Pierre-Anthony Lemieux, Sandflow Consulting
Supported By MovieLabs

Dave Kneeland, 20th Century Fox

IMSC 1.1

End-to-End Worldwide Subtitles and Captions

HPA 2019

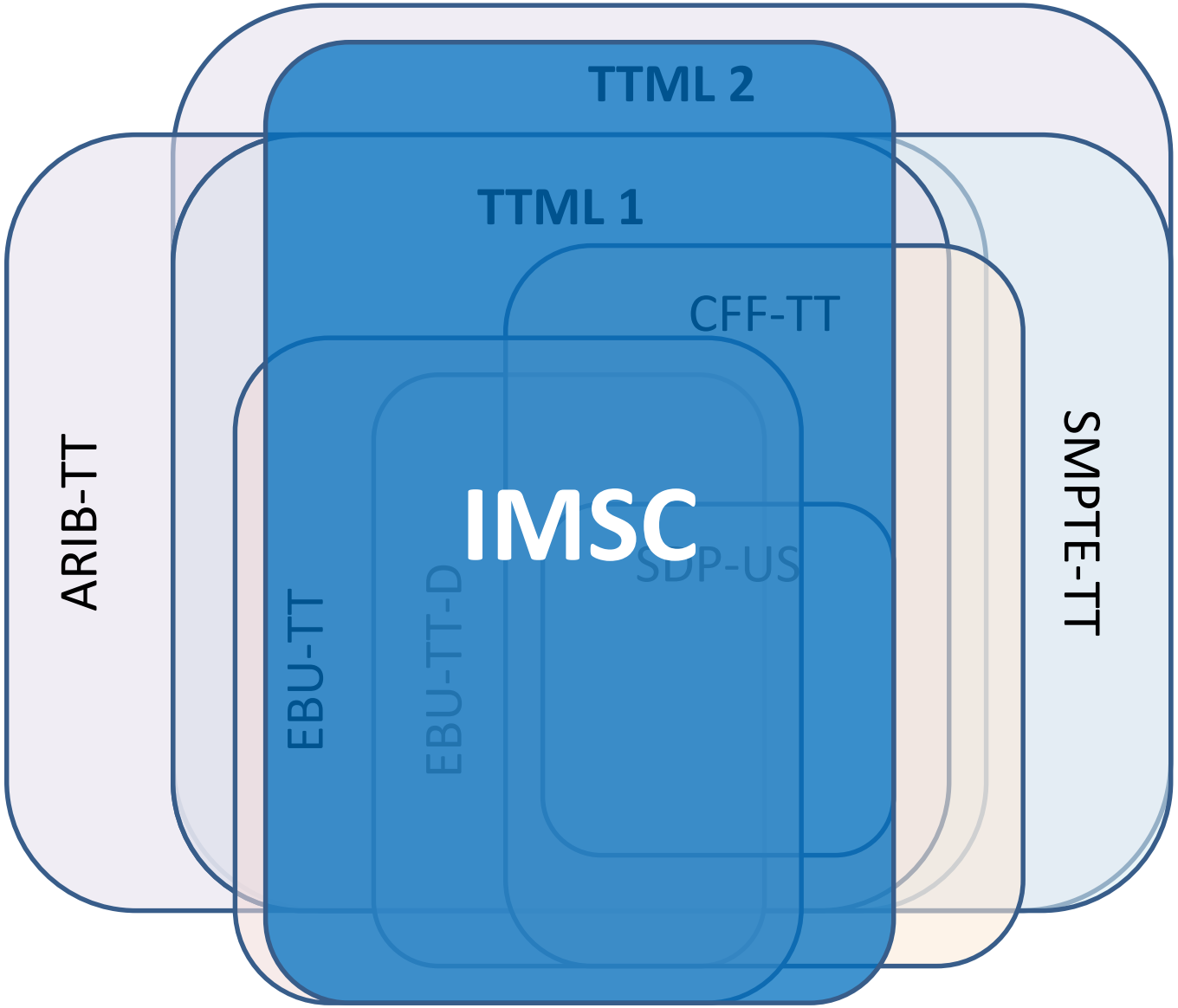
What is IMSC 1.1?

