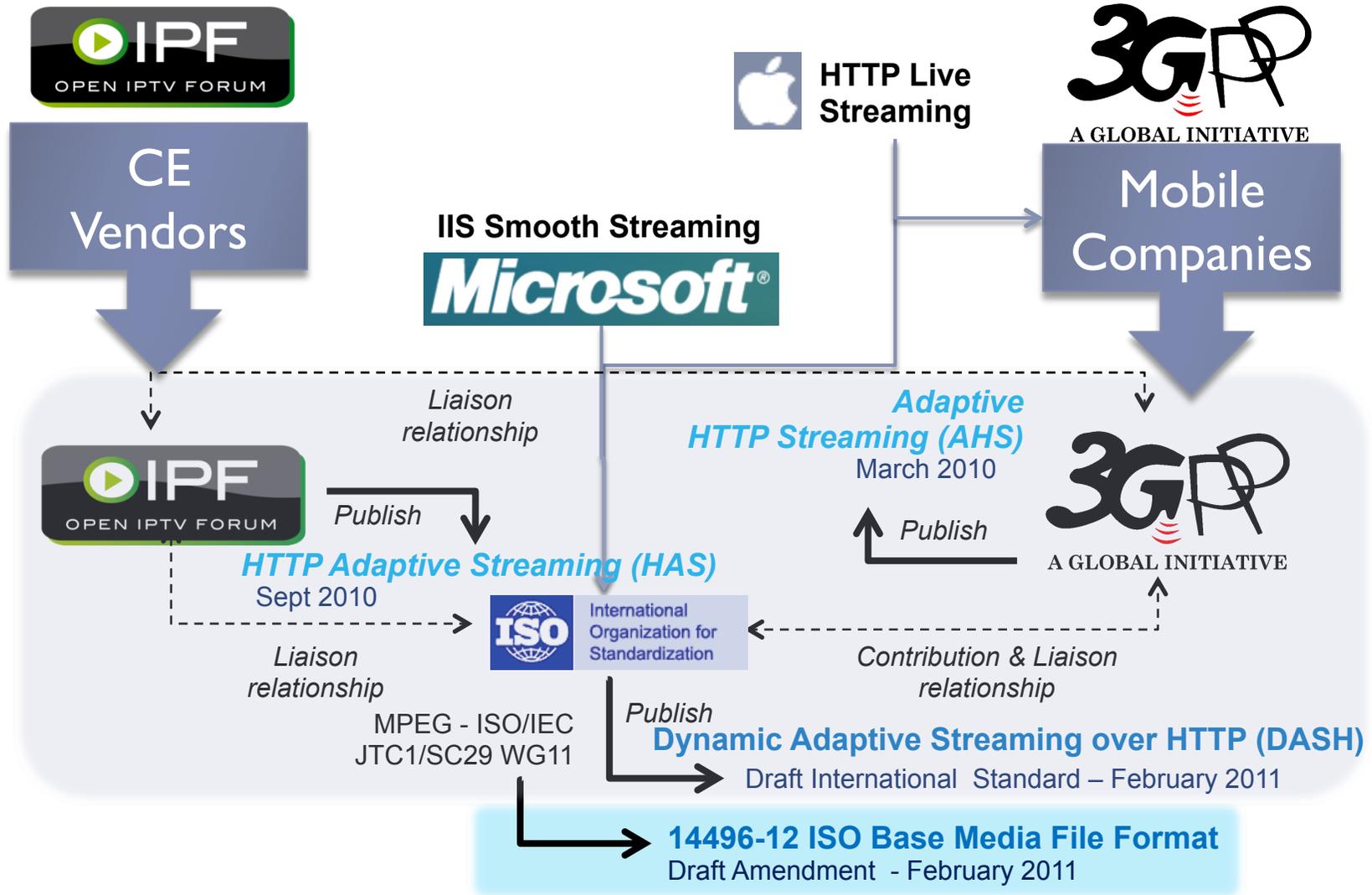**CE Vendors** → (Open IPTV Forum) **Publish** → *HTTP Adaptive Streaming (HAS)* Sept 2010

Liaison relationship (Open IPTV Forum → ISO)

IIS Smooth Streaming (Microsoft)

HTTP Live Streaming (Apple) → **Mobile Companies**

Liaison relationship

Adaptive HTTP Streaming (AHS) March 2010

Publish → 3GPP (A GLOBAL INITIATIVE)

Contribution & Liaison relationship

ISO — International Organization for Standardization

MPEG - ISO/IEC JTC1/SC29 WG11

Publish → **Dynamic Adaptive Streaming over HTTP (DASH)** Draft International Standard – February 2011

**14496-12 ISO Base Media File Format** Draft Amendment - February 2011

MPEG DASH ISO/IEC 23001-6

▸ MPEG DASH ISO/IEC 23001-6 is now the master specification

▸ Provides a superset for system specifications

  ▸ 3GPP Release-9 AHS

  ▸ Open IPTV Forum HTTP Adaptive Streaming

  ▸ 3GPP Release-10 DASH (completion target July 2011)

  ▸ System specifications may define more: codecs, DRM, etc.

