AMWA NMOS Identity & Timing

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Background

- AMWA activity started in April 2018 involving vendors and end users

- Aiming to
  - Identify how content identity and timing should be modelled such that it can be carried from **'end to end'** of a system (including **live and non-live** workflows)
  - Clearly document the models and feed back any required updates to existing AMWA specifications as a result
  - Use this to inform how identifiers and timing data should be tied to streams (such as SMPTE 2110) and stored content formats
  - Act as an enabler for new technologies and workflows

What is Identity?

- The ability to uniquely identify any resource in a networked media architecture
    - Specifically how this applies to video, audio and data content
    - Used to identify each unique piece of content, and how it relates to others

- Real world examples
    - Video on demand: Dynamic bitrate adaptation for the same content ID
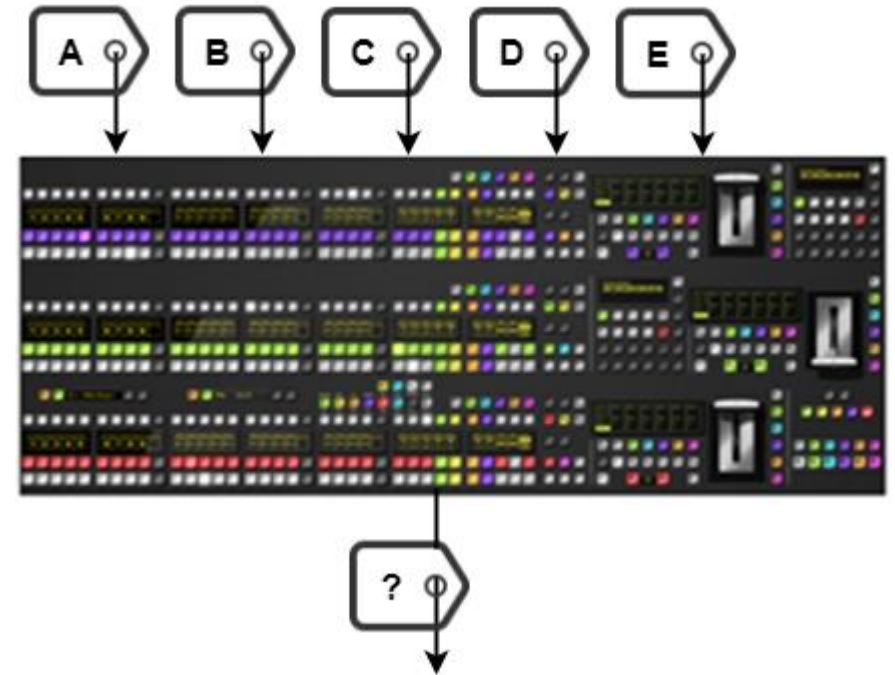   - CDNs: Download a file with a particular ID from the closest geographical location

What is Timing?

- Associating a unique time value with each video frame, audio sample or data element
  - Permitting automatic re-synchronisation (lip sync) of related media at the end of independent processing chains
  - Not reliant upon every process having access to a precise source of time

Why is it complicated?

