OpenTimelineIO

FMX 2018

http://opentimeline.io

PIXAR

SOFTWARE R&D

- Overview
- Status Update
- Use Case
- Roadmap
- Discussion

Overview

OTIO Overview

- Open Source API and interchange format for editorial timeline information.

OTIO Overview

- Tracks, Clip order, timing, references to media
- Markers, Transitions
- Metadata!
- Eventually: Timing Effects

OTIO Overview

- References to media, *not* actual media

OTIO Overview

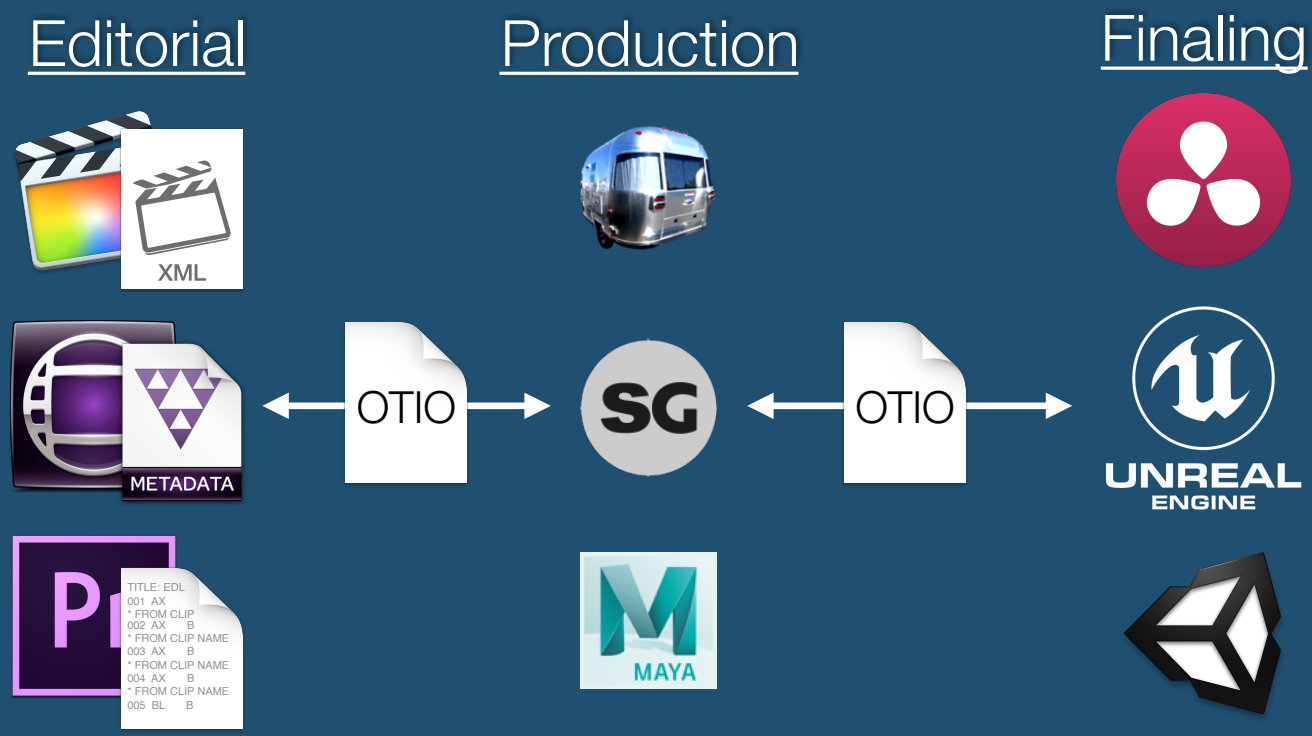
- “Has this shot changed duration since yesterday”
- “How many extra frames of this shot are used in the crossfade”
- “What shots precede and follow this shot”

Another Format?

Simple — "Just Right" — Complex

EDL — OTIO — AAF

Goal: Flexible Pipeline



OTIO Overview

- Features:
  - JSON File Format
  - Python API
    - Editorial Math library (“opentime”)
    - File Conversion Adapter Plugins
    - Media Linker Plugins

OpenTime

- RationalTime + TimeRange
- Conversion
- Math

```
t = otio.opentime.RationalTime(10, 24)
t2 = otio.opentime.RationalTime(20, 48)
t = t.rescaled_to(t2)

timecode = "00:06:56:17"
t = otio.opentime.from_timecode(timecode, 24)

t1 = otio.opentime.RationalTime(15.2)
t2 = otio.opentime.RationalTime(15.6)
self.assertTrue(t1 < t2)
self.assertTrue(t1 <= t2)
self.assertFalse(t1 > t2)
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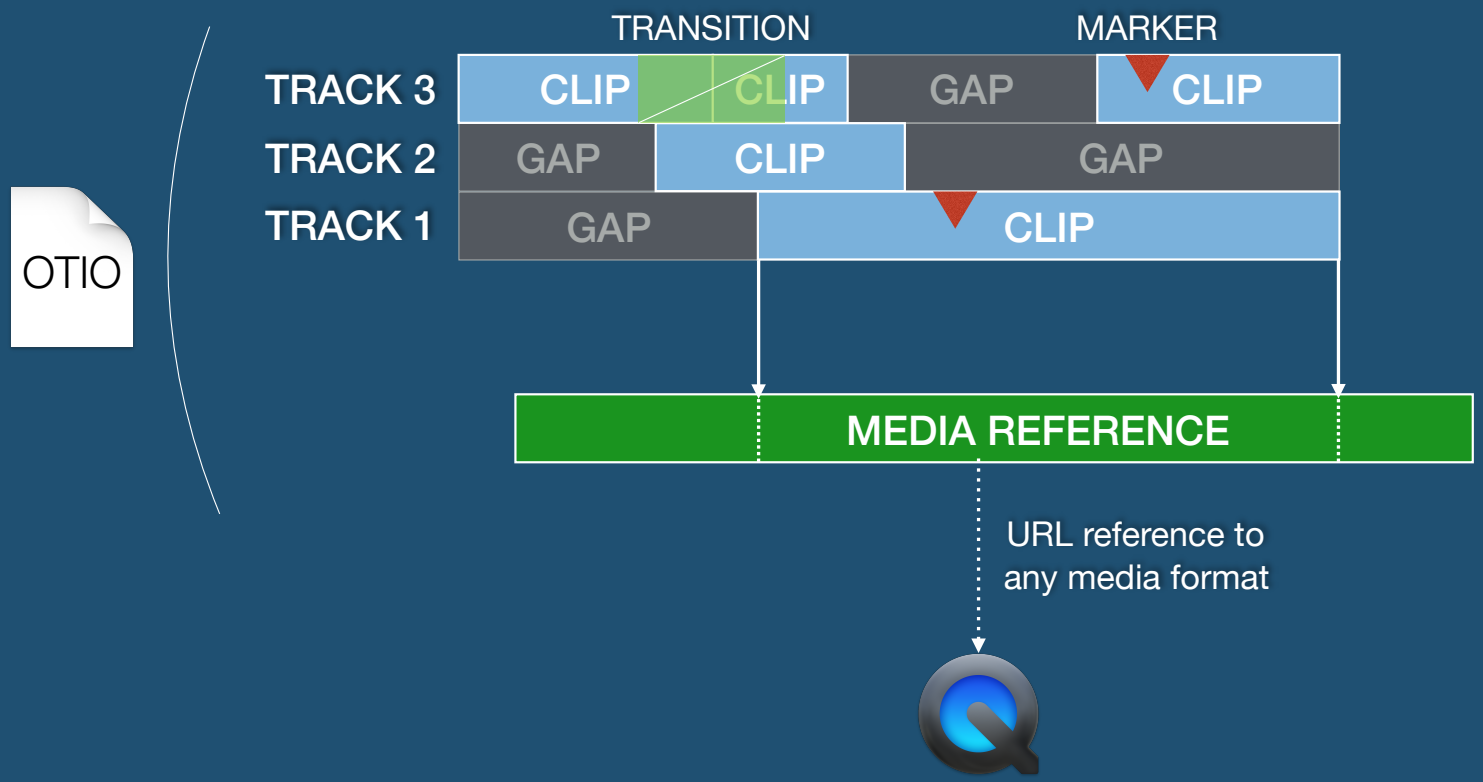
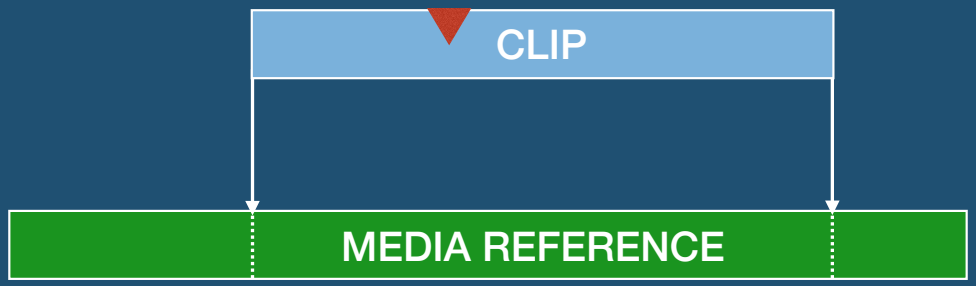


Media Reference

MEDIA REFERENCE

Media Reference



OTIO
File Format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"OTIO_SCHEMA": "Timeline.1",
"metadata": {},
"name": "Coco_Beginning.Exported.01",
"tracks": {
    "OTIO_SCHEMA": "Stack.1",
    "children": [
        {
            "OTIO_SCHEMA": "Track.1",
            "children": [
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                    "effects": [],
                    "markers": [],
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                    "metadata": {
                        "AAF": {
                            "ClassName": "MasterMob",
                            "CreationTime": "2012-05-01 00:10:54.00",
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                            "MobID": "urn:smpte:umid:060a2b34.01010101.01010f00.13000000.060e2b34.7f7f2a80.4f9f2a0e.7600f787",
                            "Name": "acad_head_leader_239 (REN1)",
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Python API Example