▸ Timeline and Activities

  ▸ Draft International Standard (DIS) 23001-6 available publicly

  ▸ 5 months balloting period until July 2011

  ▸ Parallel approval process for extensions to ISO base media FF to support DASH

  ▸ Continuous coordination with 3GPP and other organizations (DECE, OIPF, etc.)

  ▸ Conformance and Reference Software activities kicked off (see WD 23001-7)

▸ The good news: Converging standard for adaptive streaming on the way

Convergence = Confidence
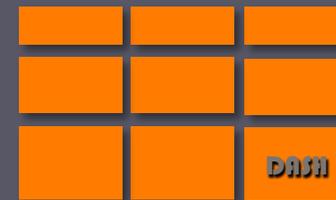
DASH Design Principles

(Some) DASH Design Principles

- DASH is not:
  - system, protocol, presentation, codec, interactivity, client specification
- DASH is an enabler
  - It provides formats to enable efficient and high-quality delivery of streaming services over the Internet
  - It is considered as one component in an e2e service
  - System definition left to other organizations (SDOs, Fora, Companies, etc.)
- It attempts to be very good in what is to be addressed by the standard
  - Enable reuse of existing technologies (containers, codecs, DRM etc.)
  - Enable deployment on top of HTTP-CDNs (Web Infrastructures, caching)
  - Enable very high user-experience (low start-up, no rebuffering, trick modes)
  - Enable selection based on network and device capability, user preferences
  - Enable seamless switching
  - Enable live and DVD-kind of experiences
  - Move intelligence from network to client, enable client differentiation
  - Enable deployment flexibility (e.g., live, on-demand, time-shift viewing)
  - Provide simple interoperability points (profiles)
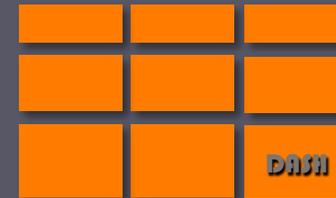
DASH Specification Insights