- End to end identity and timing requires a consistent approach

- Example: Vision and audio mixing
  - Multiple content identities at input
  - Potential for timing mis-alignment at input
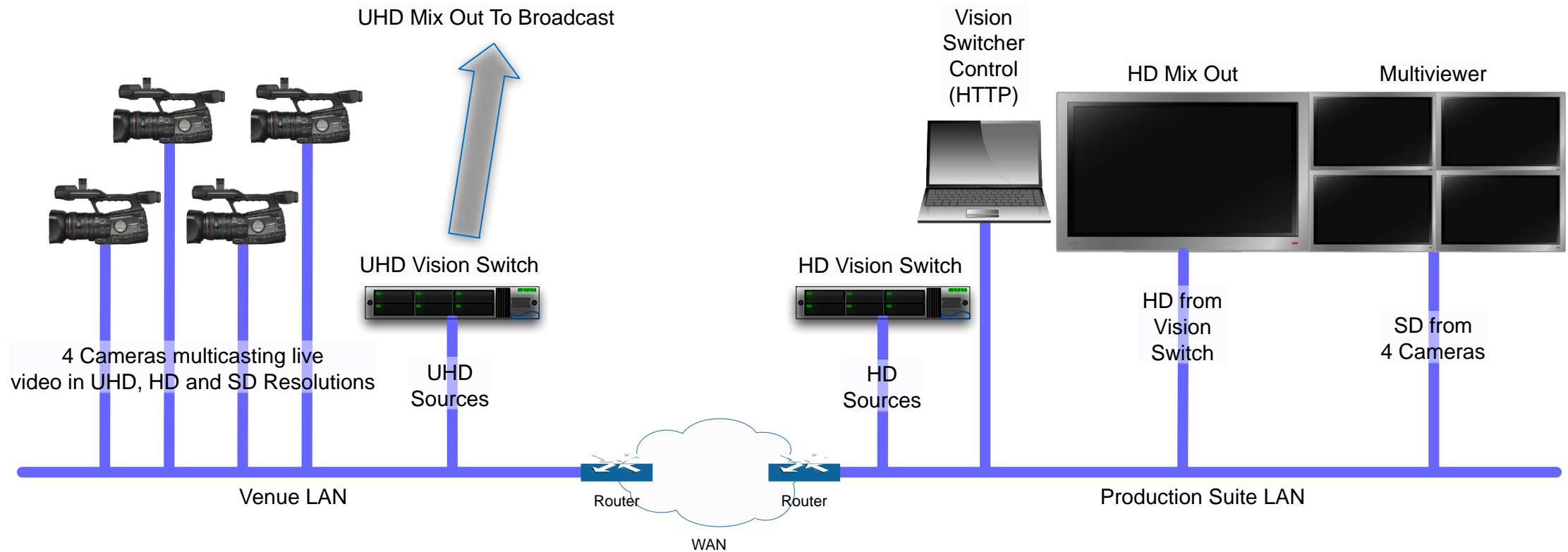 - Accumulation of identity and timing data at output

Identity and Timing in RTP (ST.2110)

- Identity and timing in media streams is nothing new
  - RTP Timestamp, SSRC, CSRC
  - Originally intended to allow modelling of mixers and alike

- In the future we will need solutions which are:
  - Transport agnostic
  - Format agnostic
  - Codec agnostic

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|V=2|P|X|  CC   |M|     PT      |       sequence number         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                           timestamp                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           synchronization source (SSRC) identifier            |
+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
|            contributing source (CSRC) identifiers             |
|                             ....                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Near term benefits: Remote production

- Sending large production teams to venues is expensive and restricts the number of events which can be covered

- End to end identity provides the means to work against proxy content and replicate the edit decisions against higher quality output

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Near term benefits: Remote production

UHD Mix Out To Broadcast

Vision Switcher Control (HTTP)

HD Mix Out

Multiviewer

UHD Vision Switch

HD Vision Switch

4 Cameras multicasting live video in UHD, HD and SD Resolutions

UHD Sources

HD Sources

HD from Vision Switch

SD from 4 Cameras

Venue LAN

Router

Router

WAN

Production Suite LAN

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Longer term benefits

- In the cloud…
  - Microservice architectures
  - Distributed object storage
  - Message queues

- In the home…
  - Elemental distribution
  - Client side rendering

- Concerning ourselves with how everything interconnects goes against cloud principles. We need a consistent way to refer to content

Activity update

- A model for tracking identity and timing has been developed
  - Using the existing NMOS concepts of **Sources** and **Flows**, building upon their definitions and identifying clearly how these relate to common production operations
  - Defining how **'Time Values'** relate to content, and how they need to change at the boundaries of facilities, productions etc.
  - Making recommendations for how to apply identity and timing 'from end to end' in live and non-live environments
- AMWA have reserved identifier MS-04 for use by the NMOS Identity and Timing specification subject to approval

