AMWA AS-11

Technical Overview of AS-11 Specifications

Updated: 9 March 2016

For the latest version of this document (and all the latest information about AS-11) please visit:
http://amwa.tv/projects/AS-11.shtml

- Comparison of Specification properties
- Rules based construction of Specifications
- Using Multichannel Audio Labeling
- Descriptive Metadata embedded as an XML Document

Comparison of Specification properties

AS-11 Specifications – Comparison of Key Properties

	AS-11 UK DPP SD (DPP SD Programs)	AS-11 UK DPP HD (DPP HD Programs)	AS-11 X1 (DPP UHD Programs)	AS-11 X2 (HD Intra Programs)	AS-11 X3 (HD Long GOP (25p, 50p) Programs)	AS-11 X4 (HD Long GOP (23.98p, 59.94p) Programs)	AS-11 X7 (SD Programs)
Underlying file format	MXF OP1a	MXF OP1a	MXF OP1a	MXF OP1a	MXF OP1a	MXF OP1a	MXF OP1a
Video encoding	50Mbit/s D-10 (MPEG-2)	AVC intra (RP 2027 Class 100)	AVC (intra or Long GOP)	AVC intra (RP 2027 Class 100)	AVC Long GOP 50 Mbit/s	AVC Long GOP 50 Mbit/s	50Mbit/s D-10 (MPEG-2)
Video signal standard	576i/25	1080i/25	2160p/25 2160p/50	1080i/25	1080p/25 1080p/50	1080p/23.98 1080p/59.94	576i/25
Audio	4 usable audio channels Fixed EBU audio track layouts	4 or 16 single-channel audio tracks Fixed EBU audio track layouts	Any number of multi-channel audio tracks Each audio track contains labeling Default audio layout (optional)	Any number of multi-channel audio tracks Each audio track contains labeling *(optional)* Default audio layout (optional)	Any number of multi-channel audio tracks Each audio track contains labeling *(optional)* Default audio layout (optional)	Any number of multi-channel audio tracks Each audio track contains labeling *(optional)* Default audio layout (optional)	4 usable audio channels Default audio layout
Descriptive Metadata	“Original” AS-11 KLV coded DM Segmentation Track	“Original” AS-11 KLV coded DM Segmentation Track	Embedded XML document(s) Segmentation Track	Embedded XML document(s) Segmentation Track	Embedded XML document(s) Segmentation Track	Embedded XML document(s) Segmentation Track	Embedded XML document(s) Segmentation Track
Timecode	1 Continuous Timecode Track	1 Continuous Timecode Track	1 Continuous Timecode Track	1 Continuous Timecode Track	1 Continuous Timecode Track	1 Continuous Timecode Track	1 Continuous Timecode Track

AS-11 Specifications – Comparison of Selected Descriptive Metadata Differences

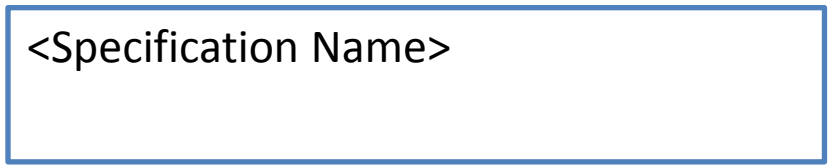
	"Original" AS-11 KLV coded Descriptive Metadata	Embedded "DM_Programmes" XML Descriptive Metadata
Descriptive Metadata architecture	Descriptive Metadata tracks embedded natively in the MXF file (each property is individually KLV coded)	Descriptive Metadata embedded in the MXF file as XML document(s)
Audio Loudness Specifications	EBU R 128	EBU R 128 EBU R 128 s1 ITU-R REC BS.1864 FreeTV OP-48 FreeTV OP-59 ATSC A/85
Visual Sign Languages	BSL (British Sign Language) BSL (Makaton)	All International visual sign language codes
Picture Ratio	Fixed list of rationals	A more expressive structure to more precisely capture the Picture Ratio. A larger list of pre-defined options (included "unspecified" options) are available as well as a "custom" option.

There are *many additional improvements* to the Descriptive Metadata introduced with the "DM_Programmes" XML Schema. Refer to the XML Schemas in the latest AS-11 Specifications for full details.