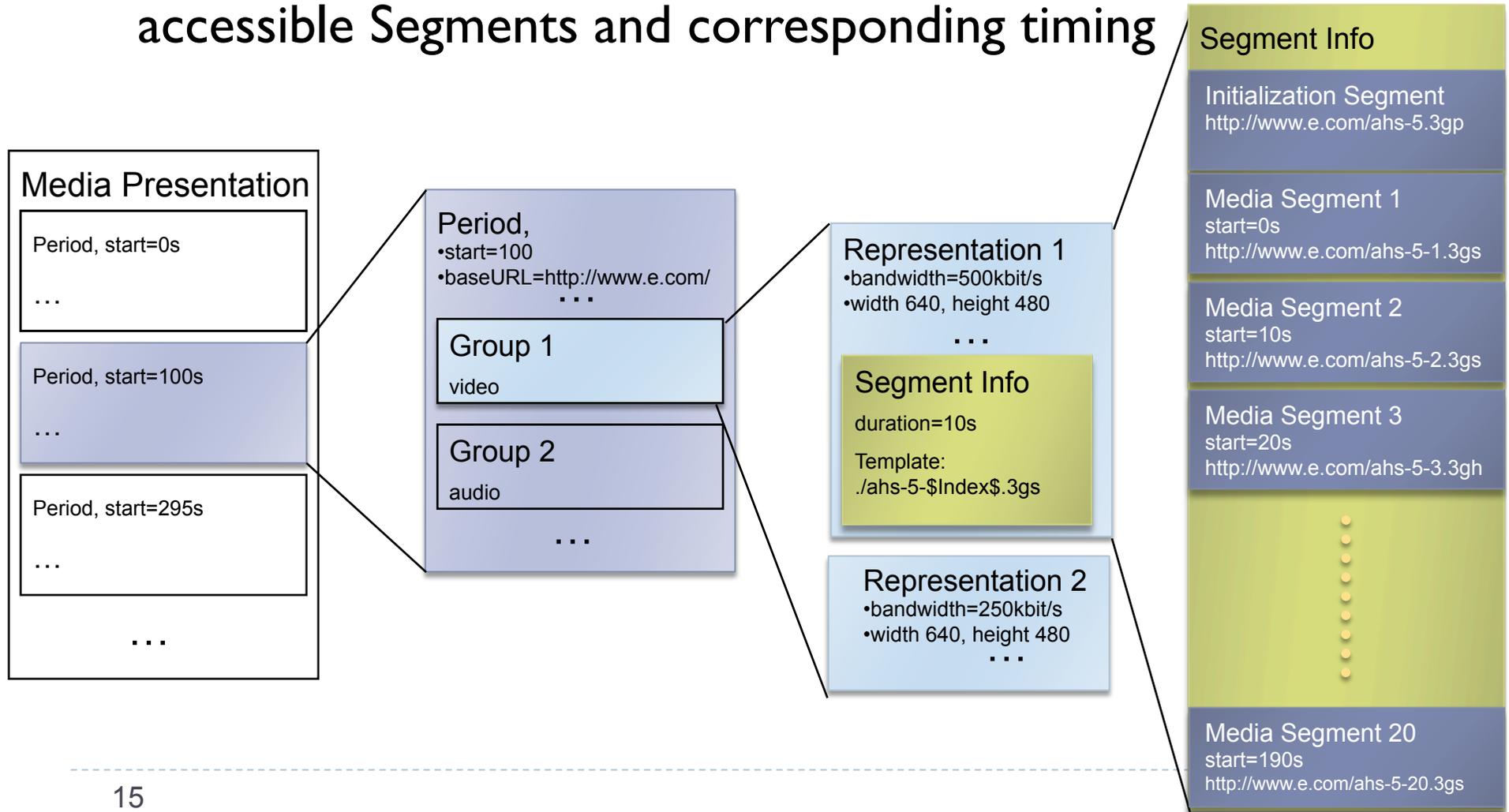# What is specified – and what is not?
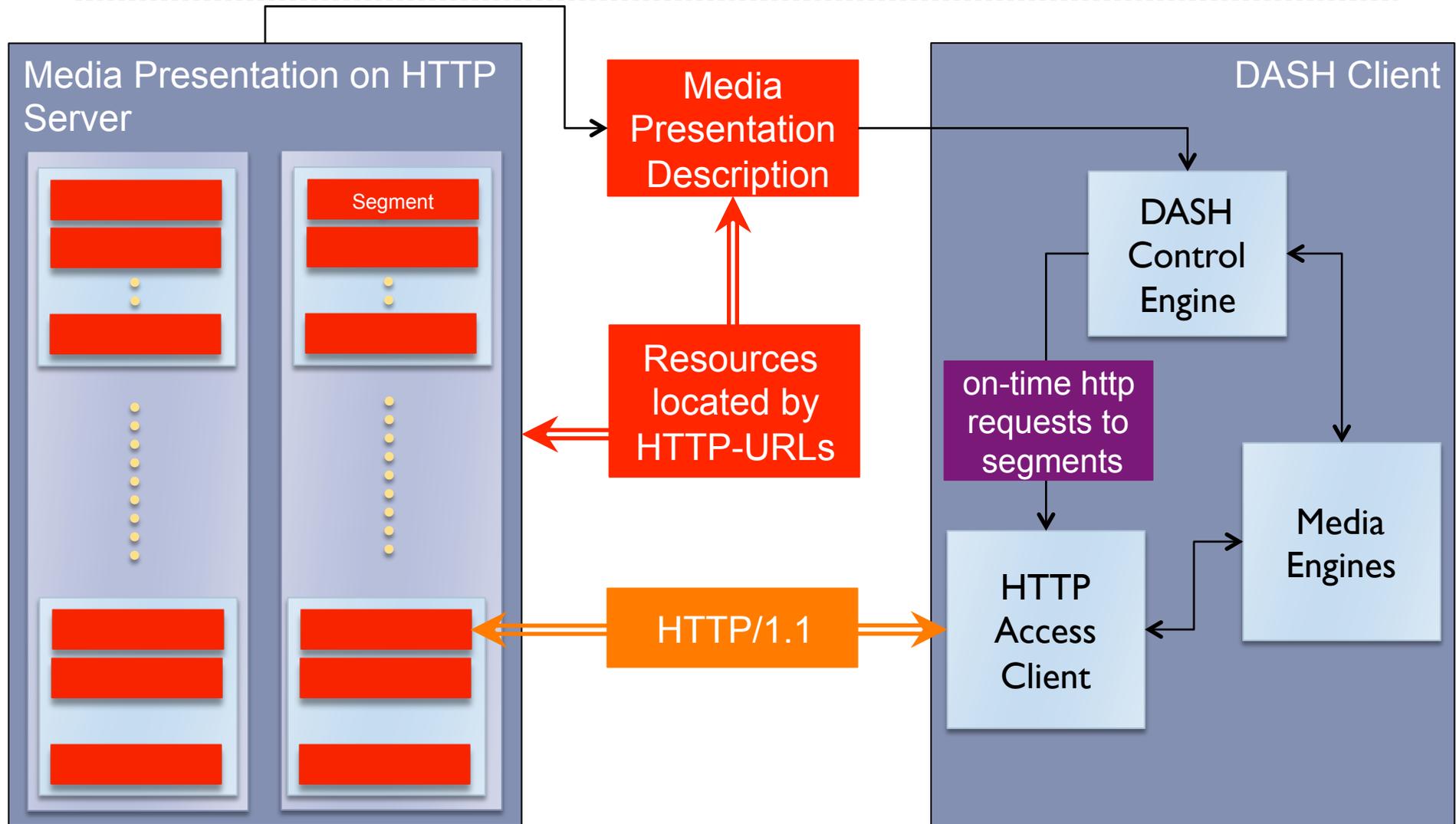
Information Classification

