working together!

PDF Days Europe 2022 | Berlin

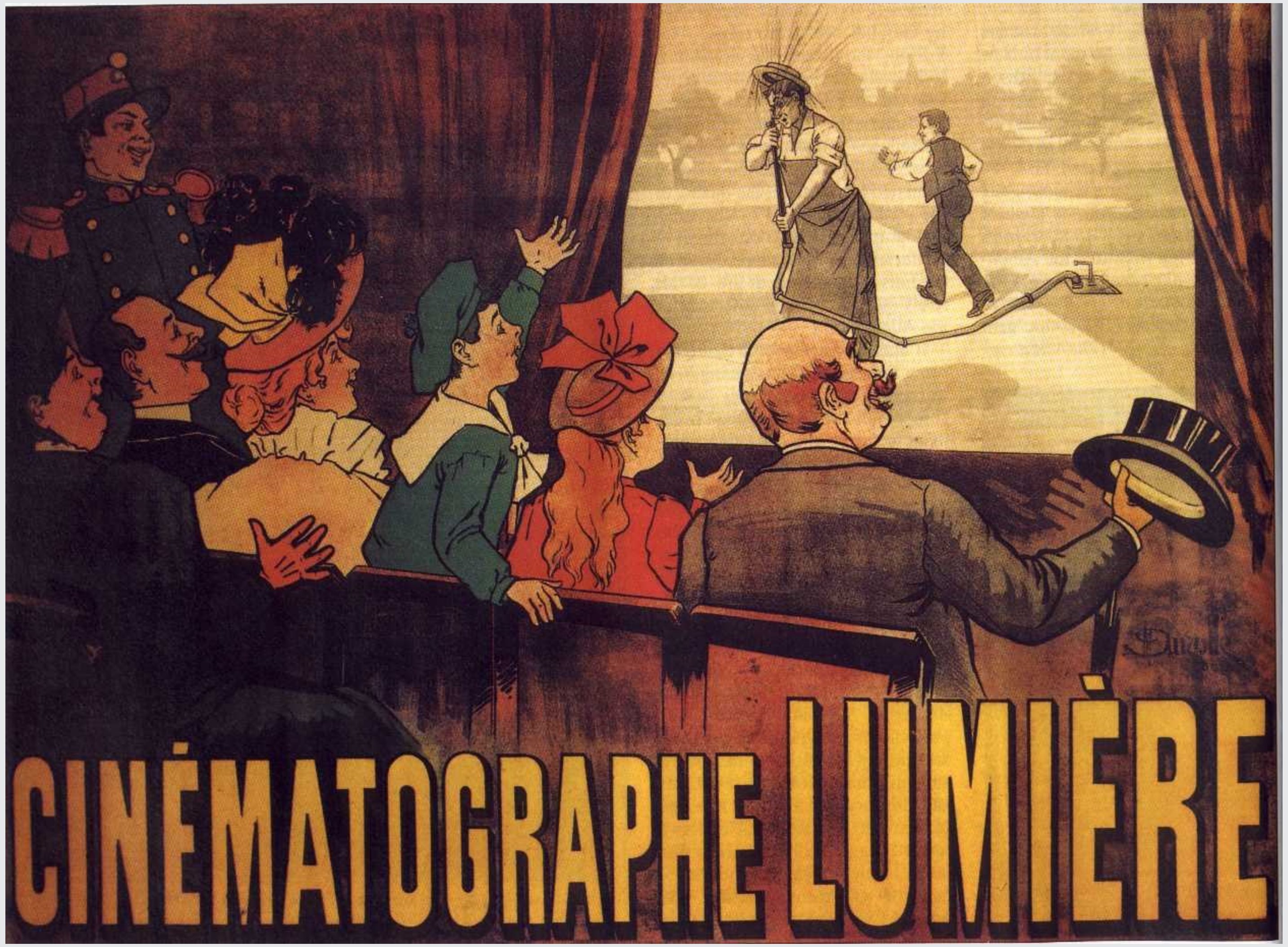
Extending RichMedia

For Audio/Video Content

Video Is ubiquitous

Why have Video in PDFs?

- PDF can provide Context for videos
- Archival (for legal/business purposes)
- Non-destructive editing of videos.



