W3C TTML Profiles for Internet Media Subtitles and Captions

IMSC

End-to-End Internet Subtitles and Captions

Pierre-Anthony Lemieux, Sandflow Consulting (pal@sandflow.com)
Supported by MovieLabs

IMSC

Developed by the W3C Timed Text Working Group (TTWG)

Application of TTML for subtitles and captions

Reduces fragmentation by bringing together multiple profiles of TTML

Focal point for Internet subtitles and captions

Evolve with worldwide requirements

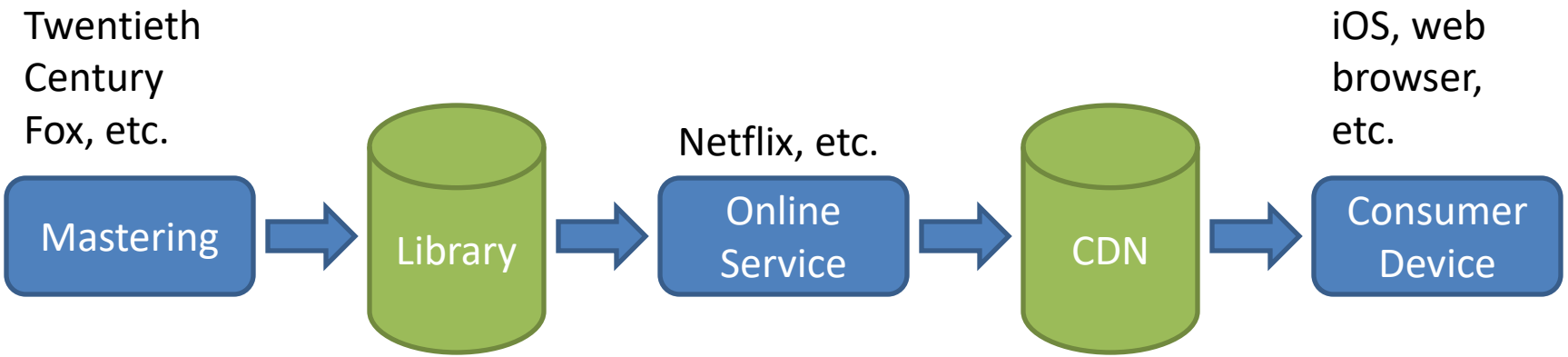
Working with other formats

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

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

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.