```python
import opentimelineio as otio

def main():
    args = parse_args()

    timeline = otio.adapters.read_from_file(args.input)
    count = _conform_timeline(timeline, args.folder)
    otio.adapters.write_to_file(timeline, args.output)

def _conform_timeline(timeline, folder):
    """ Look for replacement media for each clip in the given timeline.
    The clips are relinked in place if media with a matching name is found.
    """

    for clip in timeline.each_clip():
        # look for a media file that matches the clip's name
        new_path = _find_matching_media(clip.name, folder)

        # if no media is found, keep going
        if not new_path:
            continue

        # if we found one, then relink to the new path
        clip.media_reference = otio.schema.ExternalReference(
            target_url="file://" + new_path,
            available_range=None    # we don't know the available range
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def main():
    args = parse_args()

    timeline = otio.adapters.read_from_file(args.input)
    count = _conform_timeline(timeline, args.folder)
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def _conform_timeline(timeline, folder):
    """ Look for replacement media for each clip in the given timeline.
    The clips are relinked in place if media with a matching name is found.
    """

    for clip in timeline.each_clip():
        # look for a media file that matches the clip's name
        new_path = _find_matching_media(clip.name, folder)

        # if no media is found, keep going
        if not new_path:
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        # if we found one, then relink to the new path
        clip.media_reference = otio.schema.ExternalReference(
            target_url="file://" + new_path,
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```

Adapter Plugins

- Adapters
  - Read and/or Write formats
  - 4 functions
  - Associate w/ file suffixes

OTIO Adapters

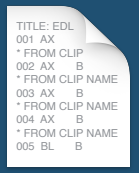
Core

Contrib

OTIO Adapters

Core

OpenTimelineIO



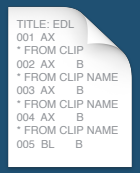
EDL

FCP7 XML
(Premiere)