PDF for video Archival

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- Need to select a minimum set of Video formats to support for long-term archival purposes.
  - ISO/IEC 14496-14 (aka mp4 file format) is 19yrs old.
  - Videos not in the supported format, may need to stored with an AFRelationship along with an “archive” version of the video, where the archive version must be generated conforming to “authorized derivative” rules.
- Might need to store a “digital signature” for the video for legal provenance purposes.
  - Need to ensure support for playing excerpts.
  - need to be able to validate the entire original source video is unadulterated.

Evolution of “Audio/Video Rich Media” in PDF

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- Generation 1: Sound/Movie Annotation.
  - Deprecated.
- Generation 2: Screen Annotations
  - Technically still alive in PDF 2.0
- Generation 3: Flash-based Richmedia
  - Was not embraced by PDF community (3D Richmedia however, gained a foothold).
- Generation 4: Flash-less PDF 2.0 RichMedia
  - …

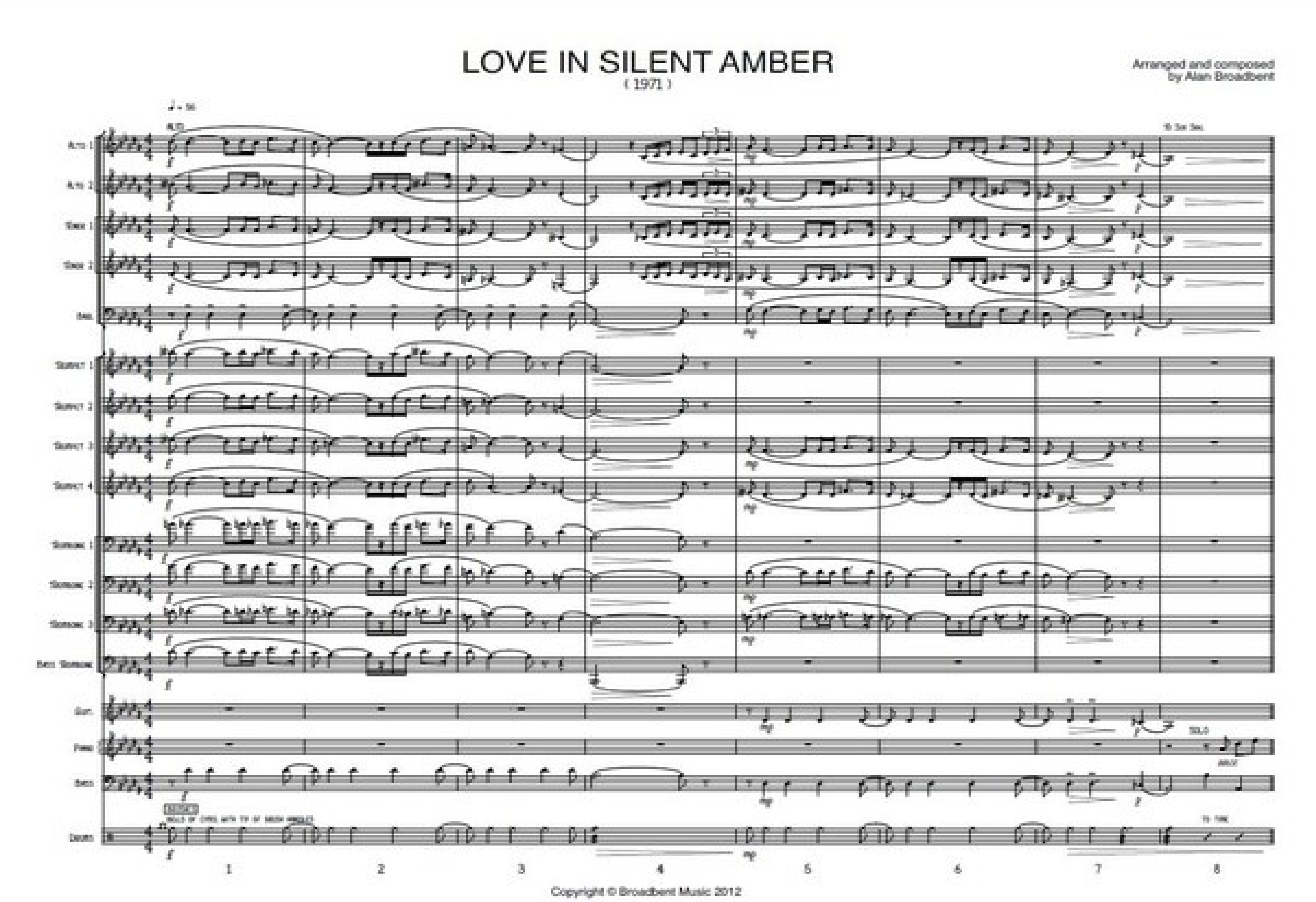
The problems w/ supporting Rich Media

- Generation 1: Media support presumably built into the Viewer. Difficult to maintain.
- Generation 2: Media Support essentially outsourced to the OS and 3rd party media libraries. Difficult to use/maintain across platforms.
- Generation 3: Media Support outsourced to a proprietary multimedia VM (aka Flash). Did not age well.
- Generation 4: interesting content structure, but lobotimized control structure.

Why start from PDF 2.0 RichMedia?

- RichMedia Content assets and configurations can be shared across a number of Annotations. Provides an Asset name tree and an array of Asset Instances.
- You could potentially use more than one A/V asset at a time:
  - A (linear) sequence of scenes.
  - Split-screen views (video sequences in parallel)
  - Overdubbed videos (video and audio sequences in parallel).
- What is missing is a declarative control mechanism to synchronize the playback of these various A/V streams.