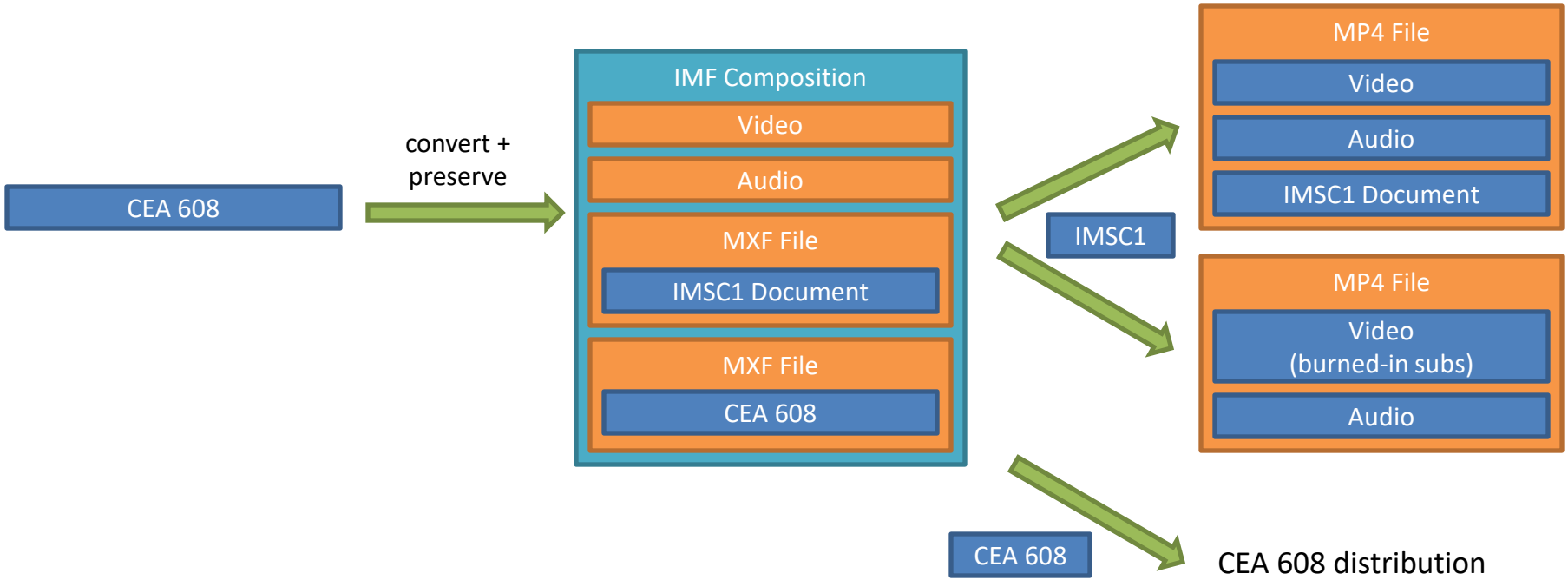
IMSC

Demo

http://subtitling.irt.de/cmaf/

Case Study: IMF

Component-based master format (SMPTE ST 2067-2)



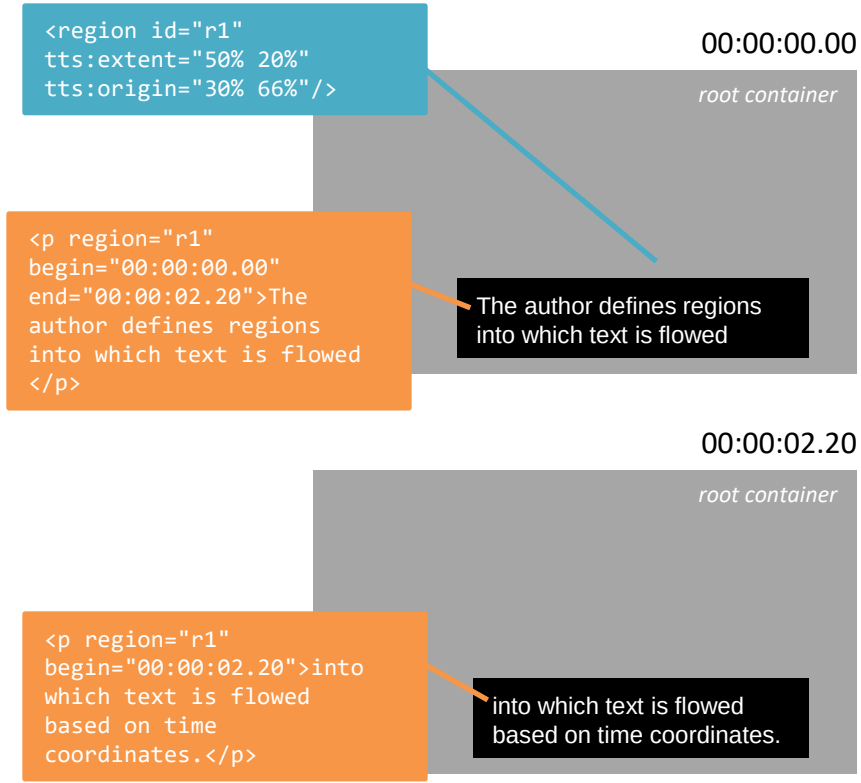
Basics

Regions defined relative to a root container

Text and images flow into regions at specified time coordinates, e.g. HH:MM:SS.fraction

Time coordinates are offsets from T=0s

- Not a timecode timestamp
- Not tied to video timecode



Anatomy of an IMSC1 Document

```
<?xml version="1.0" encoding="UTF-8"?>
<tt xml:lang="en" xmlns="http://www.w3.org/ns/ttml" …>
<head>
  <styling>
    <style xml:id="baseStyle" tts:color="white" tts:textAlign="center"/>
    <style xml:id="blackBackground" tts:backgroundColor="black"/>
    <style xml:id="greenBackground" tts:backgroundColor="green"/>
    <style xml:id="withLinePadding" ebutts:linePadding="0.5c"/>
  </styling>
  <layout>
    <region xml:id="area1" tts:origin="5% 10%" tts:extent="90% 20%" tts:displayAlign="center"/>
    <region xml:id="area2" tts:origin="5% 70%" tts:extent="90% 20%" tts:displayAlign="center"/>
  </layout>
</head>
<body>
  <div style="baseStyle">
    <p region="area1" begin="00:00:01" end="00:00:09">
      <span style="greenBackground">Centered text on two lines<br/>without padding.</span>
    </p>
    <p region="area2" style="withLinePadding" begin="00:00:01" end="00:00:09">
      <span style="blackBackground">Centered text on two lines<br/>with padding.</span>
    </p>
  </div>
</body>
</tt>
```