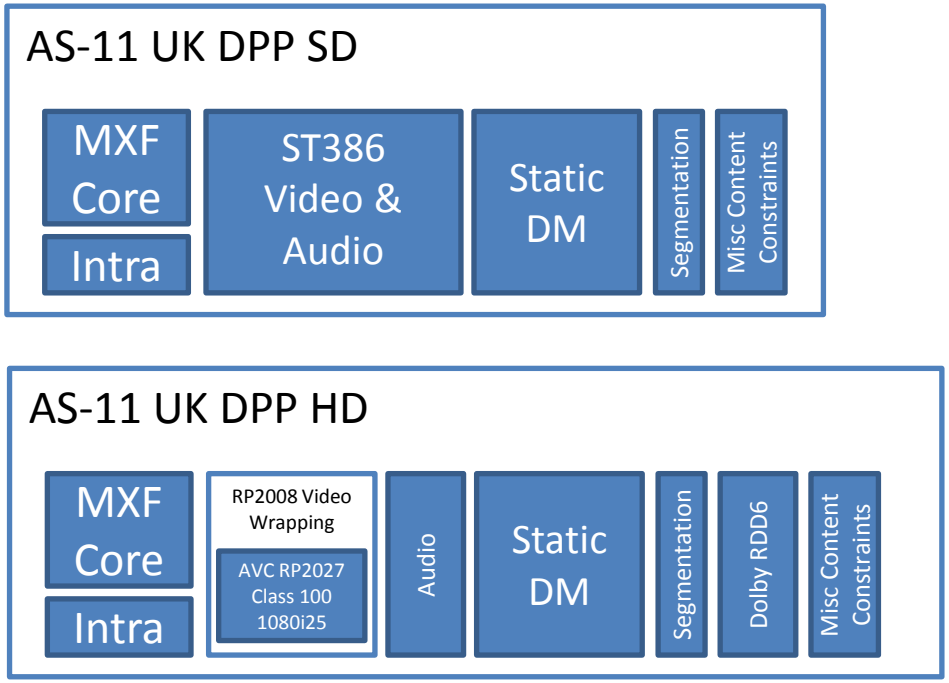
Rules based construction of Specifications

- The diagrams on the following pages give a *simplified* view of how the AS-11 Specifications are constructed from Blocks (the “building blocks” of rules based Specifications)

- Specifications are shown like this:

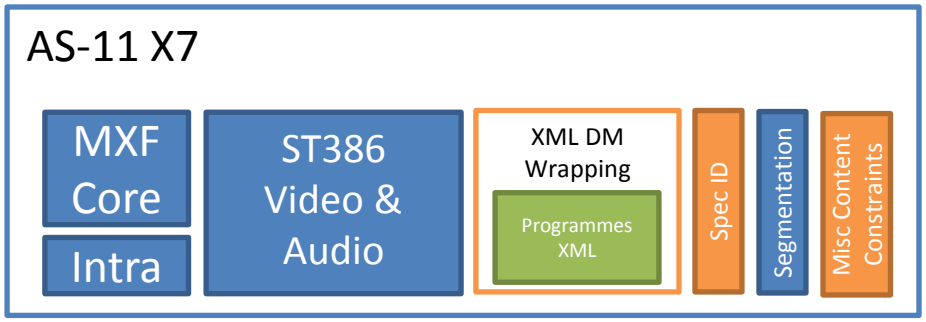


Rules based representations of the original AS-11 DPP SD & HD Specifications



Some of these dark blue Blocks appear in the diagrams of newer AS-11 Specifications on the following pages. This indicates that these Blocks of the original Specifications have been re-used and are identical in the newer Specifications.

Rules based representations of AS-11 X7 (MXF Program Contribution – SD)



Common MXF file architecture “Blocks File Format 0”

Common file architecture “Blocks File Format 0”

Supports:

- *inter-coded and intra-coded*
- *variable bytes per element (VBE) and constant bytes per element (CBE)*
- *interlaced and progressive*

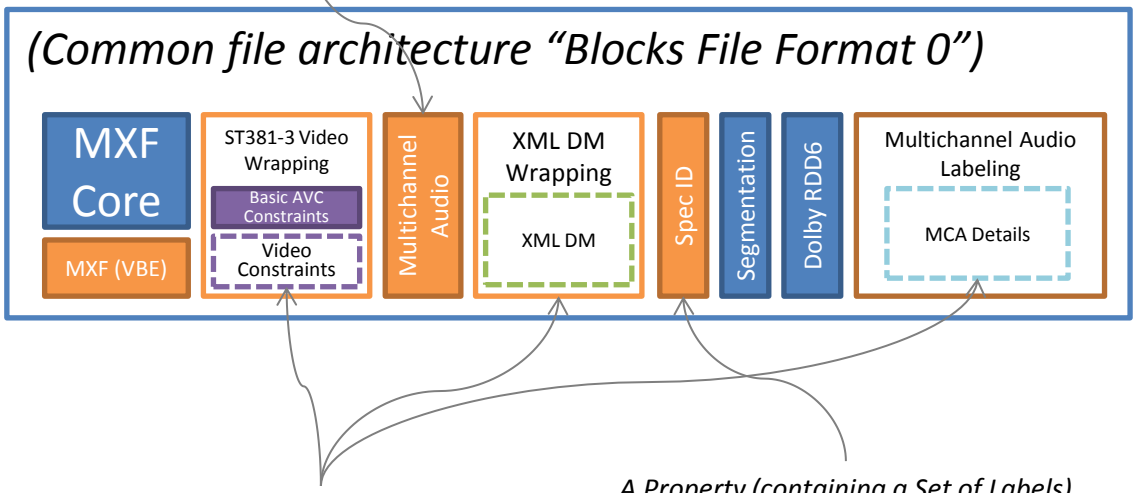
Inclusion of Dolby Metadata bitstreams (RDD6) is optional but a fully compliant device must support them. If present the defined mechanism must be used.