- MPD and Index Information for DASH Access client
    - Core specification aspects of DASH
- Initilialisation and Media Segments for Media engine
    - Reuse of existing container formats and easy conversion
    - Small adaptations may be necessary for usage in DASH

MPD

Segment data → **DASH Access Client** → MPEG format media + timing → **Media engine** → Media output
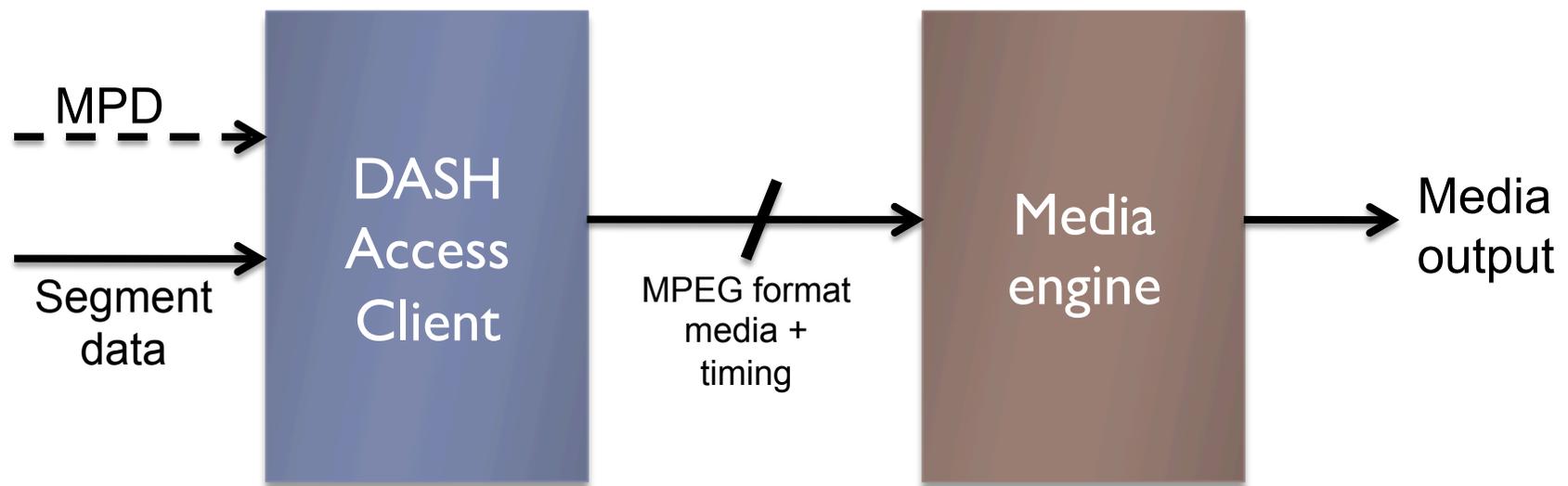
Media Presentation Data Model

▸ Media Presentation Description (MPD) describes accessible Segments and corresponding timing