Synchronizing multiple A/V sources



PDF Concepts for A/V Configuration

- Rendition Operations
- PDF Functions
- Affine Transformations

Rendition Operations

- Screen Rendition Operations:
  - Play (0),
  - Stop (1),
  - Pause (2),
  - Resume (3),
  - play-or-resume (4),
  - and JavaScript (NaN).

- Bitwise combinations:
  - Play(bit 0): 1
  - Pause(bit 1): 2
  - Stop (bit 2): 4
  - Audio-only (bit 3): 8
  - Video-only (bit 4): 16

  - No-op: 0
  - Resume: 3
  - Play-or-resume: 5?
  - Loop: 6?
  - Mute: 7?
  - Play-audio-only: 9
  - Resume-video-only: 19

PDF Functions

- PDF provides several types of *function objects (PDF 1.2)* that represent parameterized classes of functions, including mathematical formulas and sampled representations with arbitrary resolution.
- In general, a function can take any number *(m)* of input values and produce any number *(n)* of output values
- In PDF functions, all the input values and all the output values shall be numbers, and functions shall have no side effects.
- Type 2 functions *(PDF 1.3)* include a set of parameters that define an *exponential interpolation* of one input value and *n* output values
- Type 3 functions *(PDF 1.3)* define a *stitching* of the subdomains of several 1-input functions to produce a single new 1-input function.

PDF Functions for rendition operations

- 10 0 obj <</FunctionType 3 /Domain [0 240.0] /Bounds [60.0 120.0 180.0]
- /Encode [0 1.0 0 1.0 0 1.0 0 1.0]
- /Functions [11 0 R 12 0 R 13 0 R 14 0 R]>>
-
- 11 0 obj <</FunctionType 2 /Domain [0 1] /C0 21 0 R /C1 21 0 R/N 1.0>>
- 12 0 obj <</FunctionType 2 /Domain [0 1] /C0 22 0 R /C1 22 0 R/N 1.0>>
- 13 0 obj <</FunctionType 2 /Domain [0 1] /C0 23 0 R /C1 23 0 R/N 1.0>>
- 14 0 obj <</FunctionType 2 /Domain [0 1] /C0 24 0 R /C1 24 0 R/N 1.0>>
-
- 21 0 obj [1 0 0 0]
- 22 0 obj [4 1 0 0]
- 23 0 obj [0 4 1 0]
- 24 0 obj [0 0 4 1]

Image manipulation via Matrices

- Affine Transformations:
  - Translate: [1 0 0 1 tx ty]
  - Scale: [sx 0 0 sy 0 0]
  - Rotate: [cos q sin q -sin q cos q 0 0]
  - Mirror
  - Skew: [1 tan a tan b 1 0 0]