styles

regions

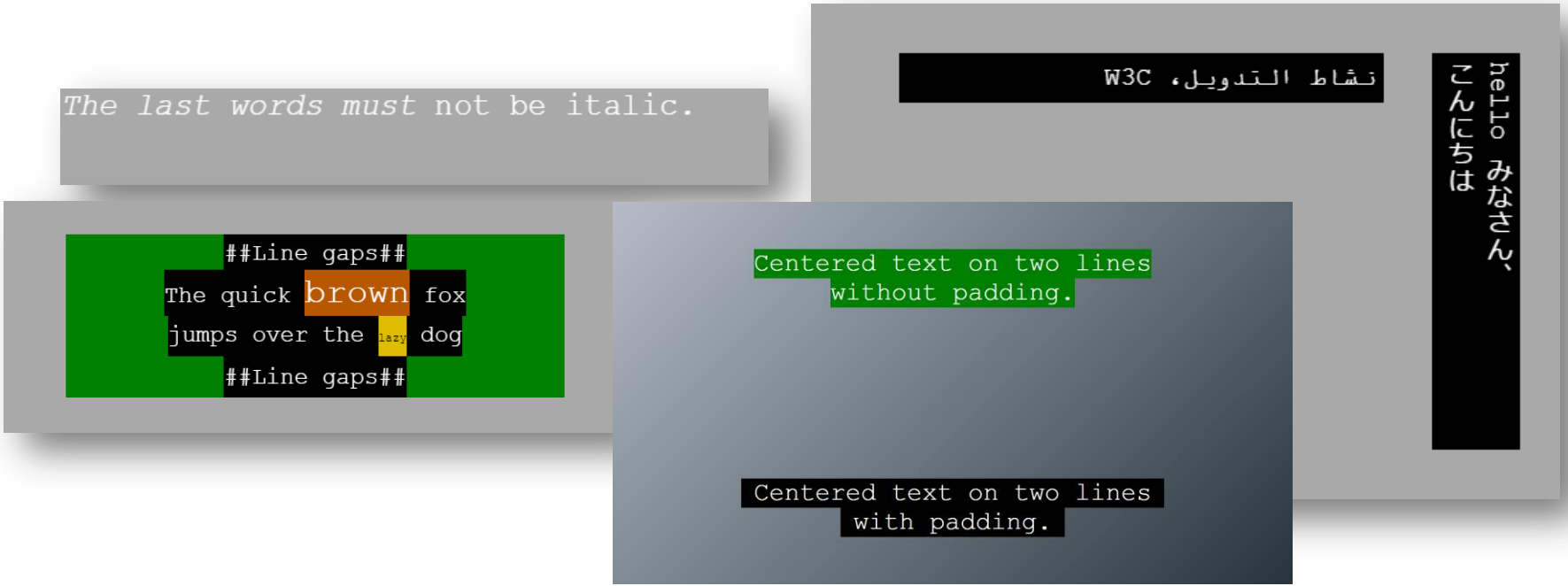
timing

header

sub #1

sub #2

Flexible styles and writing modes



Text or Image Subtitles

Text

Image (+ text string equivalent)


```
<ittm:altText>Once upon a time…<ittm:altText>
```

Test Suite

FillLineGap001.ttml

```
<?xml version="1.0" encoding="UTF-8"?>
<tt xmlns="http://www.w3.org/ns/ttml"
...
 <body>
  <div>
   <p xml:id="subtitle1" region="bottom"
begin="00:00:00.000" end="00:00:30.000"
style="paragraphStyle">
    <span style="spanStyle">##Line gaps##</span><br/>
...
    <span style="spanStyle">##Line gaps##</span>
   </p>
  </div>
 </body>
</tt>
```

Exemplar Render

https://github.com/w3c/imsc-tests

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?