W3C Recommendation

XML-based format for worldwide subtitles and captions

Critical improvements over IMSC 1.0.1

- Advanced Japanese language features
- Stereoscopic 3D and HDR presentations


TTML 2
TTML 1
CFF-TT
IMSC
SDP-US
EBU-TT-D
EBU-TT
ARIB-TT
SMPTE-TT

Flexible styles and writing modes

Other Features

Text and Image

Stereoscopic 3D

- Disparity-based
- Similar to SMPTE ST 428-7 (D-Cinema) and CEA 708.1

High-Dynamic Range (HDR)

- Map onto PQ using an author-supplied luminance gain
- Map onto HLG using a fixed recommended gain

Anatomy of an IMSC Document

```
<?xml version="1.0" encoding="UTF-8"?>
<tt xml:lang="en" xmlns="http://www.w3.org/ns/ttml"
xmlns:tts="http://www.w3.org/ns/ttml#styling">
<head>
  <layout>
    <region xml:id="area1" tts:displayAlign="center"/>
  </layout>
</head>
<body>
  <div>
    <p region="area1" begin="1s" end="2s">
      Centered text
    </p>
  </div>
</body>
</tt>
```

A Few Open Source Projects

imscJS	JavaScript library for rendering IMSC documents to HTML5
Timed Text Toolkit (ttt)	Java-based TTML renderer and validator
MP4Box	ISO BMFF multiplexer
dash.js	Reference DASH web player
asdcplib	Wraps IMSC in MXF

Many other projects with some IMSC compatibility, e.g. Shaka Player, Exo Player…

What is imscJS?

JavaScript library

Renders IMSC documents to HTML5

- XML to JSON temporal segments
- JSON to HTML5

Open source (BSD license)

Used by dash.js (reference DASH player)

Supported by MovieLabs and Netflix

https://github.com/sandflow/imscJS

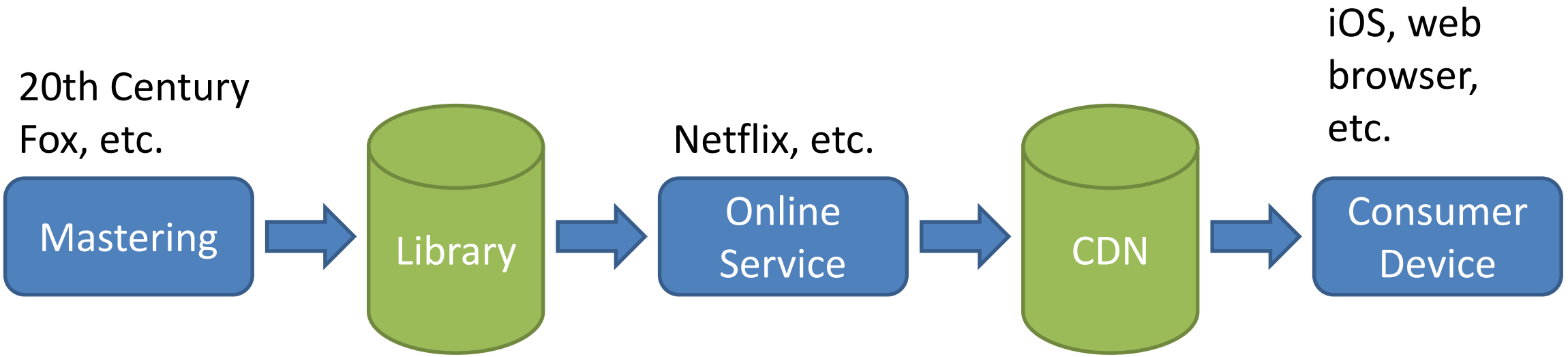
Working with other formats

SMPTE-TT	Likely no conversion necessary to IMSC1
CEA 608	SMPTE RP 2052-10
CEA 708	SMPTE RP 2052-11
SDP-US	No conversion necessary to IMSC1
EBU-TT-D	No conversion necessary to IMSC1
EBU STL	Via EBU-TT-D (EBU Tech 3360)
WebVTT	Draft mapping

Adoption

SMPTE ST 2067-2	Interoperable Master Format (IMF)
ISO 23000-19	Common media application format (CMAF) for segmented media
DVB A174	Digital Video Broadcasting (DVB); TTML Subtitling Systems
ATSC A/343	ATSC Standard: Captions and Subtitles
CTA WAVE	Consumer Technology Association: Web Application Video Ecosystem
HLS	HTTP Live Streaming 2nd Edition
APEX Specification 0415	Media & Device IFE Ecosystem Specification Version 1.0

End-to-End



IMF (SMPTE ST 2067)	CMAF (ISO 23000-19) + DASH (ISO 23009) | HLS
MXF (SMPTE ST 377-1)	ISO BMFF (ISO 14496-30)
JPEG 2000, etc...	AVC, etc.
PCM	AAC, etc.