PDF Functions with affine transformation

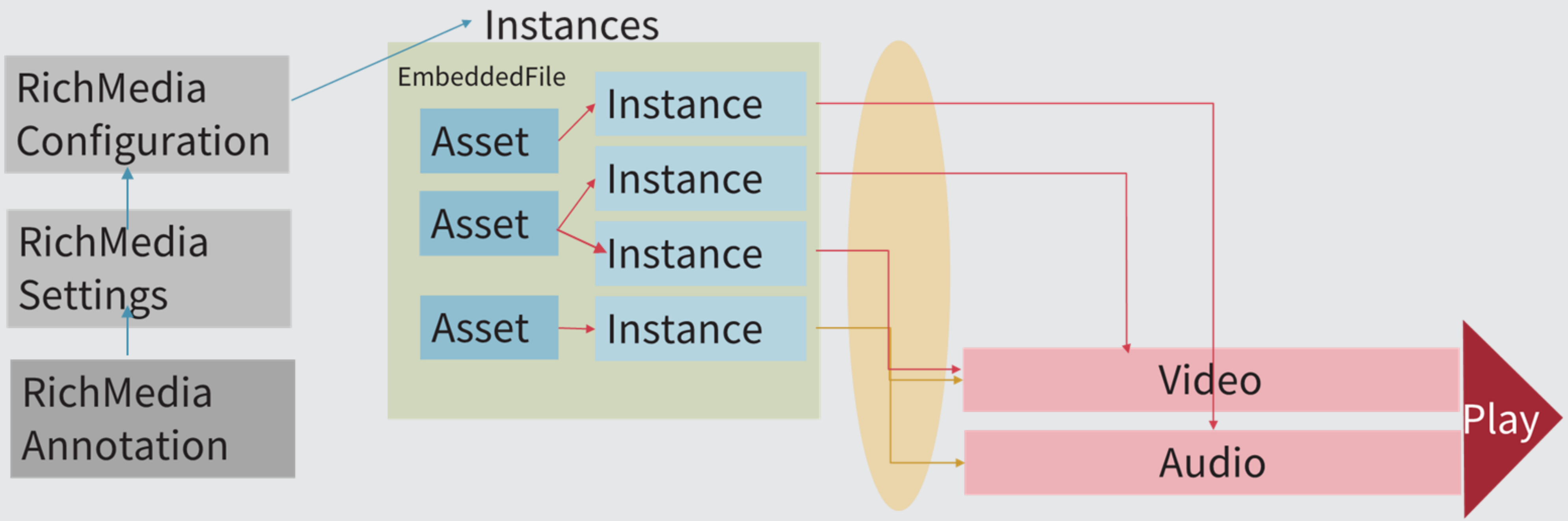
- $[\ sx_1\ 0\ 0\ sy_1\ tx_1\ ty_1] \rightarrow [sx_2\ 0\ 0\ sy_2\ tx_2\ ty_2]$