Open source JavaScript library

Renders IMSC documents to HTML5

Implements IMSC 1.0.1 today, and IMSC 1.1 soon

Used by dash.js (reference DASH player)

Supported by MovieLabs and Netflix

https://github.com/sandflow/imscJS

Demos

Sample imscJS web application:
http://sandflow.com/imsc1proc/index.html

Working with dash.js and MP4Box:
http://sandflow.com/public/foms2017-2/CEP150_512kb.htm

Browser support for subtitle and caption stylistic features is not perfect.

IMSC Status Roadmap

IMSC 1 Recommendation [April 2016]

IMSC 1.0.1 Recommendation [April 2018]

IMSC 1.1 Candidate Recommendation [May 2018]

Publication of IMSC 1.1 Recommendation planned for October 2018

IMSC 1.1

Based on TTML 2

Superset of IMSC 1.0.1

- IMSC 1.0.1 document is a valid IMSC 1.1 document
- IMSC 1.1 processor presents an IMSC 1.0.1 document as it would have been presented by an IMSC 1.0.1 processor
- A few deprecated features
- A number of new features…

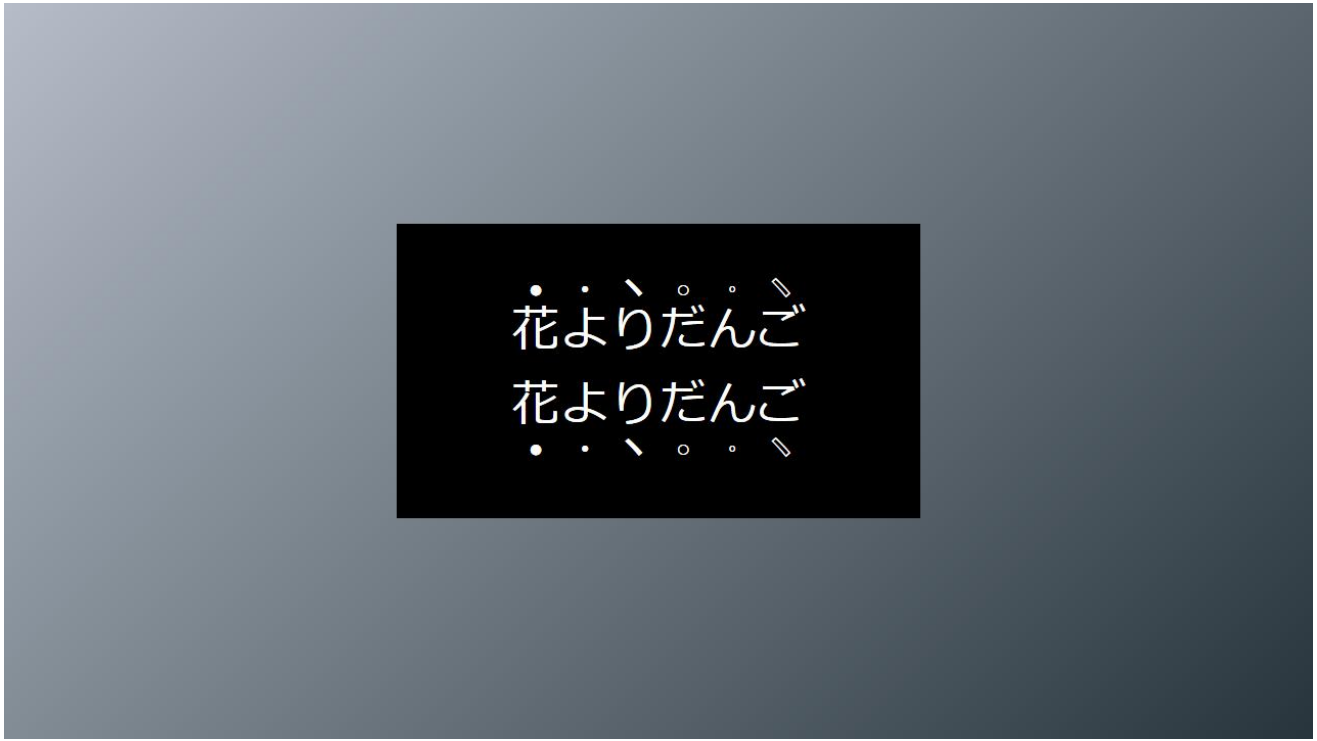
https://github.com/w3c/imsc-vnext-reqs

Ruby

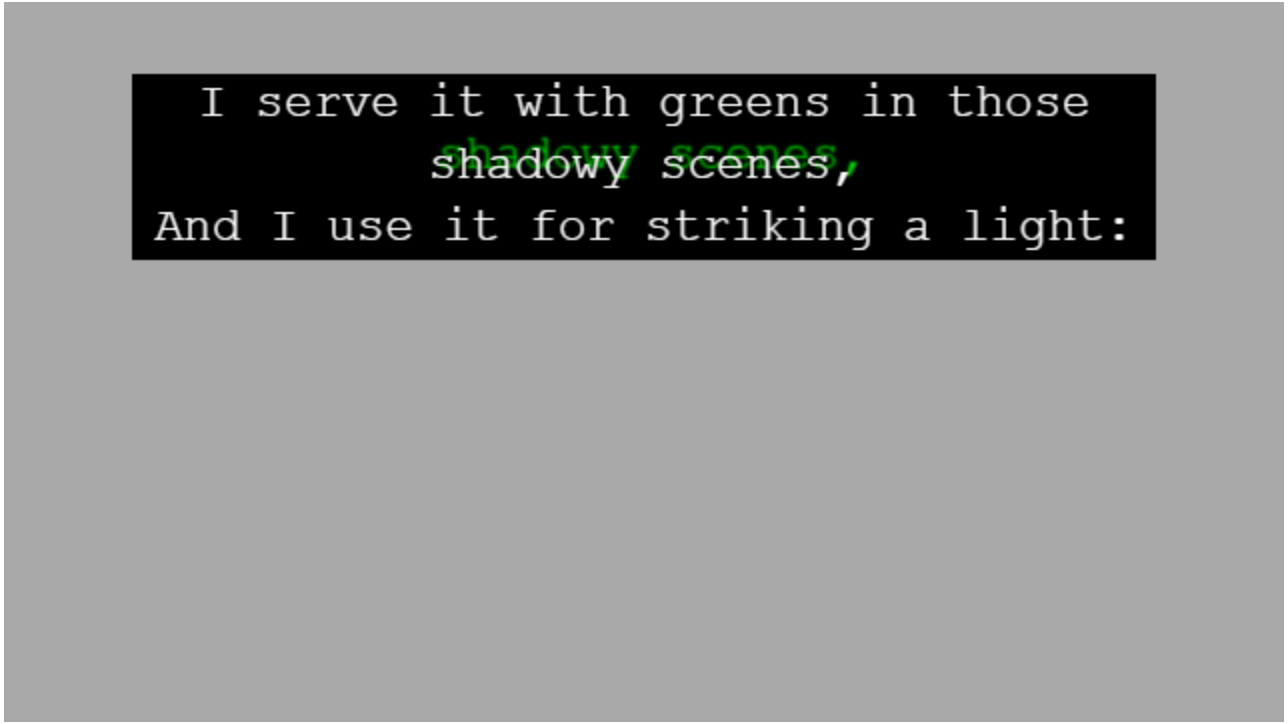
Tate-Chu-Yoko

Slant

Emphasis Marks



Shadow


I serve it with greens in those
shadowy scenes,
And I use it for striking a light:

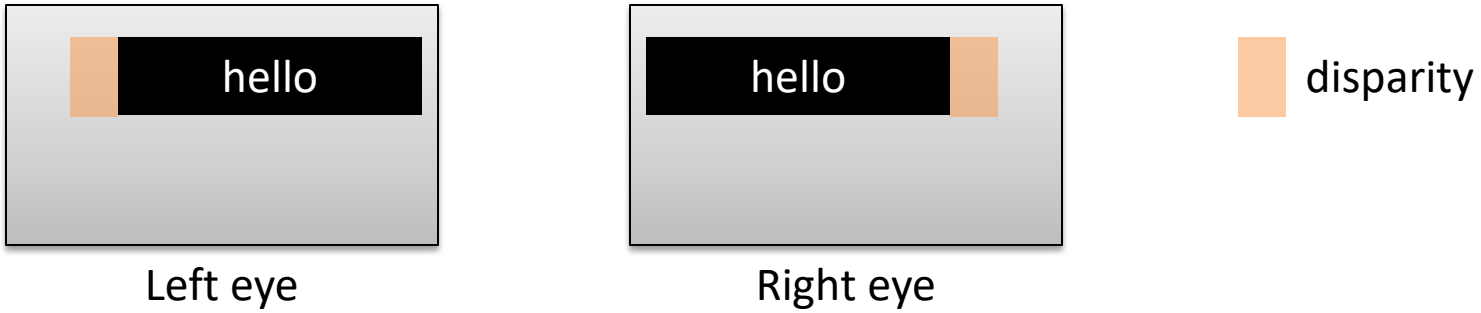
Stereoscopic 3D

tts:disparity sets binocular disparity between renderings of a region

- Positive disparity → perceived behind the plane of the display
- Negative disparity → perceived in front of the plane of the display