OTIO Adapters

Contrib

AAF



ALE

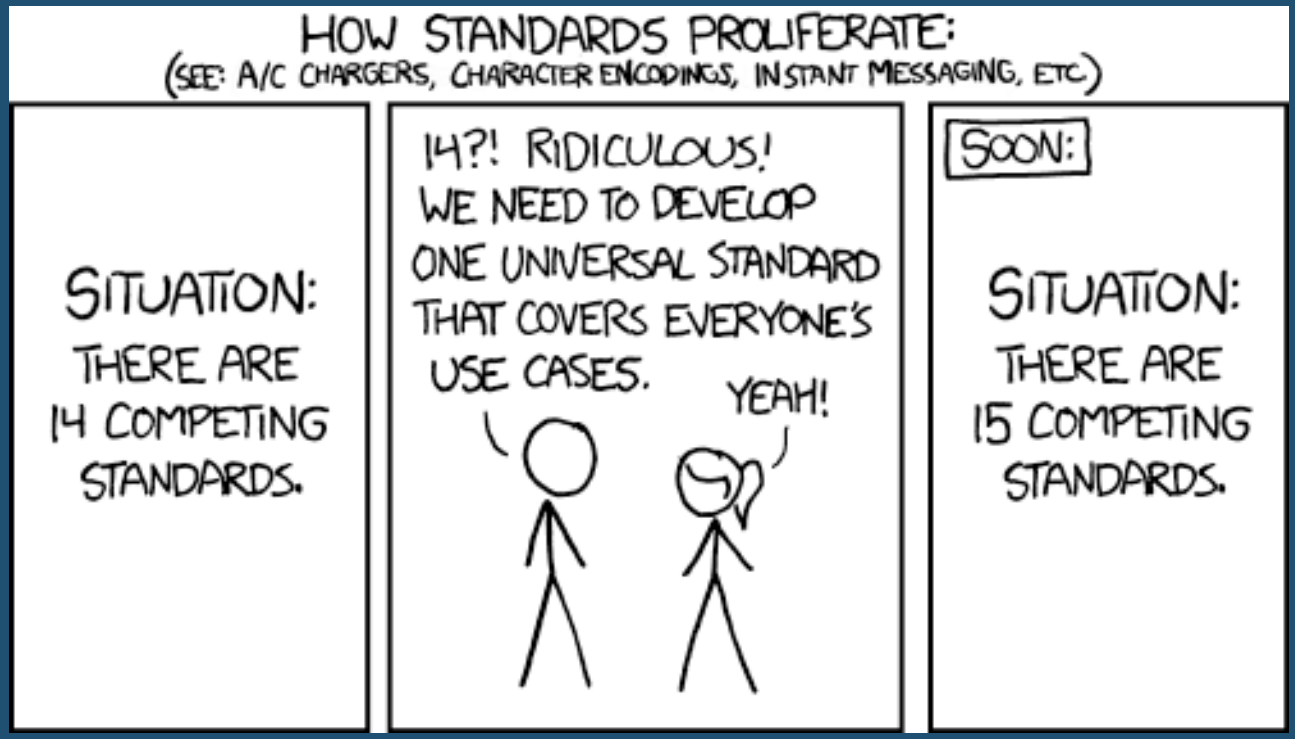
RV Session

FFmpeg Burnins

Maya Sequencer

HLS playlist

OTIO Adapters



source: https://xkcd.com/927/

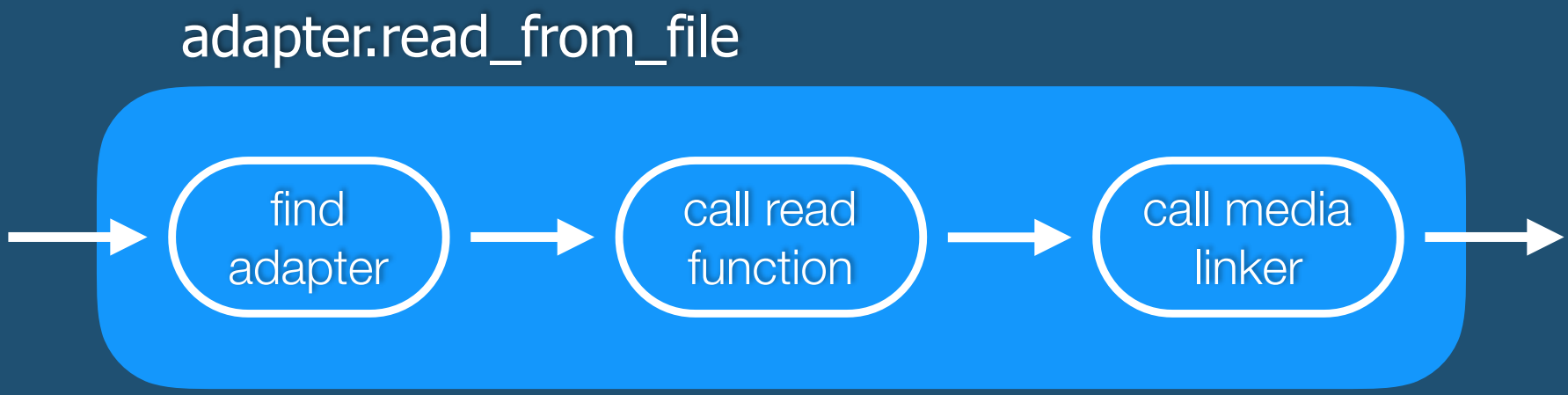
Adapter Plugins

- Adapters
  - Read and/or Write formats
  - 4 functions
  - Associate w/ file suffixes

Media Linker Plugins

- Adapter may not have enough information to link to media
- Logic to link to actual media on disk is usually proprietary
  - EDL Comments?
  - Production database lookup based on metadata?

Media Linker Plugins



Media Linker Plugins

- Adapter creates ‘missing references’
- calls $OTIO_DEFAULT_MEDIA_LINKER before returning resulting object

```
{
    "OTIO_SCHEMA": "Clip.1",
    "effects": [],
    "markers": [],
    "media_reference": {
        "OTIO_SCHEMA": "MissingReference.1"
        "available_range": null,
        "metadata": {},
        "name": null
    },
    "metadata": {
        "pixar": {
            "globaltake": "1",
            "prod": "PXR",
            "shot": "PXR_HeadLeader_AllRatios",
            "unit": "studio"
        }
    },
    "source_range": {
        "OTIO_SCHEMA": "TimeRange.1",
        "duration": {
            "OTIO_SCHEMA": "RationalTime.1"
            "rate": 24,
            "value": 640
        },
        "start_time": {
            "OTIO_SCHEMA": "RationalTime.1"
            "rate": 24,
            "value": 0
        }
    }
},
```

Media Linker Plugins

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```
{
    "OTIO_SCHEMA": "Clip.1",
    "effects": [],
    "markers": [],
    "media_reference": {
        "OTIO_SCHEMA": "MissingReference.1"
        "available_range": null,
        "metadata": {},
        "name": null
    },
    "metadata": {
        "pixar": {
            "globaltake": "1",
            "prod": "PXR",
            "shot": "PXR_HeadLeader_AllRatios",
            "unit": "studio"
        }
    },
    "source_range": {
        "OTIO_SCHEMA": "TimeRange.1",
        "duration": {
            "OTIO_SCHEMA": "RationalTime.1"
            "rate": 24,
            "value": 640
        },
        "start_time": {
            "OTIO_SCHEMA": "RationalTime.1"
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            "value": 0
        }
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    "markers": [],
    "media_reference": {
        "OTIO_SCHEMA": "MissingReference.1"
        "available_range": null,
        "metadata": {},
        "name": null
    },
    "metadata": {
        "pixar": {
            "globaltake": "1",
            "prod": "PXR",
            "shot": "PXR_HeadLeader_AllRatios"
            "unit": "studio"
        }
    },
    "source_range": {
        "OTIO_SCHEMA": "TimeRange.1",
        "duration": {
            "OTIO_SCHEMA": "RationalTime.1"
            "rate": 24,
            "value": 640
        },
        "start_time": {
            "OTIO_SCHEMA": "RationalTime.1"
            "rate": 24,
            "value": 0
        }
    }
},
```


Media Linker Example

```
"metadata": {
    "pixar": {
        "globaltake": "1",
        "prod": "PXR",
        "shot": "PXR_HeadLeader_AllRatios",
        "unit": "studio"
    }
},
```

```
"media_reference": {
    "OTIO_SCHEMA": "ExternalReference.1",
    "available_range": null,
    "metadata": {},
    "name": null,
    "target_url": "/shows/studio/diskfarm/T
},
```

Media Linker Example