Non-destructive A/V editing

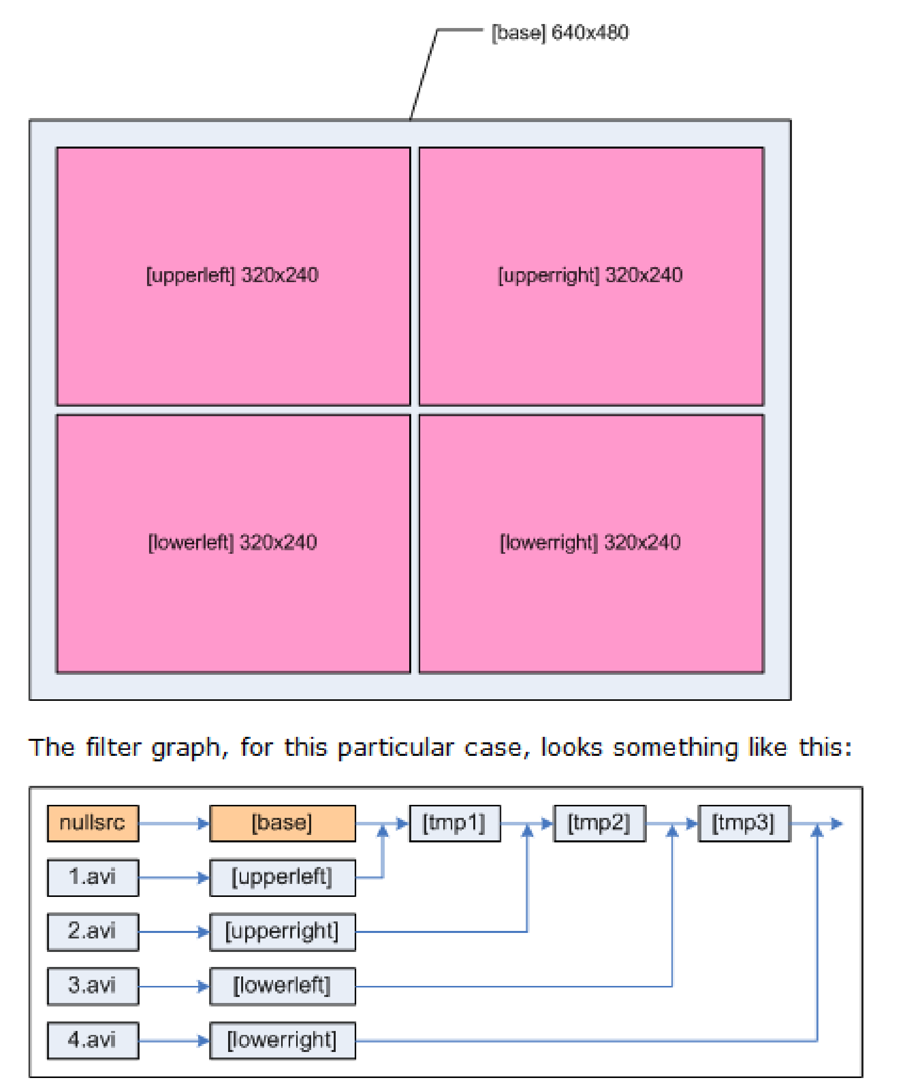
- Authoring controls that capture parameters that can be reasonably serialized into a PDF document
- Parameters that can be deserialized from the PDF into a control structure that allows a viewer application to efficiently put together the video frame/Audio sequence for playback.
- The deserialized parameters for playback are not necessarily the A/V editing/authoring data structures.

Connection to RichMedia

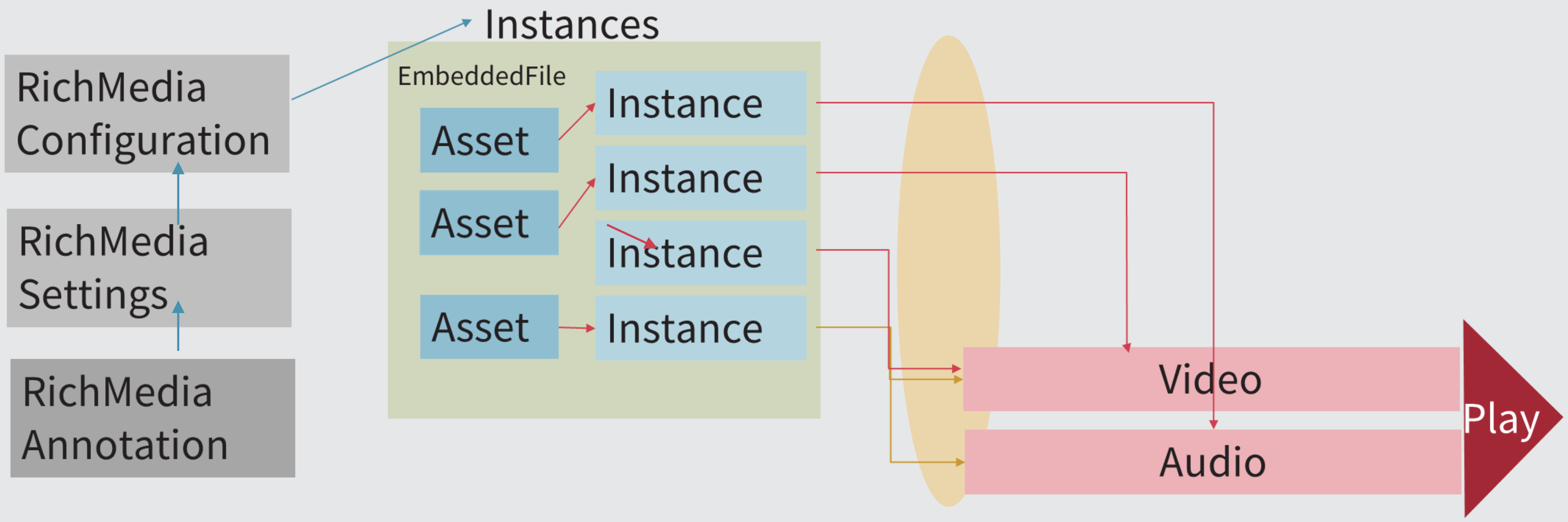
- RichMediaConfiguration (section 13.7.2.3.3: Table 342)
- RichMediaInstance (Section 13.7.2.3.4 Table 343)