Activity update
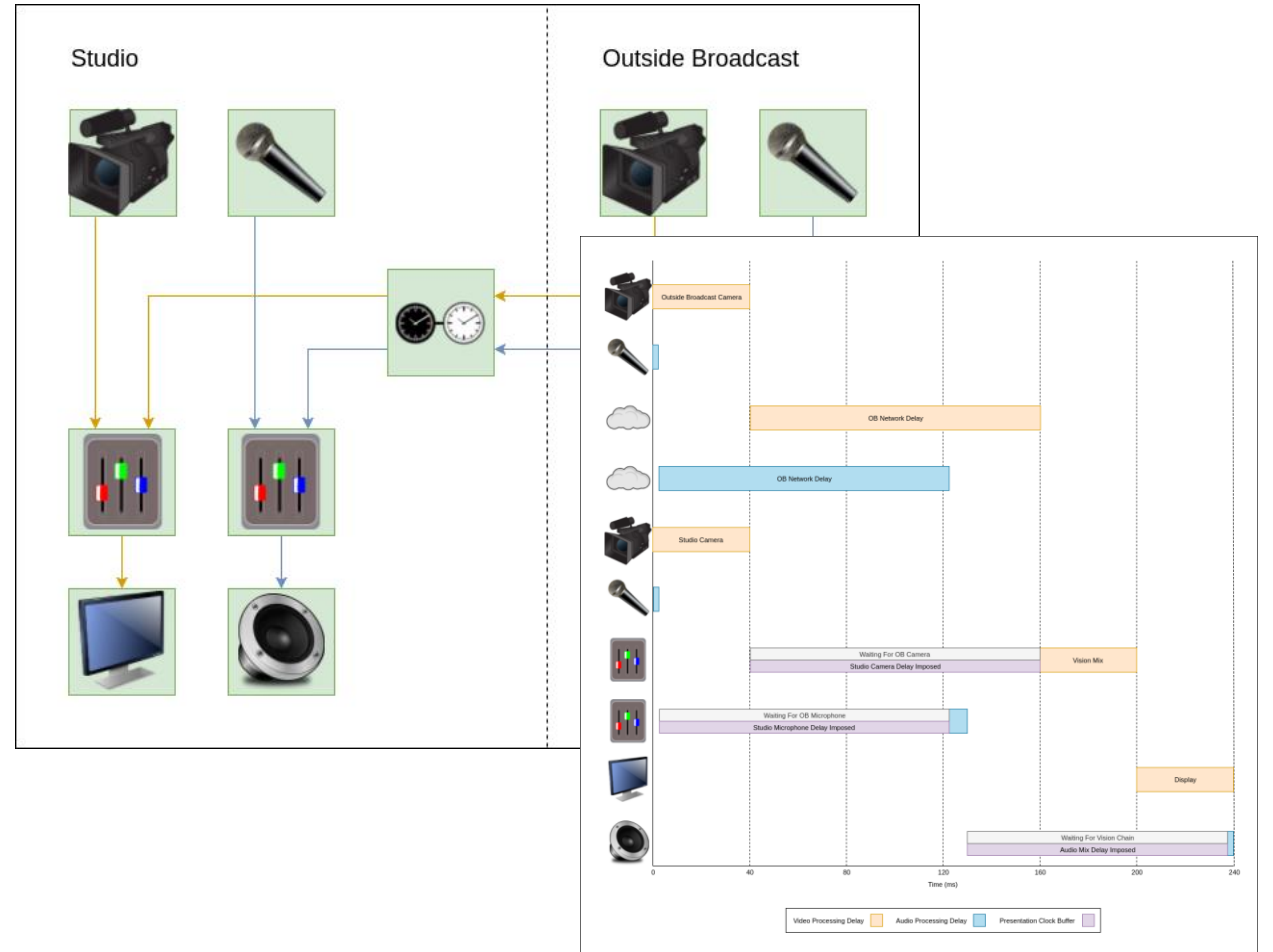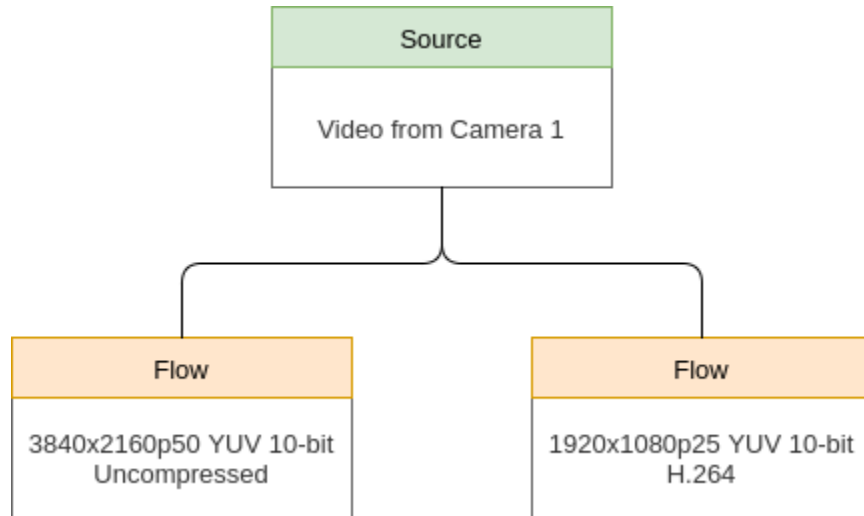
How does this relate to IS-0X?