```
1 def link_media_reference(in_clip, media_linker_argument_map):
```

Media Linker Plugins

- Media Linkers
  - Optional
  - Run after the adapter has read the file
  - Alter the media references

Python API

- JSON Backed File Format
- Python API
  - Opentime Library
  - Adapter Plugins
  - Media Linker Plugins

Status Update

OTIO Status Update

- Since 2016
  - Contributions from 10 different groups
  - 8 releases
- Used in production
  - Pixar, Marvel Studios, ILM, PIX System, and a few more

OTIO Status Update

- “Open Beta”

OTIO Status Update

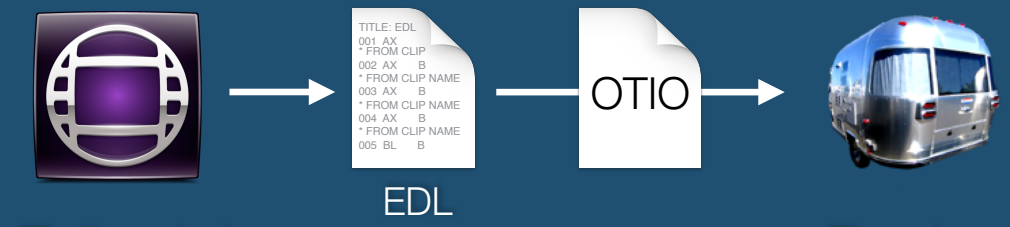
- Public Beta 0.7.1
  - https://github.com/PixarAnimationStudios/OpenTimelineIO
  - http://opentimeline.io
  - pip install OpenTimelineIO

License

- Pixar Open Source License
  - Modified Apache 2.0 License
  - Same as OpenSubdiv & USD
- Need a Contributor License Agreement (CLA) to contribute code


PIXAR
ANIMATION STUDIOS

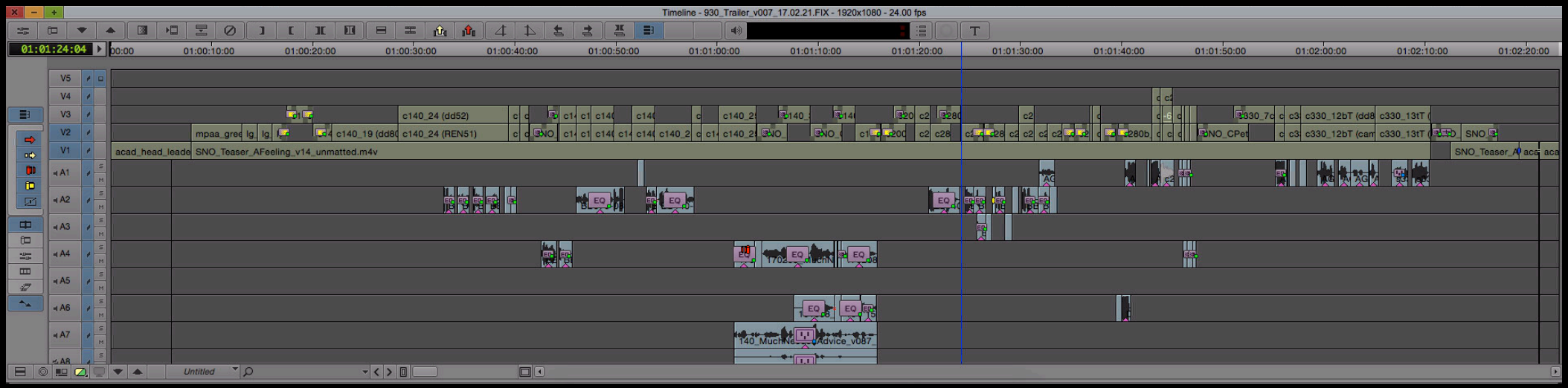
OTIO Use Case: Pixar Coco (2017)

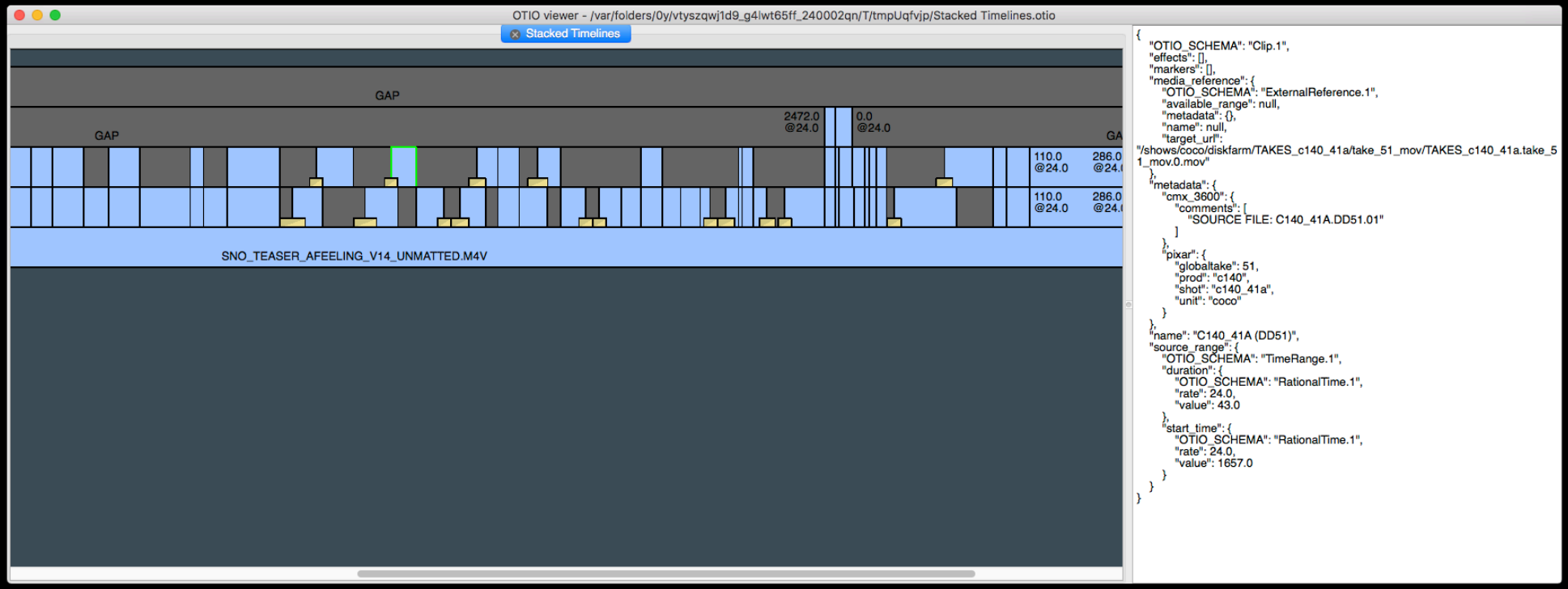


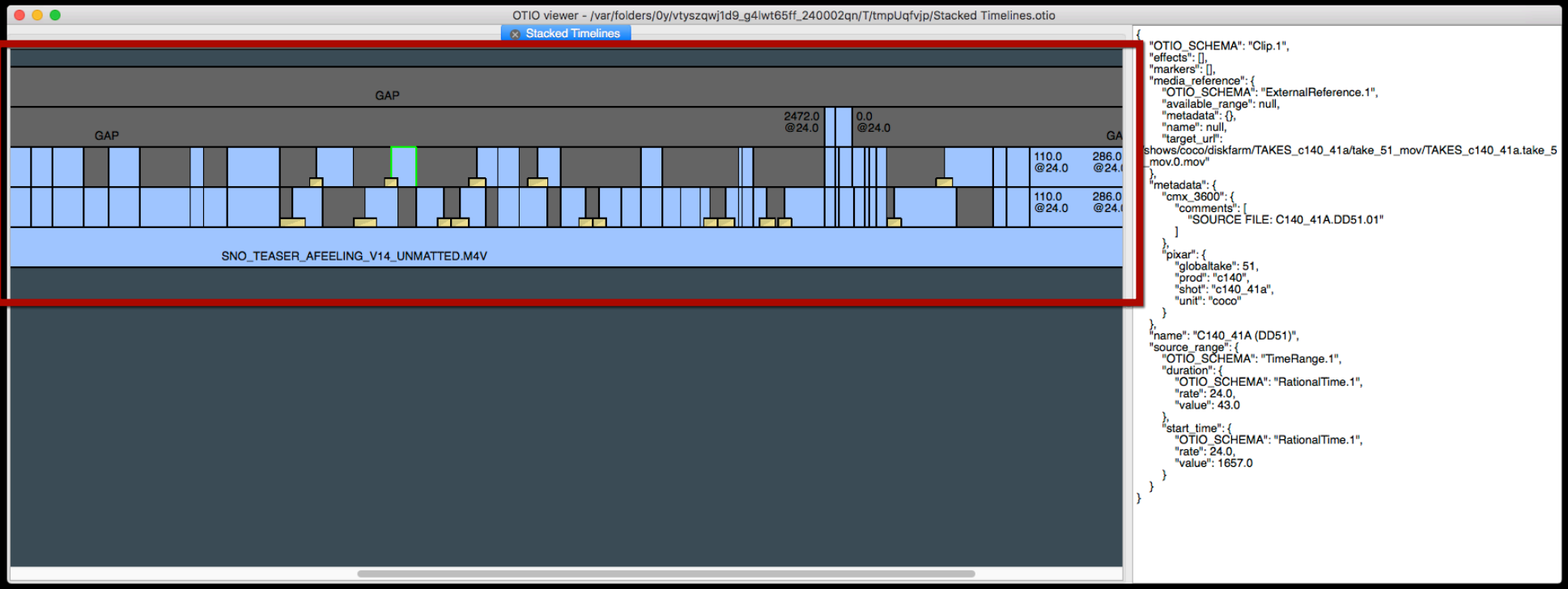
OTIO Use Case: Pixar Coco (2017)

- Avid EDL to RV
- Relink media to latest renders
- Transitions


Disney · PIXAR
COCO


Timeline - 930_Trailer_v007_17.02.21.FIX - 1920x1080 - 24.00 fps
01:01:24:04
V5
V4
V3
V2
V1
A1
A2
A3
A4
A5
A6
A7
A8
c140_24 (dd52)
mpaa_gree
c140_19 (dd80
c140_24 (REN51)
acad_head_leade
SNO_Teaser_AFeeling_v14_unmatted.m4v
SNO_CPet
c330_12bT (dd8
c330_13tT (
SNO_Teaser_A
EQ
Untitled


OTIO viewer - /var/folders/0y/vtyszqwj1d9_g4lwt65ff_240002qn/T/tmpUqfvjp/Stacked Timelines.otio
Stacked Timelines
GAP