Implementation considerations



The filter graph, for this particular case, looks something like this:



Instances

RichMedia Configuration

RichMedia Settings

RichMedia Annotation

EmbeddedFile

Asset

Asset

Asset

Instance

Instance

Instance

Instance

Video

Audio

Play

Take-Aways.

- The case for supporting video in PDFs is: Context, archival, and unlocking non-destructive edits to videos.
- For archival support, need to support at least 1 standardized format fully. Configurable without scripting.
- You can capture/enable a lot of non-destructive A/V editing with a fairly minimal set of time-based stitching and interpolating functions, combined with a slightly richer set of rendition operations.
- PDF 2.0 RichMedia can be extended to make this happen.
- If you’re interested in this, please join the RichMedia TWG

And now for something different…

working together!

PDF association

The RichMedia Doom challenge

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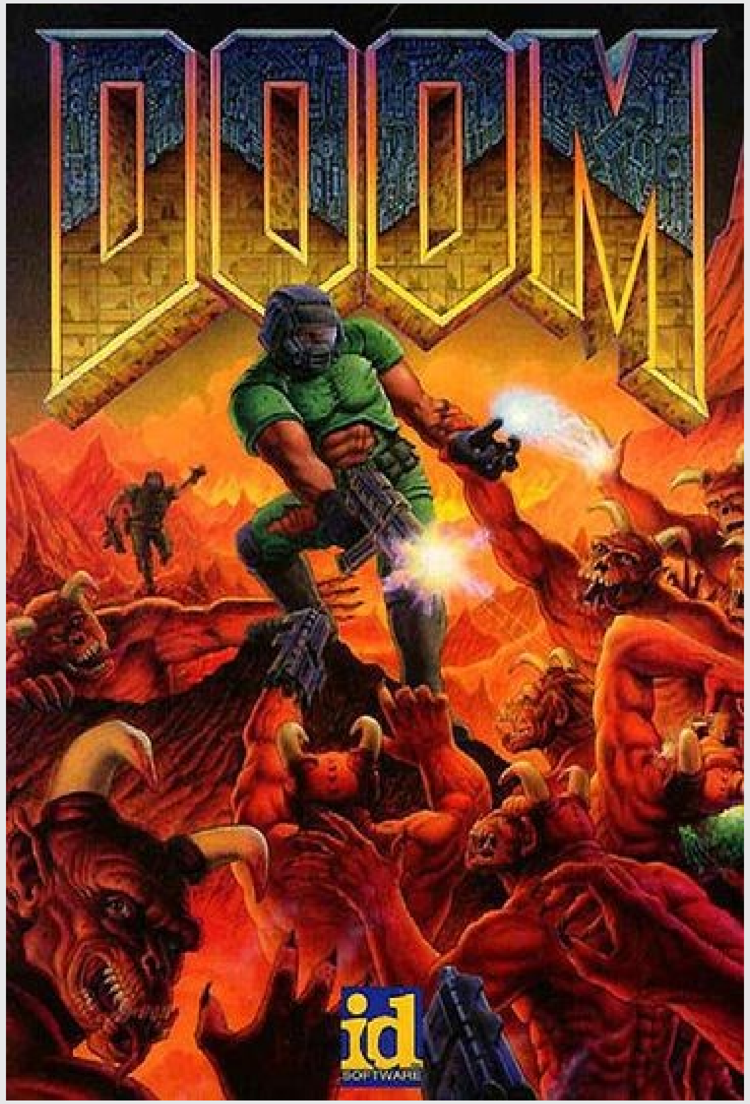

http://github.int13h.com/webgldoom/
https://github.com/HeavyIndustries/webgldoom

Thank You!

- To Make this Happen, Please Join the RichMedia TWG!