Media Presentation

- Period, start=0s
  …
- Period, start=100s
  …
- Period, start=295s
  …

…

Period,
- start=100
- baseURL=http://www.e.com/
…

Group 1
video

Group 2
audio

…

Representation 1
- bandwidth=500kbit/s
- width 640, height 480
…

Segment Info

duration=10s

Template:
./ahs-5-$Index$.3gs

Representation 2
- bandwidth=250kbit/s
- width 640, height 480
…

Segment Info

Initialization Segment
http://www.e.com/ahs-5.3gp

Media Segment 1
start=0s
http://www.e.com/ahs-5-1.3gs

Media Segment 2
start=10s
http://www.e.com/ahs-5-2.3gs

Media Segment 3
start=20s
http://www.e.com/ahs-5-3.3gh

Media Segment 20
start=190s
http://www.e.com/ahs-5-20.3gs

MPD Information

▸ **Redundant information of Media Streams for the purpose to initially select or reject Groups or Representations**

  ▸ Examples: Codec, DRM, language, resolution, bandwidth

▸ **Access and Timing Information**

  ▸ the HTTP-URL(s) and byte range for each accessible Segment

  ▸ the earliest next update of the MPD on the server

  ▸ the segment availability start and end time in wall-clock time

  ▸ the approximated media start time and duration of a Media Segment in the media presentation timeline

  ▸ for live service, instructions on starting playout such that media segments will be available in time for fluent playout in the future

▸ **Switching and splicing relationships across Representations**

▸ **Relatively little other information**

Segment Indexing

▶ **Provides binary information in ISO box structure on**

  ▶ Accessible units of data in a media segment

  ▶ Each unit is described by

    ▶ Byte range in the segments (easy access through HTTP partial GET)

    ▶ Accurate presentation duration (seamless switching)

    ▶ Presence of representation access positions, e.g. IDR frames

▶ **Provides a compact bitrate-over-time profile to client**

  ▶ Can be used for intelligent request scheduling

▶ **Generic Data Structure usable for any media segment format, e.g. ISO BMFF, MPEG-2 TS, etc.**

▶ **Hierarchical structuring for efficient access**
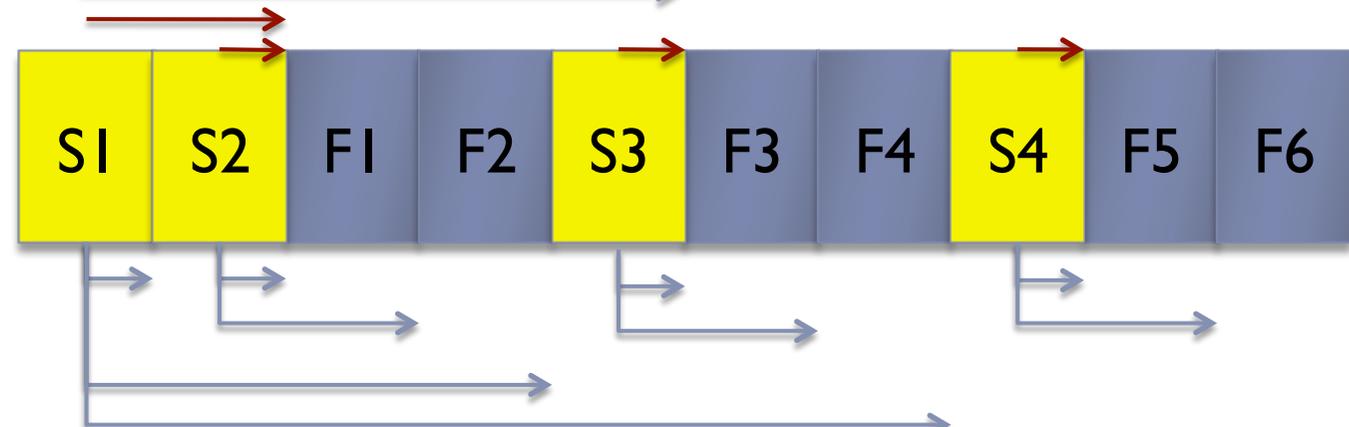
▶ **May be combined with media segment or may be separate**
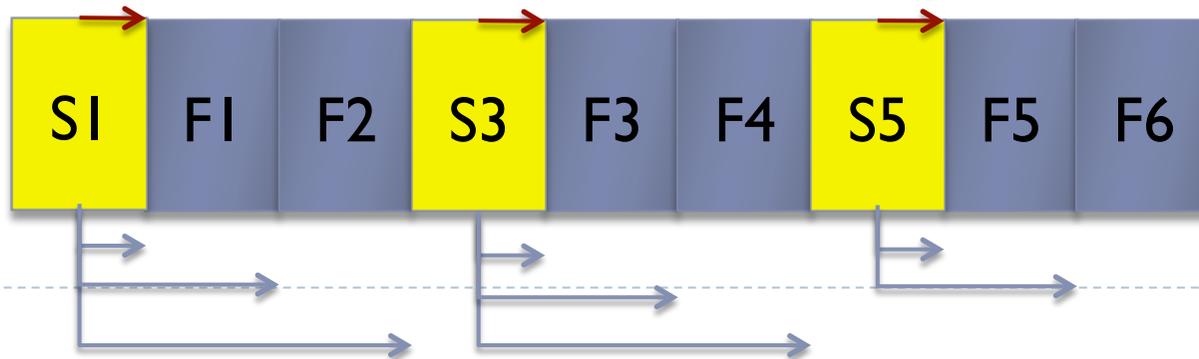
Media Segment with Segment Index
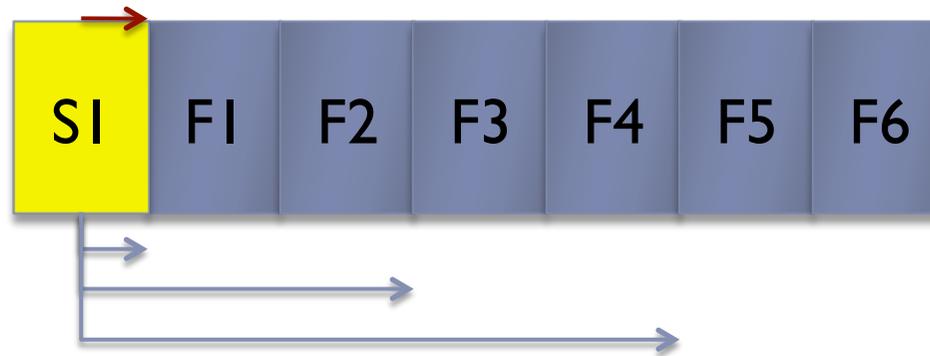
Media Segments