IMSC

Building a Spec from a Standard

What is the scope?

- Is this for archive or distribution?
- What is your toolset?
- Can systems properly decode and transform your subtitles?
- What are you willing to compromise?

Building a Spec from a Standard

Our IMSC goals

- Create once, repurpose many
  - Archive
  - Distribution
  - Stylized burn-in source
  - HDR/SDR
- Robust enough to survive platform and device decoding inconsistencies

IMSC 1.1 for Archive

We have standardized certain attributes

- fontFamily="proportionalSansSerif"
- backgroundColor="transparent"
- textOutline="black 4%"
- color="#DCDCDC"
- luminanceGain="4.0"
    - This change is coming soon

IMSC 1.1 for Distribution

Once it leaves our environment

- Placement can change
- Visual style can change
- Font sizes can change

IMSC 1.1

How have we controlled for this?

- Acceptance
- Subtitle authoring style
  - Our default placement is bottom center
  - We add character identifiers to indicate the speaker when needed
- We've worked with manufacturers and platforms for IMSC decoding compliance

IMSC 1.1 Compliance

IMSC 1.1 Test Reel

- This test content was created as a reaction to early IMSC implementations
- This tests for:
  - Region rendering
  - Text placement
  - Font rendering
  - Frame accurate timing
  - Foreign language rendering
  - Color transformations
- This was created in collaboration with industry colleagues at other studios and platforms.

IMSC 1.1 Compliance

IMSC Test Reel

- Rec. 709 and Rec. 2020 PQ Backplates
- IMSC 1.1 file
- Rec. 709 and Rec. 2020 PQ Composited proxies