GAP
2472.0
@24.0
0.0
@24.0
110.0
@24.0
110.0
@24.0
SNO_TEASER_AFEELING_V14_UNMATTED.M4V
{
"OTIO_SCHEMA": "Clip.1",
"effects": [],
"markers": [],
"media_reference": {
"OTIO_SCHEMA": "ExternalReference.1",
"available_range": null,
"metadata": {},
"name": null,
"target_url":
"/shows/coco/diskfarm/TAKES_c140_41a/take_51_mov/TAKES_c140_41a.take_51_mov.0.mov"
},
"metadata": {
"cmx_3600": {
"comments": [
"SOURCE FILE: C140_41A.DD51.01"
]
},
"pixar": {
"globaltake": 51,
"prod": "c140",
"shot": "c140_41a",
"unit": "coco"
}
},
"name": "C140_41A (DD51)",
"source_range": {
"OTIO_SCHEMA": "TimeRange.1",
"duration": {
"OTIO_SCHEMA": "RationalTime.1",
"rate": 24.0,
"value": 43.0
},
"start_time": {
"OTIO_SCHEMA": "RationalTime.1",
"rate": 24.0,
"value": 1657.0
}
}
}


OTIO viewer - /var/folders/0y/vtyszqwj1d9_g4lwt65ff_240002qn/T/tmpUqfvjp/Stacked Timelines.otio
Stacked Timelines
GAP
GAP
2472.0
@24.0
0.0
@24.0
110.0
@24.0
110.0
@24.0
SNO_TEASER_AFEELING_V14_UNMATTED.M4V
{
"OTIO_SCHEMA": "Clip.1",
"effects": [],
"markers": [],
"media_reference": {
"OTIO_SCHEMA": "ExternalReference.1",
"available_range": null,
"metadata": {},
"name": null,
"target_url":
shows/coco/diskfarm/TAKES_c140_41a/take_51_mov/TAKES_c140_41a.take_5
_mov.0.mov"
},
"metadata": {
"cmx_3600": {
"comments": [
"SOURCE FILE: C140_41A.DD51.01"
]
},
"pixar": {
"globaltake": 51,
"prod": "c140",
"shot": "c140_41a",
"unit": "coco"
}
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"name": "C140_41A (DD51)",
"source_range": {
"OTIO_SCHEMA": "TimeRange.1",
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"OTIO_SCHEMA": "RationalTime.1",
