# ACES Meta-Framework

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This document provides some thoughts and ideas about the long-term future of the ACES project. It reflects the need for a framework for collaboration between different participants within a movie production, while still leaving room for customisation of and differentiation between various aspects of a movie production.

The ideas are not formulated in great detail but should provide grounds for discussion.

## Current Situation

Before we start with the actual proposal, I want to clarify some terminology:

### Terminology

#### Colour Management System (CMS)

> A colour management system is a production system that performs colour transformations on images based on rules.

- Truelight Colour Spaces
- OpenColorIO
- ColorSync
- Autodesk Colour Policy

With a colour management system the user does not need to select a **colour transformation** but *tags* the different *colour spaces* at different stages. The correct **colour transformation** will be chosen/constructed by the colour management system.
A colour management system can accommodate many **colour management workflows**.

#### Colour Management workflow (CMW)

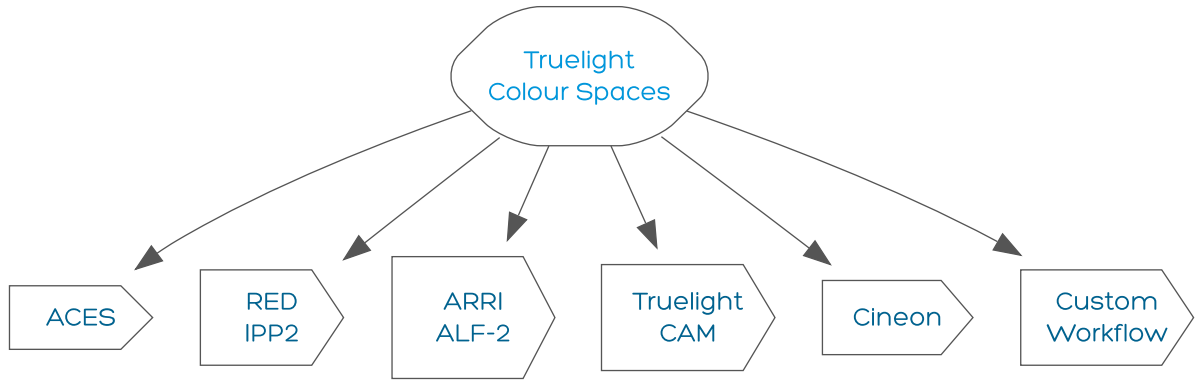
> A **colour management workflow** is one explicit way of applying specific **colour transformations** in a predefined order.

- ACES
- Truelight CAM
- ARRI ALF-2
- RED IPP2
- Cineon
- custom

To use a colour management workflow you need a colour management system, to ensure the correct *colour transformations* are applied in exact order.

This diagram shows the relationship between a single CMS and many CMWs.

> A colour management system brings a colour management workflow into an application



### ACES 1.0 might be too specific

We can see that the efforts of ACES 1.* led to one particular CMW that all CMS needed to support. With one specific CMW, it is clear that wide adoption in the industry is hard, if not even impossible - the ACES CMW design has needed to be general enough to deal with all input and output requirements.

There will always be one specific CMW which is better for the specific needs of a specific movie production. For example, a specific production can always produce a better particular *display rendering transform* for a given set of:

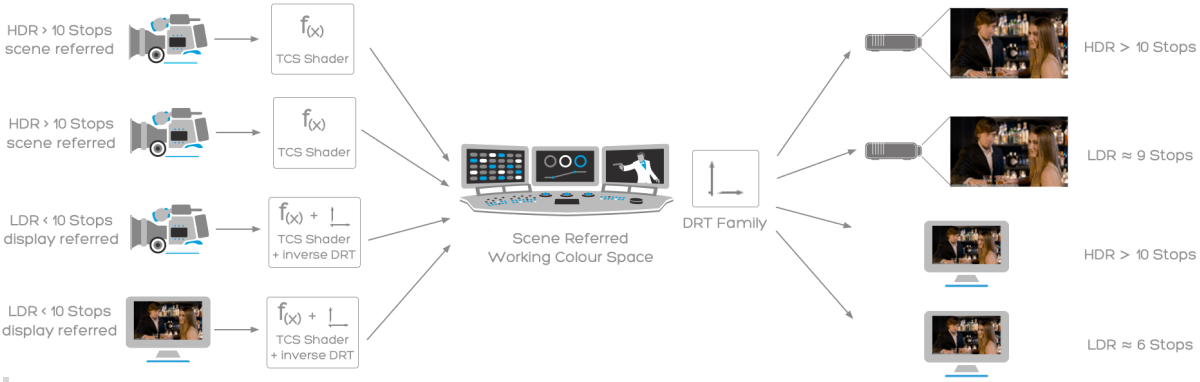
- scene (light and objects)
- observer (camera)
- VFX/grading preference
- output requirements

It is naive to believe that a single CMW will be the best choice for all movie productions. Also, individual stakeholders in the value creation chain earn their money by offering custom CMWs for specific movie productions.

