SubTech 1
Symposium on Subtitling Technology

Subtitles in MP4 and DASH
Report from the MP4Box open-source team
Subtitles: historic usage

- Historic usages
  - Translation: different languages
  - Accessibility aspect:
    - Close captions
    - Subtitles for the deaf or hard-of-hearing (SDH)
  - Same-Language Subtitling (karaoke, presentation)
Subtitles: emergent usages

Emergent usages

- Watching a video without the audio on (eg. In public places, bars or on youtube, facebook)
  - FB: subtitles increase the viewer engagement (40%)
- Help for a better indexation of the video with search engines
- Subtitles on 360 video (more on ImAc later)
Proliferation of subtitle formats (before TTML)

Software video players
- AQTitle
- MPSub
- SubViewer
- Phoenix Subtitle
- SubStation Alpha
- PowerDivX
- MPEG-4 Timed Text
- Gloss Subtitle
- Ogg Writ
- RealText
- XSUB
- VobSub
- Universal Subtitle Format
- JACOSub

DVD video
- DVD Video
- MicroDVD
- Blu-ray Disc
- DVB Subtitles
- Philips Overlay Graphics Text
- Imitext
- Teletext

Cinéma
- D-Cinema
- Spruce subtitle format
- SubRip
- SMIL
- WebVTT

Internet Delivery

TV Broadcast
TTML: a new standard

- There are too many standards
  - Specify one standard that covers all existing standards
  - TTML: **one standard to rule them all**!

- New standards creation:
Proliferation of subtitle formats (after TTML)

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- PowerDivX
- VobSub
- Universal Subtitle Format
- DVD Video
- Spruce subtitle format
- Blu-ray Disc
- SubRip
- DVD video
- D-Cinema Cinema
- TV Broadcast
- SMPTE-TT
- EBU-TT
- SMIL
- Internet Delivery
- TTML (ex DFXP)
- CFF-TT
- SDP-US
- WebVTT

DVD Video
- DVB Subtitles
- Philips Overlay Graphics Text
- Percent text
- .ESY .XIF .X32 .PAC .RAC .CHECK
- .AYA .890 .CIP .CAP .ULT .USF
- .CIN .L32 .ST4 .ST7 .TIT .STL

Blu-ray Disc
- Philips Overlay Graphics Text
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TTML and derived profiles/captions formats

- Started in 2004.
- The Timed Text format is a Recommendation of W3C (2010)
What is GPAC?

- GPAC is a multimedia framework started in 1999
  - Code became free and open-source in 2003
  - Used by major services (Youtube, Sony, IRT, …)
  - Powered by a community of enthusiasts: x264, …
    - Started a lot of companies

- Softwares
  - MP4Box packager
  - MP4Client player
  - Many other tools (mostly MP4/MPEG2-TS, DASH, live tools…)

- A team
  - Research and standards @Telecom ParisTech
  - A commercial arm: GPAC Licensing (SME) in 2012
GPAC and subtitles: a love story

- First subtitle support: MPEG-4 Timed Text (2001)
- Industry-grade conformant open-source tools
  - GPAC as a utility software at MPEG
  - Help the industry to produce better formats (GPAC Licensing):
    - Guidelines to embed TTML in MP4 and DASH (with IRT, BBC, EBU, TPT)
- ImAc H2020 project (Immersive Accessibility)
  - Accessibility (subtitles, audio description, sign language) in VR
  - Push for “accessibility as a first-class citizen”
  - Consortium includes companies (Motion Spell, Anglatecnic), user associations (RNIB), broadcasters (RBB, CCMA) and academic partners (IRT, I2cat, UAB, USAL).
Subtitles and GPAC support

- **ISOBMFF vision:**
  - Any human readable text (subtitles, closed captions…) is a subtitle.
- **2 major classes of formats:**
  - ‘text ’: text processing capabilities only
    - e.g. WebVTT
  - ‘subt’: text and image processing capabilities
    - e.g. TTML
- **WebVTT and TTML in ISOBMFF**
  - MPEG-4 part 30:
    - Title: “Timed Text and other visual overlays”
    - Standardized in 2014-03
    - Co-edited by D. Singer, M. Dolan and C. Concolato from GPAC
WebVTT support in GPAC

- First integration in Sept 2012
- Completed in July 2013 (import, muxing, dashing)
- Conform to ISOBMFF spirit:
  - Metadata are separated from the data
  - Output file is smaller than input
- Challenge for adaptive streaming segmentation:

https://concolato.wp.imt.fr/2012/09/12/webvtt-streaming/
TTML support in GPAC (1/2)

- TTML support in GPAC:
  - Started with NHML generic support in Jan 2014
    - MPEG-4 Part 30 is ok (see later)
  - GPAC Licencing commissioned by DASH-IF for EBU-TT-D
    - initial support: Aug 2014
  - Some fixes with IRT about HbbTV in 2015

- New profiles keep appearing:
  - Faster than deployed.
  - Faster than we implement them.
  - IMSC will be the new standard to rule them all !!
    - IMSC 1 + text & image profiles
    - IMSC 2 is coming soon ?
TTML support in GPAC (2/2)

- Need to parse deeply to extract the useful information (timings, regions)
  - which then need to be semantically processed...

- TTML is extended from XML:
  - Heavy to handle properly in native C code (FFmpeg, GPAC, VLC, …): deep hierarchy tree, namespaces, extensibility ...

- Redundancy
  - Same functionality described in many ways (timings, positions, etc.)
    - Same drawback as MPEG-DASH

- These are pain points for both muxers and players implementors.
No playback.
Parsing is incomplete in GPAC.
Conformance model.
Need an elaborate model for pivotal representation:
  Ex: ISD (Intermediate Synchronic Document)
Rendering seems to expect the presence of a CSS stack.
  No user asked for it.
  We gave up, waiting for an industry input.
Segmenting TTML in MP4

- MPEG-4 part 30 for TTML:
  - Put the TTML document in one ISOBMFF sample.
  - Operations on MP4 file (cutting, extracting) require to rewrite the TTML content.
    - First time we need to re-encode content when manipulating MP4s.
      - Give me a H267 or AC-5 stream in MP4 and I can cut, DASH and encrypt it. Not for TTML.
    - The muxer need to map ISOBMFF timeline with TTML timeline.
      - Solution: data shouldn’t be repeated over the layers.
Segmenting TTML in MP4

- Find a solution with industry leaders (GPAC Licensing):
  - Guidelines to embed TTML in MP4 and DASH (with IRT, BBC, EBU, TPT)
  - Samples (from Andreas Tai @ IRT)

- Authoring tools need to:
  - Prepare for segmentation (DASH).
  - Same as when video encoders communicate closely with muxer.
  - Add a pre-packager tools: no existing solution
Timeline issues for TTML streaming

- 3 possibilities, all deployed!
  - ISOBMFF « The Standard »
    - Time is relative to the media: streaming session start time is zero.
    - Not resilient
  - Smooth Streaming « The de-facto »
    - Each chunk/segment start time starts at zero.
    - Resilient
  - Non standard « The alternative »
    - Absolute UTC time.
    - Resilient

- Problems:
  - The packager needs to parse and rewrite the TTML
  - We have to maintain consistency between the TTML and ISOBMFF timelines
  - The player may need to guess the timeline
Thanks and acknowledgements

Horizon 2020
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