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}
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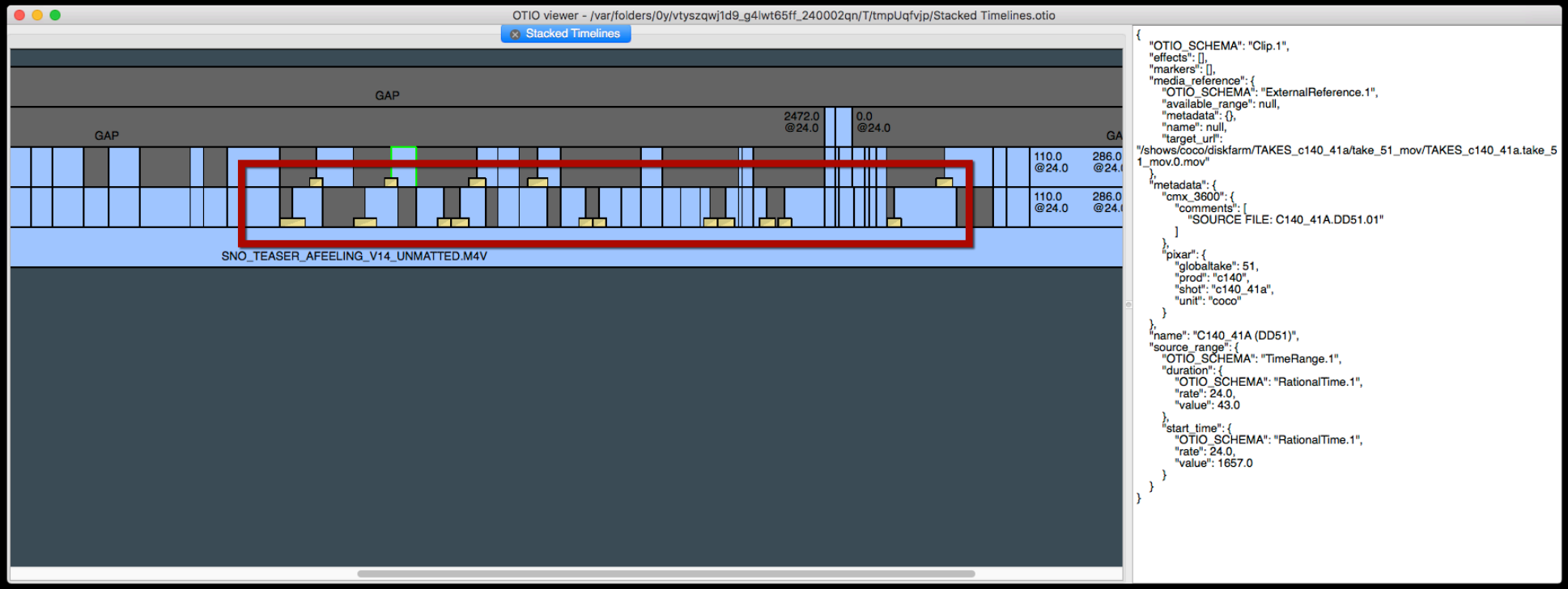
OTIO viewer - /var/folders/0y/vtyszqwj1d9_g4lwt65ff_240002qn/T/tmpUqfvjp/Stacked Timelines.otio
Stacked Timelines
GAP
GAP
2472.0
@24.0
0.0
@24.0
110.0
@24.0
286.0
110.0
@24.0
286.0
SNO_TEASER_AFEELING_V14_UNMATTED.M4V
{
"OTIO_SCHEMA": "Clip.1",
"effects": [],
"markers": [],
"media_reference": {
"OTIO_SCHEMA": "ExternalReference.1",
"available_range": null,
"metadata": {},
"name": null,
"target_url":
"/shows/coco/diskfarm/TAKES_c140_41a/take_51_mov/TAKES_c140_41a.take_51_mov.0.mov"
},
"metadata": {
"cmx_3600": {
"comments": [
"SOURCE FILE: C140_41A.DD51.01"
]
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"pixar": {
"globaltake": 51,
"prod": "c140",
"shot": "c140_41a",
"unit": "coco"
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"source_range": {
"OTIO_SCHEMA": "TimeRange.1",
"duration": {
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"rate": 24.0,
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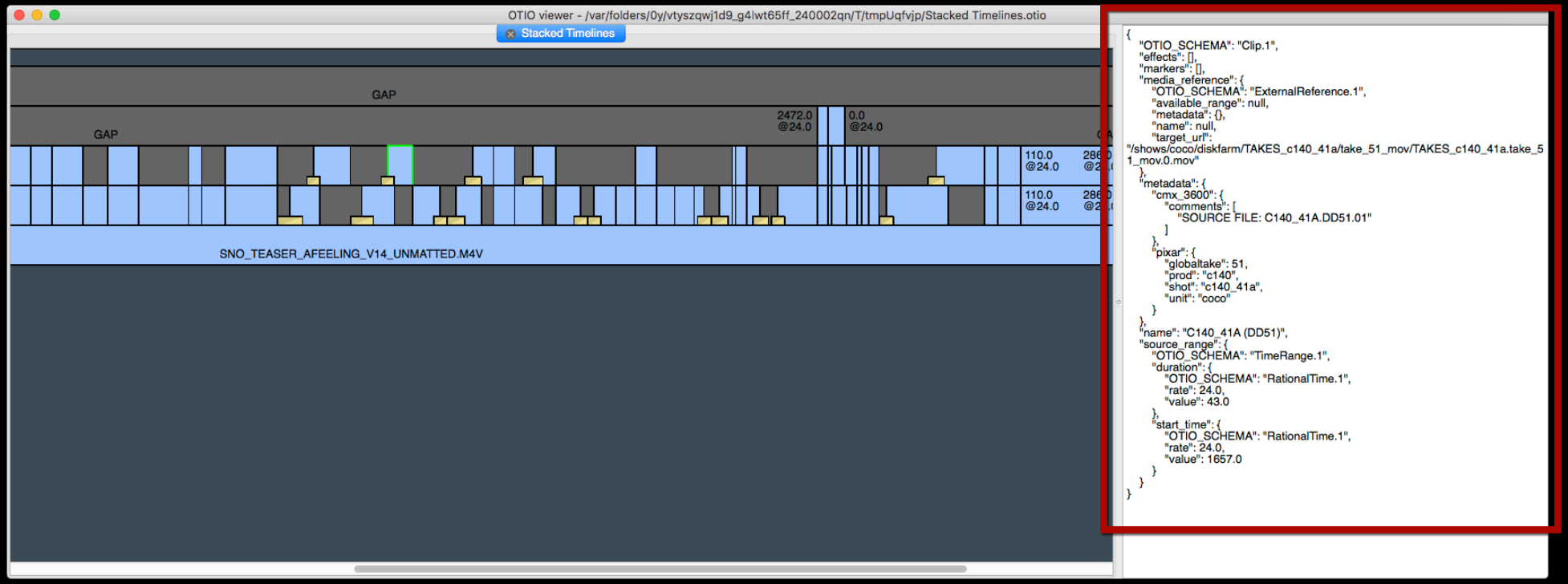
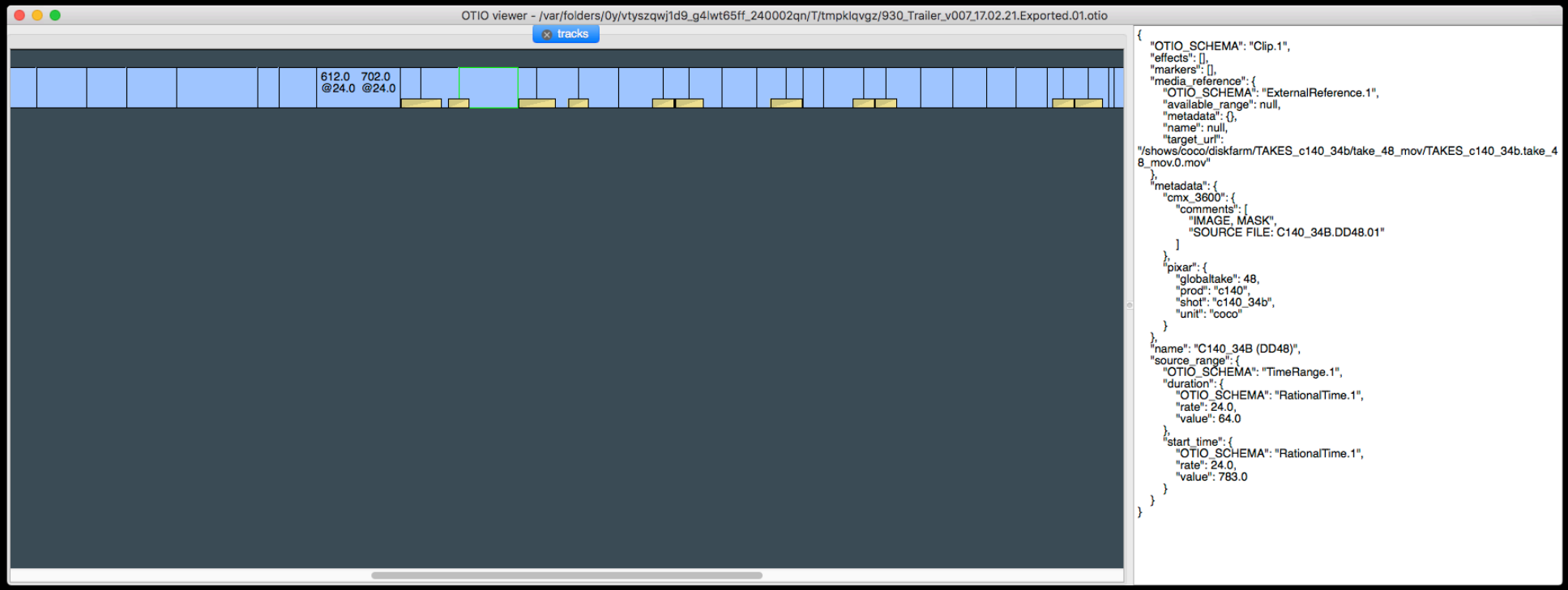

OTIO viewer - /var/folders/0y/vtyszqwj1d9_g4lwt65ff_240002qn/T/tmpUqfvjp/Stacked Timelines.otio
Stacked Timelines
GAP
GAP
2472.0
@24.0
0.0
@24.0
110.0
@24.0
110.0
@24.0
SNO_TEASER_AFEELING_V14_UNMATTED.M4V
{
"OTIO_SCHEMA": "Clip.1",
"effects": [],
"markers": [],
"media_reference": {
"OTIO_SCHEMA": "ExternalReference.1",
"available_range": null,
"metadata": {},
"name": null,
"target_url":
"/shows/coco/diskfarm/TAKES_c140_41a/take_51_mov/TAKES_c140_41a.take_51_mov.0.mov"