- The NMOS specifications are built upon common concepts including Sources and Flows

- Tracking of this identity through production chains depends upon its persistence through file formats and transport mechanisms
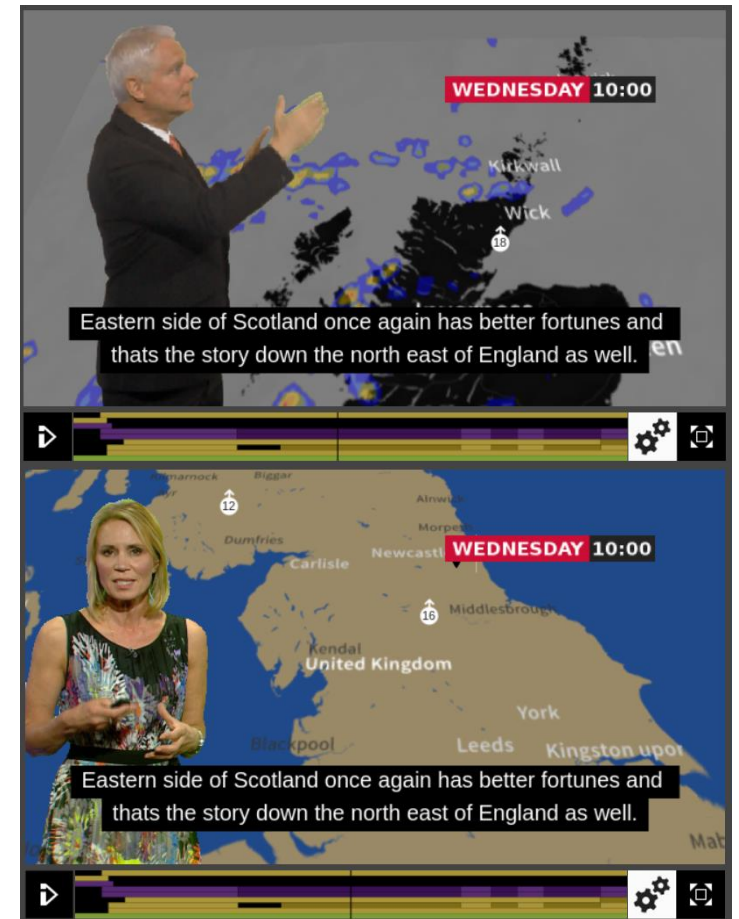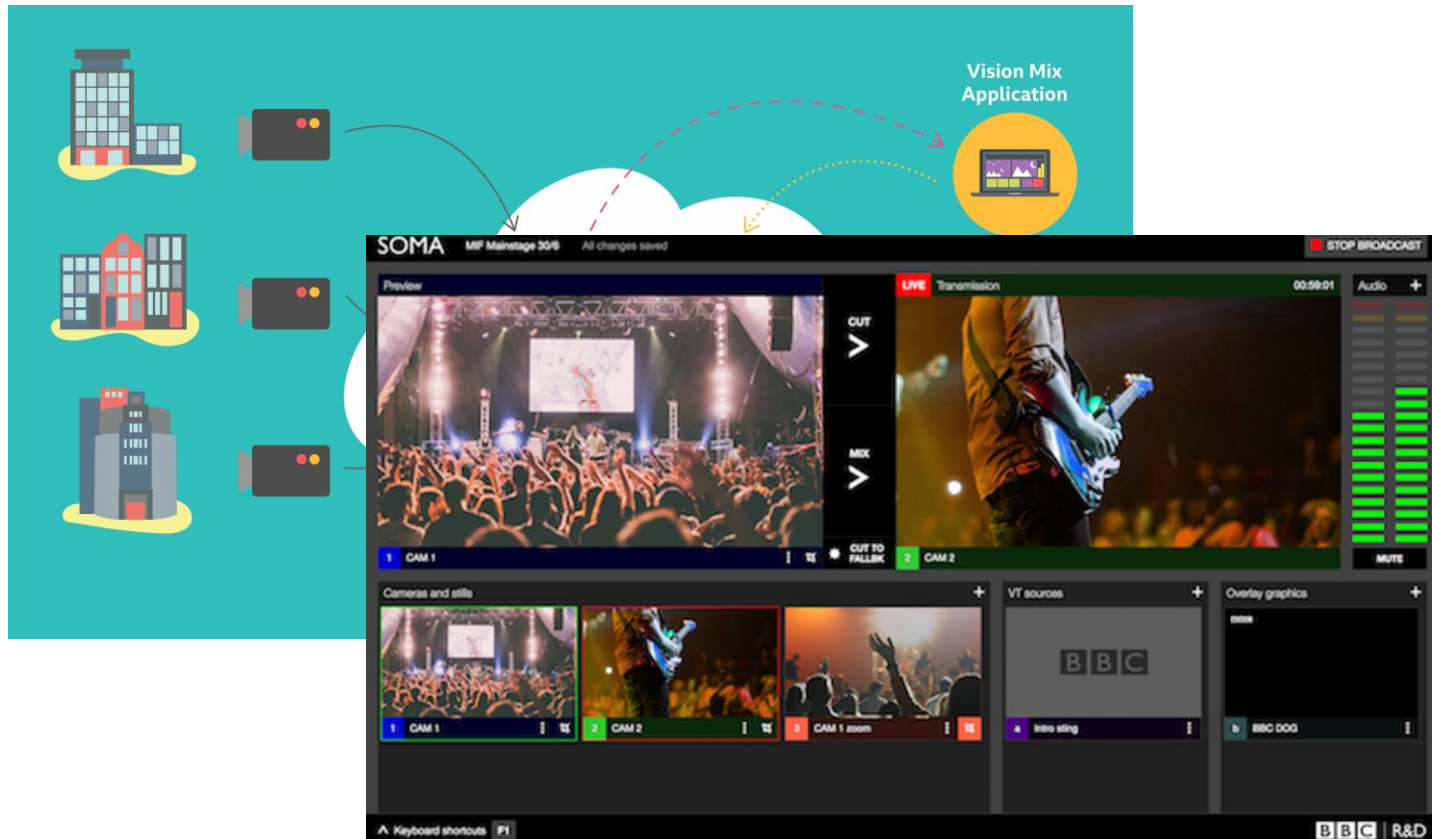
How does this relate to IS-0X?
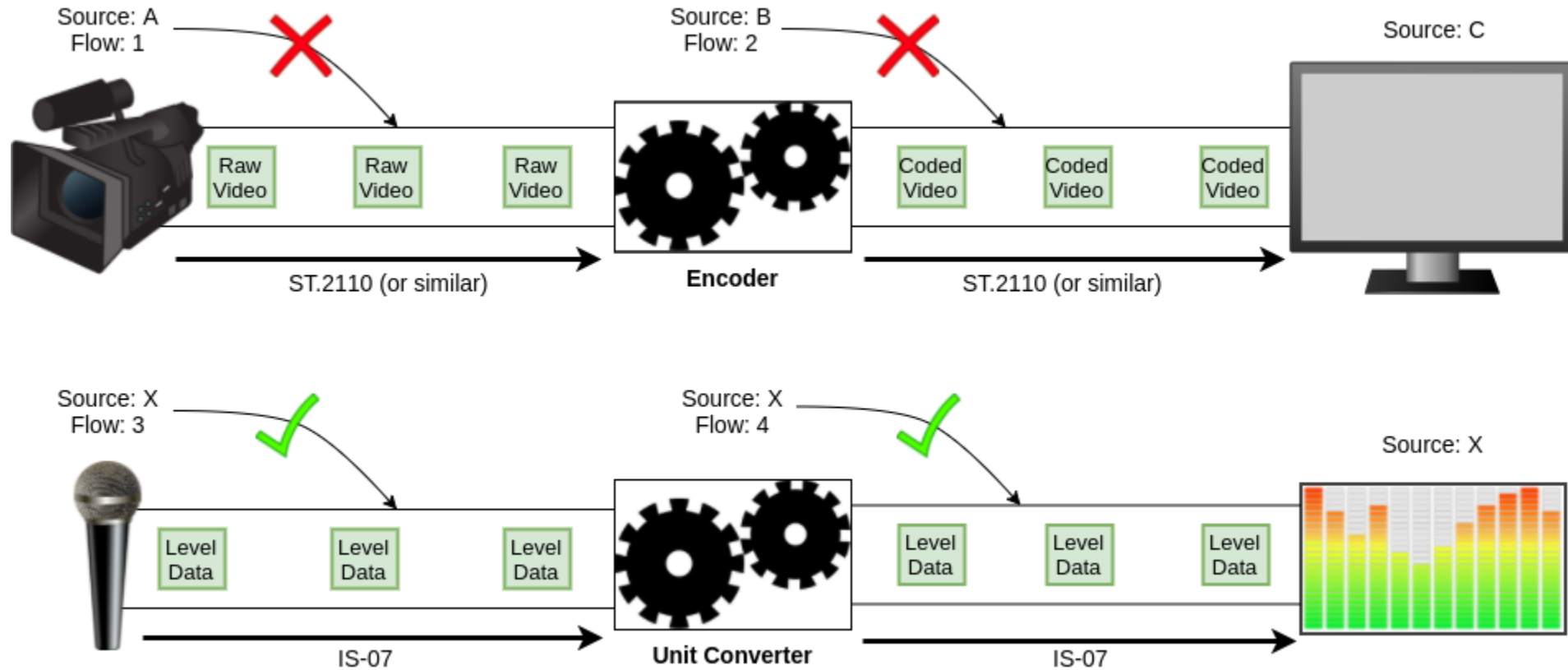
What's next?

- Carriage of consistent identity and timing with content is critical
  - Work on mappings to ST.2110 and other transports and file formats is required
  - Definition of content APIs could provide common interfaces to media in cloud architectures

- There needs to be buy in from both end users and vendors

It's not just theoretical

Summary

- Identity and Timing enables us to define workflows in terms of the content of business value rather than the systems processing it
  - With this foundation we can let the IT technology we are building upon worry about the underlying complexity of getting it from A to B
  - This approach is critical to ensure we can develop multi-vendor cloud solutions which interoperate and scale
  - There is scope for countless new production techniques and new products built upon this foundation

https://amwa-tv.github.io/nmos-id-timing-model
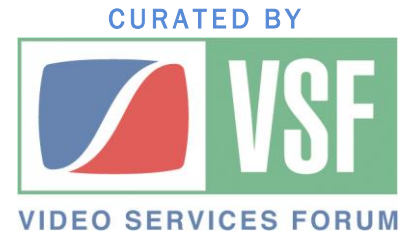
Thank You

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