- Contain information to map segment into media presentation timeline for switching and synchronous presentation with other Representations
- For ISO BMFF, contains one or more movie fragments
- Can be short (≈1-10 sec) and long (≈10sec – 2h)

Segment duration	Advantages	Disadvantages
Short	• Commonality with Live • High switching granularity on segment level	• Large number of files • Large number of URLs • Fixed request size • switching granularity on segment level
Long	• Small number of files • Small number of URLs • High switching granularity • Flexible request sizes • Improved cache performance	• Need for Segment Index • Difference from Live
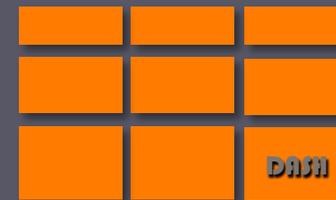
DASH Selected Features

DASH Selected Feature list

▸ Live, On-Demand and Time-shift services

▸ Independency of request size and segment size (byte range requests)

▸ Segment formats

  ▸ ISO base media FF and MPEG-2 TS

  ▸ guidelines for integrating any other format

  ▸ Are codec independent

▸ Support for server and client-side component synchronization (e.g., separate and multiplexed audio and video)

▸ Support for efficient trick mode

▸ Simple splicing and (targeted) ad insertion

▸ Definition of quality metrics

▸ Profile: restriction of DASH and system features (claim & permission)

▸ Content Descriptors for Protection, Accessibility, Rating, etc.

 ▸ Enables common encryption, but different DRM (DECE-like)

Forward looking

▸ Do the homework

  ▸ Specification completion in the next few months

  ▸ Conformance, interoperability and reference software

▸ DASH is rich and simple at the same time

  ▸ Understand more detailed market needs

  ▸ Create profiles as considered necessary

  ▸ Collaborate with system creators on how to integrate DASH

▸ Integrate it into the web – what is necessary?

▸ Get it deployed

▸ Everyone is invited - get involved in and excited about DASH

Confident? Or more Chocolate?
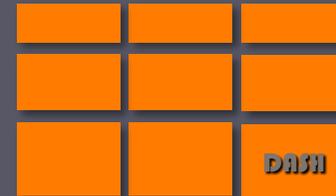
Thank you

Comments – Questions - Feedback