},
"metadata": {
"cmx_3600": {
"comments": [
"SOURCE FILE: C140_41A.DD51.01"
]
},
"pixar": {
"globaltake": 51,
"prod": "c140",
"shot": "c140_41a",
"unit": "coco"
}
},
"name": "C140_41A (DD51)",
"source_range": {
"OTIO_SCHEMA": "TimeRange.1",
"duration": {
"OTIO_SCHEMA": "RationalTime.1",
"rate": 24.0,
"value": 43.0
},
"start_time": {
"OTIO_SCHEMA": "RationalTime.1",
"rate": 24.0,
"value": 1657.0
}
}
}


OTIO viewer - /var/folders/0y/vtyszqwj1d9_g4lwt65ff_240002qn/T/tmpklqvgz/930_Trailer_v007_17.02.21.Exported.01.otio
tracks
612.0 @24.0
702.0 @24.0
{
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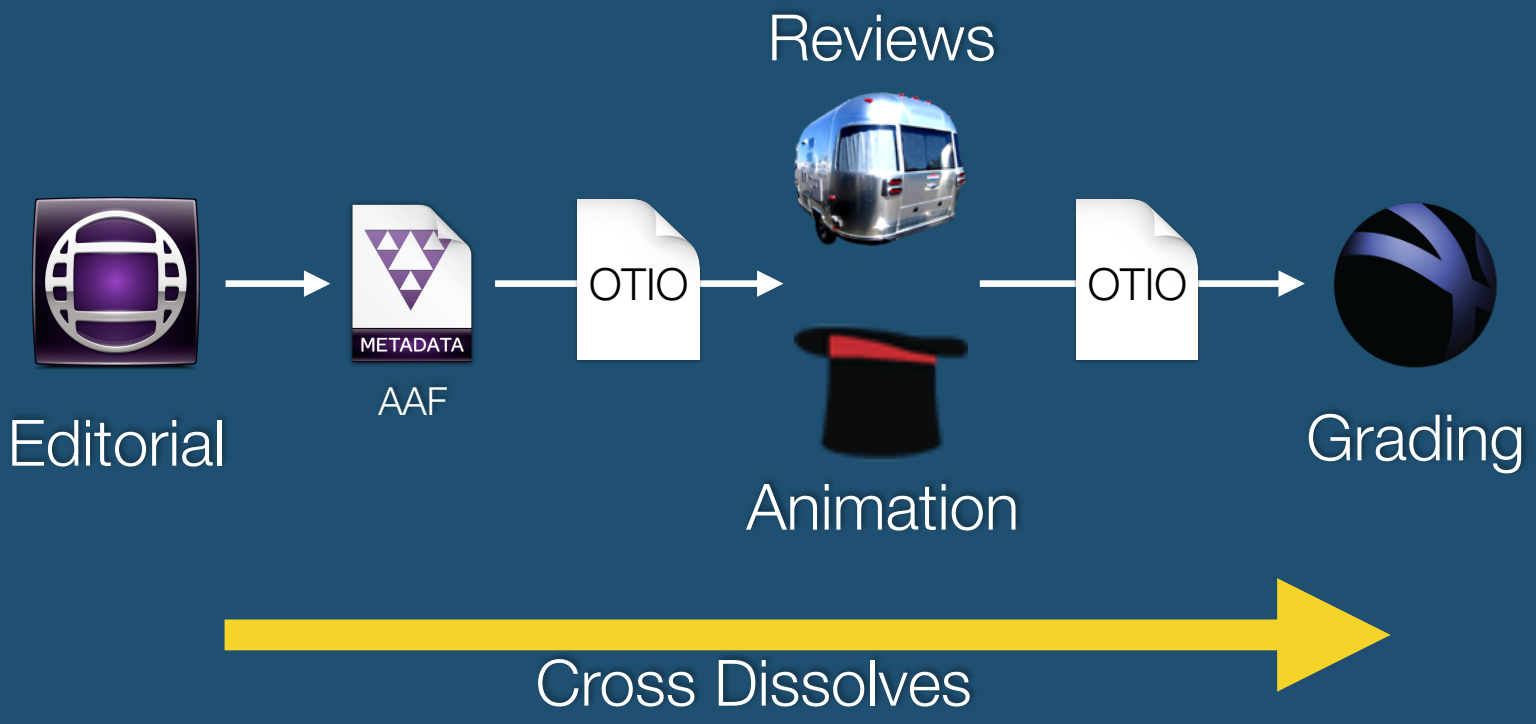
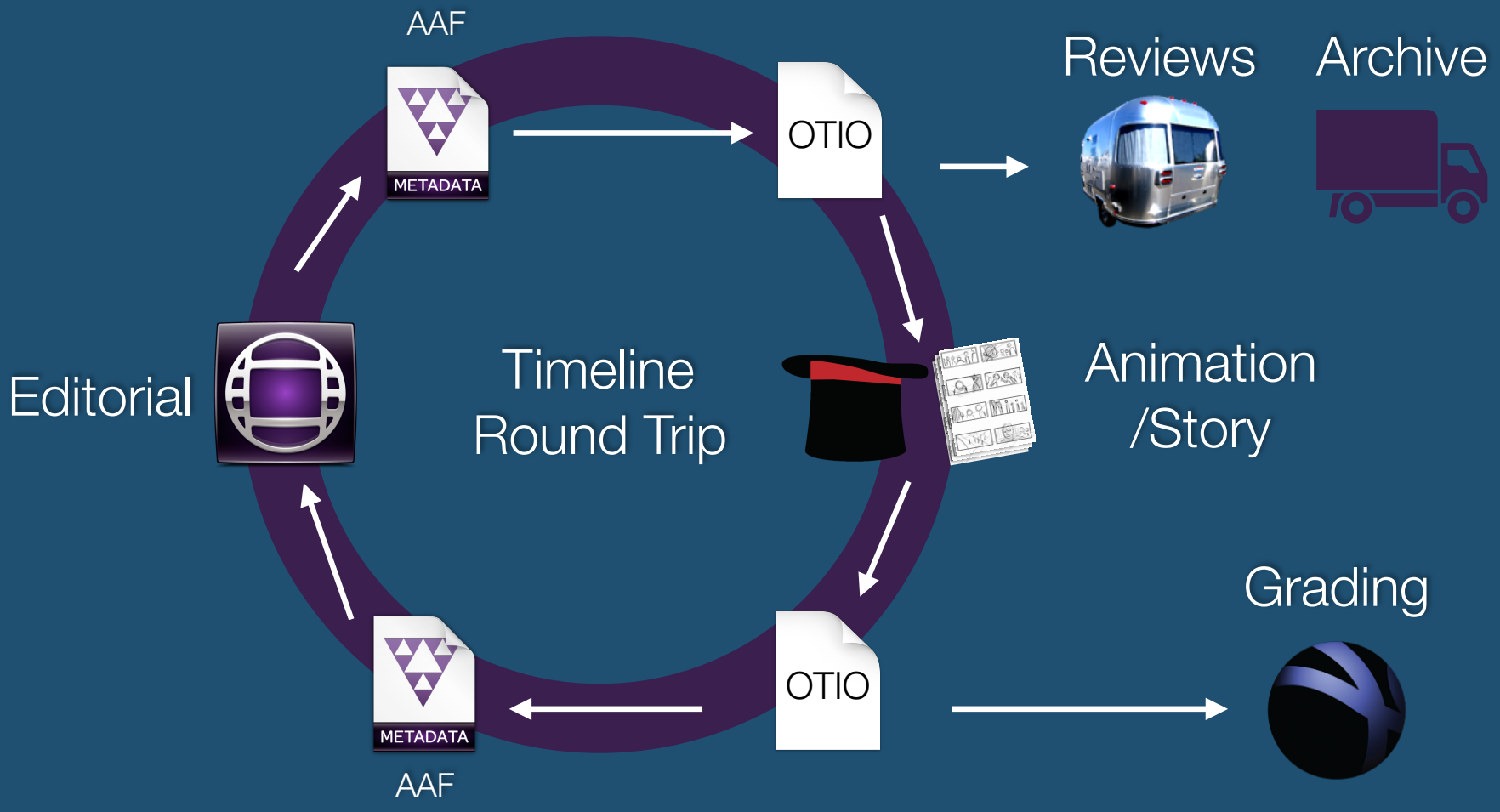
"effects": [],
"markers": [],
"media_reference": {
"OTIO_SCHEMA": "ExternalReference.1",
"available_range": null,
"metadata": {},
"name": null,
"target_url":
"/shows/coco/diskfarm/TAKES_c140_34b/take_48_mov/TAKES_c140_34b.take_48_mov.0.mov"
},
"metadata": {
"cmx_3600": {
"comments": [
"IMAGE, MASK",
"SOURCE FILE: C140_34B.DD48.01"
]
},
"pixar": {
"globaltake": 48,
"prod": "c140",
"shot": "c140_34b",
"unit": "coco"
}
},
"name": "C140_34B (DD48)",
"source_range": {
"OTIO_SCHEMA": "TimeRange.1",
"duration": {
"OTIO_SCHEMA": "RationalTime.1",
"rate": 24.0,
"value": 64.0
},
"start_time": {
"OTIO_SCHEMA": "RationalTime.1",
"rate": 24.0,
"value": 783.0
}
}
}


TAKES_c140_26b.take_53_fullmov.0.mov -- Frame 54
Name
TAKES_acad_tailpop_239.take_2.* (2) (1)
SEQUENCES
V
Default Sequence
STACKS
tracks
Default Stack
Inputs
Edit
TAKES_acad_head_leader_239.take_1.*
blank,start=86400.0,end=86447.0,fps=24.0