But all modern CMWs have a similar approach or architecture:

- concept of scene- and display-referred image states
- a standard observer that all other colour spaces are defined to/from
- concept of a display rendering transform for a given set of viewing colour spaces that belong to the same viewing condition
- white point management
- output gamut mapping
- etc...

Here is FilmLight's generalised CMS to accommodate all modern CMWs:




> from scene to screen

We can see that the above diagram is an accurate description of all modern CMWs, including ACES.

## ACES Meta-Framework

Instead of working on a single CMW, the Academy could move the ACES project in the direction of a *Meta-CMS* or **Über-CMS**.

ACES could be used to specify, and in the long term archive, existing and future CMWs, and to help port specific CMWs to all existing CMS.

ACES could certify CMS and CMW by defining adapters to and from the ACES Meta-Framework.

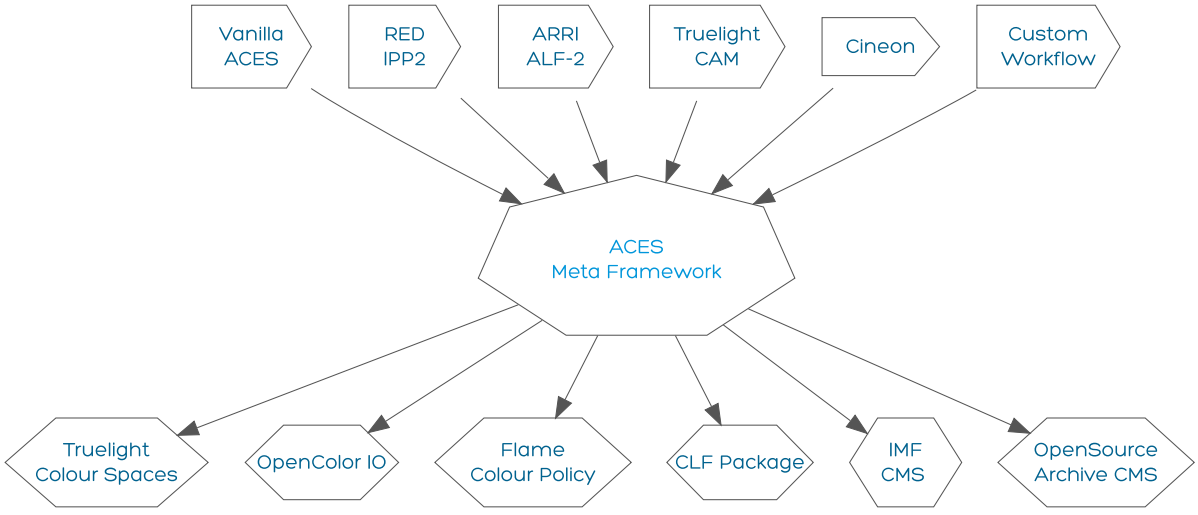
There could be specific requirements for a CMS to be ACES-compliant, for example:

- distinction of a scene- and display-referred image state
- concept of a reference colour space and observer
- archivable description of the reference colour space and observer
- archivable description of the working and archive colour space in the form of formulas and CLF
- concept of display rendering transforms
- archivable display rendering transforms via CLF
- concept of viewing conditions
- etc...

There could be certain requirements for a given CMW to be ACES-compliant, for example:

- minimum set of input colour spaces
- minimum set of display rendering transforms to specific viewing conditions
  (for example cinema-48, video-100, video-1000)
- set of CLFs from all input colour spaces (used in a production) to connection colour spaces
- set of CLFs from the connection colour space to all output colour spaces

There should be a programmatic way of porting an ACES-certified CMW into all ACES-certified CMS.




This would allow stakeholders both in the development of CMW (typically post-production companies) and development of CMS (image processing software) to freely innovate and iterate - while being compatible with the ACES Meta-Framework. It would allow movie archives to be references towards an open standard.

Let's use an analogy for this proposal:

> Once the Academy defined the 35mm meta-framework that could carry different film emulsion products in cameras, film labs and projectors.
> It was the 35mm meta-framework that allowed our industry to collaborate, innovate and create value.