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

Ignored when not rendering onto a stereoscopic image pair



disparity < 0

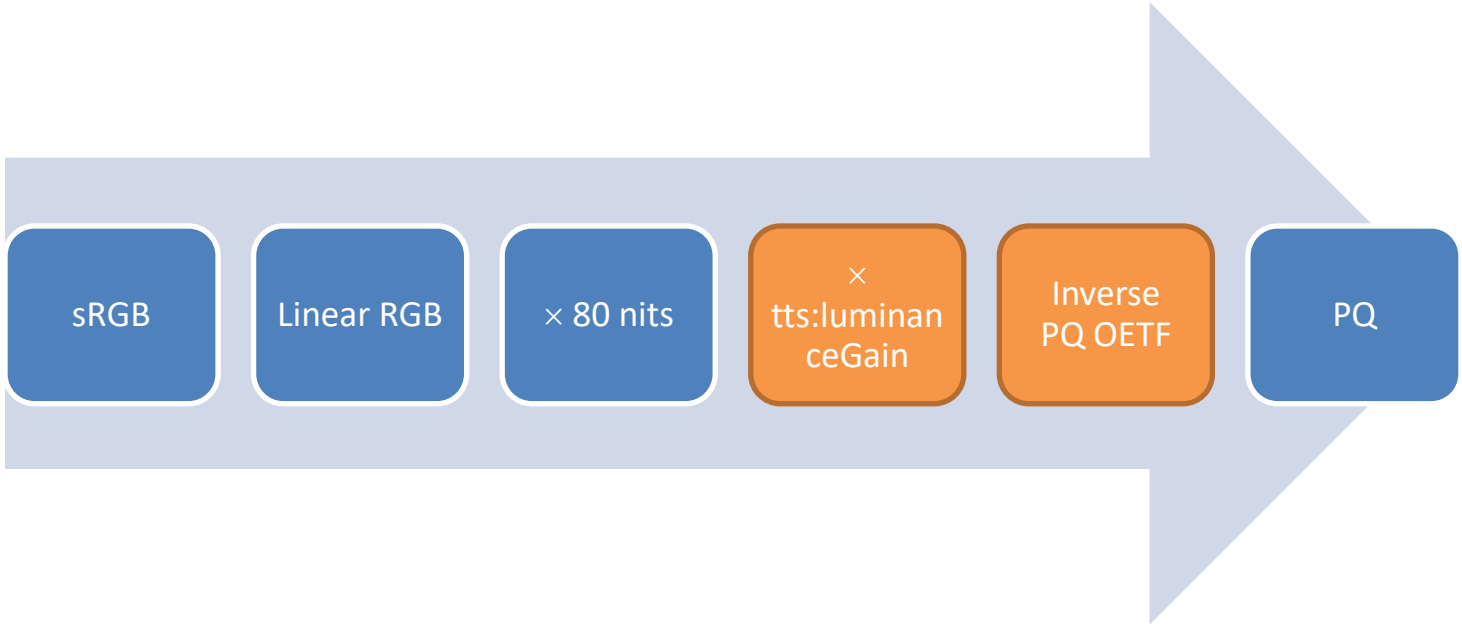
HDR in IMSC 1.1

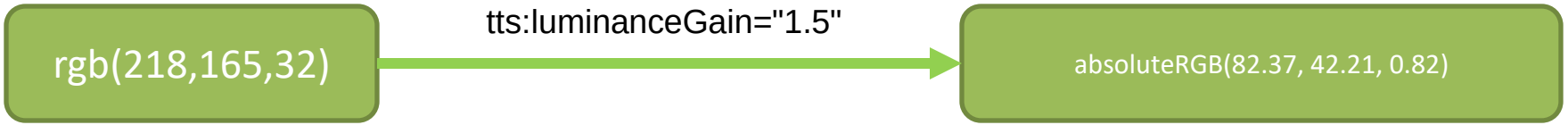
Two options

- Mapping of SDR RGB colors to HDR presentations
- Carry PQ images in PNG

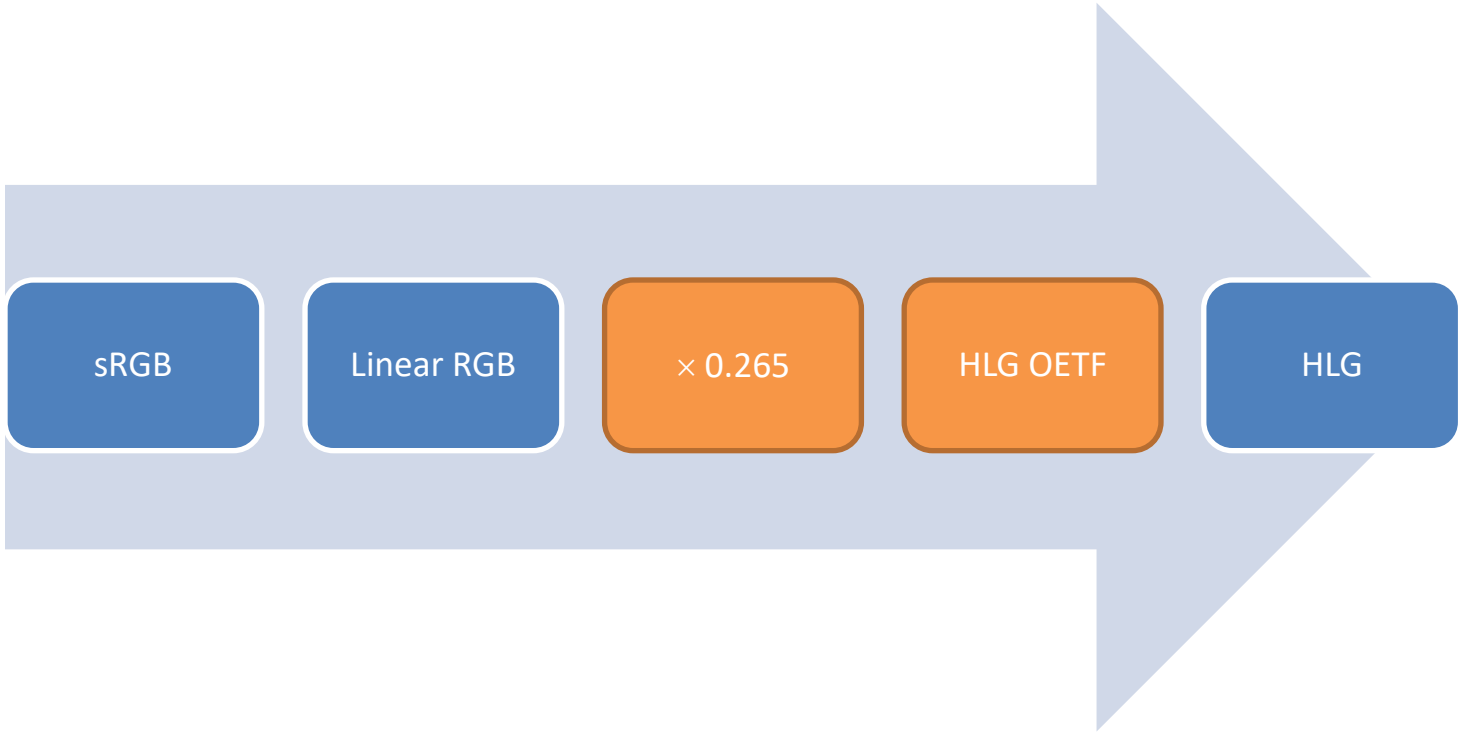
Map sRGB onto PQ	Map sRGB onto HLG
Author-supplied luminance gain (TTML2 tts:luminanceGain and Annex Q.1)	Fixed recommended mapping (TTML2 Annex Q.2)
Ignored if compositing onto SDR image	

Mapping SDR RGB to PQ image





Mapping sRGB to HLG image



PQ in PNG

Using the ITU BT.2100 PQ EOTF with the PNG Format (W3C WG Note)

Uses the existing iCCP chunk profile name to signal BT.2100 PQ images

Graceful processing by legacy decoders with fallback

- gAMA chunk
- cHRM chunk
- embedded ICC profile

Code and examples at https://github.com/sandflow/hdr4png

Thank you!