TAKES_acad_head_leader_239.take_1.* (2)
blank,start=86449.0,end=86495.0,fps=24.0
TAKES_mpaa_green_preview_239.take_8_fullmov.0
TAKES_lg_black239.take_2_fullmov.0
TAKES_lg_disneysparkle_trailer239.take_3.*
TAKES_lg_pixarluxo_head239f.take_1_fullmov.0
TAKES_c140_17d.take_96_fullmov.0
C140_17D (DD96)
blank,start=86783.0,end=86783.0,fps=24.0
SNO_TEASER_AFEELING_V14_UNMATTED.M4V
TAKES_c140_18.take_64_fullmov.0 (2)
TAKES_c140_19.take_80_fullmov.0
TAKES_c140_24.take_52_fullmov.0
TAKES_c140_25d.take_66_fullmov.0
TAKES_c140_47b.take_43_fullmov.0
blank,start=87297.0,end=87297.0,fps=24.0
A - Z
Z - A
00:02:06
00:42:01 min
24.00 0.0 fps

OTIO Use Case: Pixar 2018



OTIO Use Case: Pixar 2019

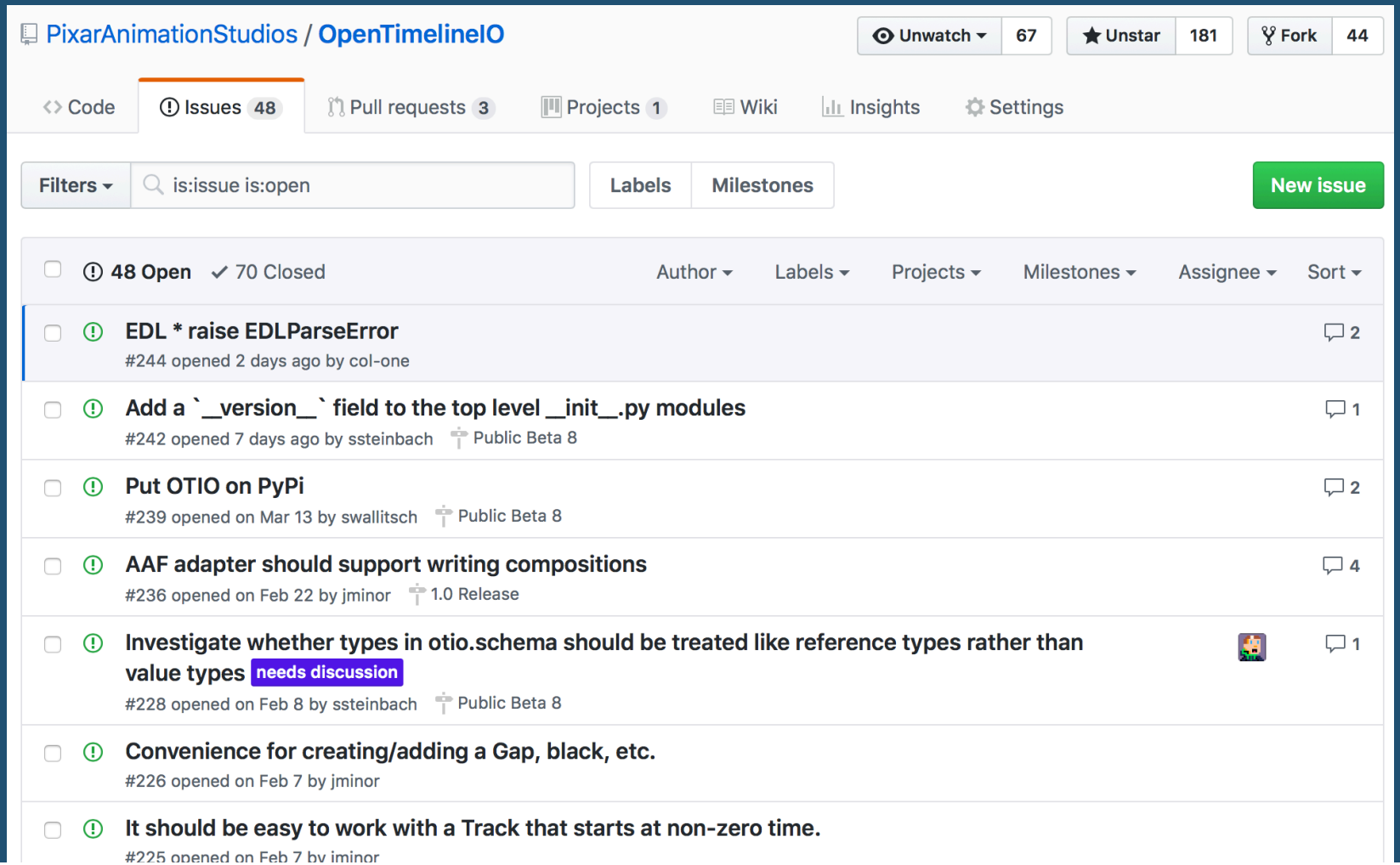


Roadmap

OTIO Roadmap

- Driven by studio use cases
- Community contributions

OTIO Roadmap



OTIO Roadmap

- Next Steps:
  - AAF Adapter
  - Speed Effects

OTIO Roadmap

- Longer Term:
  - AAF Creation
  - Subtitles, more effects, etc.
  - C++ API w/ Python Bindings
  - Native Integration w/ 3rd Party Apps (NLEs, Shotgun, etc.)

Contributions

OTIO Contributions

- Axis Animation: Premiere adapter
- Lucasfilm: ffmpeg burnin adapter
- PIX System: HLS Live Stream adapter

OTIO Call for Contributions

- Use cases written up on the wiki
- Sample EDLs, AAFs, XMLs, etc.
- Engagement on C++ API for native support in 3rd party tools
- Adapters for IMF/CPL, FCP X, etc.

Discussion

Follow up

- We’re eager to help you get started and/or hear your use cases.
- To schedule something, contact opentimelineio@pixar.com

Thank You

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