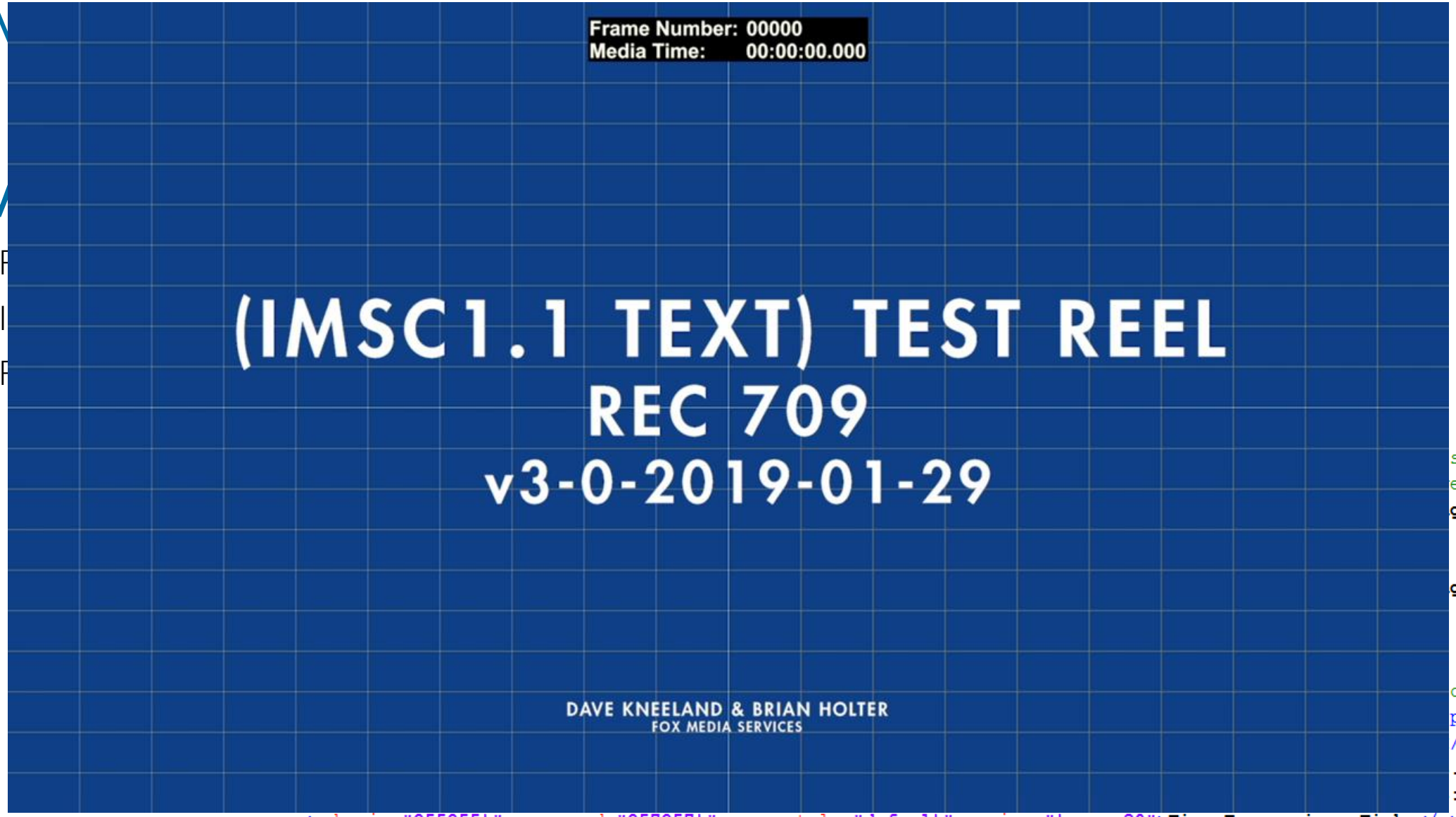
```
                <!--These will evaluate that the sRGB values in this IMSC file are being properly mapped to the color space of the vid
                tts:luminanceGain is only applicable when compositing subtitles on HDR10 content. The following two events will look i
                <p begin="00:01:21.081" end="00:01:23.083" style="lineH125_mono" region="trans_80_G1">Color Compositing - Gain 1<br/><
                    <span tts:color="#DCDCDC">#DCDCDC Text INVISIBLE Rest of Text</span><br/><br/>
                    <span tts:color="#FF0000">#FF0000 Text INVISIBLE Rest of Text</span></p>
                <p begin="00:01:24.084" end="00:01:26.086" style="lineH125_mono" region="trans_80_G5">Color Compositing - Gain 5<br/><
                    <span tts:color="#DCDCDC">#DCDCDC Text INVISIBLE Rest of Text</span><br/><br/>
                    <span tts:color="#FF0000">#FF0000 Text INVISIBLE Rest of Text</span></p>

                <!--These are to ensure that the various time expression syntaxes are properly interpreted. It's very common for certa
                <p begin="5832f"        end="5880f"        style="default" region="trans_80">Time Expression: Frames</p>
                <p begin="246.246s"     end="248.248s"     style="default" region="trans_80">Time Expression: Seconds</p>
                <p begin="00:04:09.249" end="00:04:11.251" style="default" region="trans_80">Time Expression: HH:MM:SS.ms</p>
                <p begin="00:04:12:06"  end="00:04:14:06"  style="default" region="trans_80">Time Expression: HH:MM:SS:FF</p>
                <p begin="255255t"      end="257257t"      style="default" region="trans_80">Time Expression: Ticks</p>
            </div>
        </body>
    </tt>
```

IM

IM

- F
- I
- F




```
space of the vid
ents will look i
g - Gain 1<br/><

g - Gain 5<br/><

common for certa
p>
/p>
.ms</p>
:FF</p>
                <p begin="255255t"      end="257257t"      style="default" region="trans_80">Time Expression: Ticks</p>
            </div>
        </body>
    </tt>
```

IMSC 1.1 Compliance

IMSC Compliance Reel

- IMSC 1.1 TEXT: https://github.com/FoxMediaServices/IMSC-1.1_Text_TestContent
- IMSC 1.1 IMAGE: https://github.com/FoxMediaServices/IMSC-1.1_Image_TestContent

Thank you!