The use of Multichannel Audio (MCA) Labeling is optional but a fully compliant device must support it. If present the defined mechanism & Labels must be used.

If MCA Labeling is not used there is no means to signal audio layout, audio language, etc. If these details are required then MCA Labeling must be used.

A basic default two Sound Track layout (main mix: stereo & 5.1) will be available (additional Tracks are permitted but MCA Labeling must be used to signal what they contain). This default can be used with or without MCA Labeling. This default is designed to ensure that the file can at least be played-out with valid main audio during the transition to using MCA Labeling.

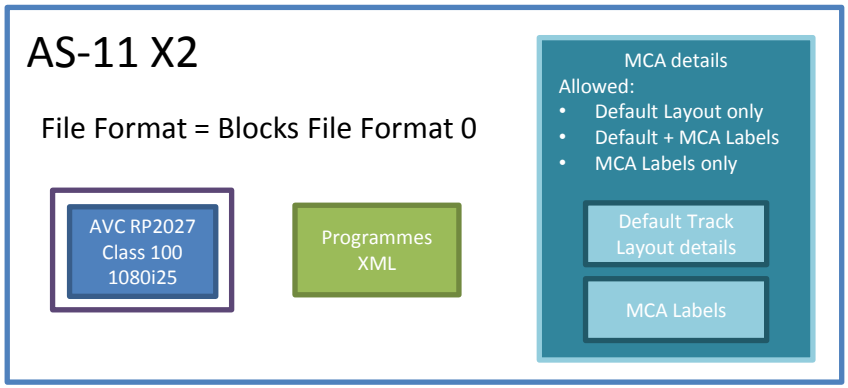
In this new configuration each MXF Sound Track contains all the audio channels for a “Soundfield Group” (for example: two audio channels for a stereo “Soundfield Group”)



A Specification using this architecture can choose compatible Blocks to insert in place of “parameter” Blocks.

A Property (containing a Set of Labels) that is added to the MXF Preface – this can be used to identify which Specifications the file complies with

Rules based representation of AS-11 X2 (MXF Program Contribution – HD Intra)



Rules based representations of AS-11 X3, X4 and X1 (HD & UHD Program Contribution; all include AVC Long GOP)

AS-11 X3

File Format = Blocks File Format 0

ITU-R BT.709
"Transport": "Progressive"
"Frame frequency (Hz)": **"25" or "50"**
"Coding format": "10 bits/component"

High 4:2:2 Profile

LongGOP AVC Constraints
- 50 Mbit/s
- SPS/PPS
- GOP size
- etc

MCA details
Allowed:
- Default Layout only
- Default + MCA Labels
- MCA Labels only

Default Track Layout details

MCA Labels

Programmes XML

AS-11 X4

File Format = Blocks File Format 0

ITU-R BT.709
"Transport": "Progressive"
"Frame frequency (Hz)": **"23.98" or "59.94"**
"Coding format": "10 bits/component"

High 4:2:2 Profile

LongGOP AVC Constraints
- 50 Mbit/s
- SPS/PPS
- GOP size
- etc

MCA details
Allowed:
- Default Layout only
- Default + MCA Labels
- MCA Labels only

Default Track Layout details

MCA Labels

Programmes XML

AS-11 X1

File Format = Blocks File Format 0

ITU-R BT.2020
"Pixel count": "3840x2160"
"Coding format": "10 bits per component"
"Frame frequency (Hz)": "25" or "50"

High 10 profile "4:2:0 system" or High 4:2:2 profile "4:2:2 system"

LongGOP AVC Constraints
- SPS/PPS
- GOP size
- etc

or

High 10 Intra profile "4:2:0 system" or High 4:2:2 Intra profile "4:2:2 system"

Intra AVC Constraints
- SPS/PPS
- etc

AVC Signalling
- video_full_range
- colour_description

Restrictions on presence of properties (such as AFD, Transfer Characteristic, etc) in Descriptor

MCA details
Allowed:
- ~~Default Layout only~~
- Default + MCA Labels
- MCA Labels only

Default Track Layout details

MCA Labels

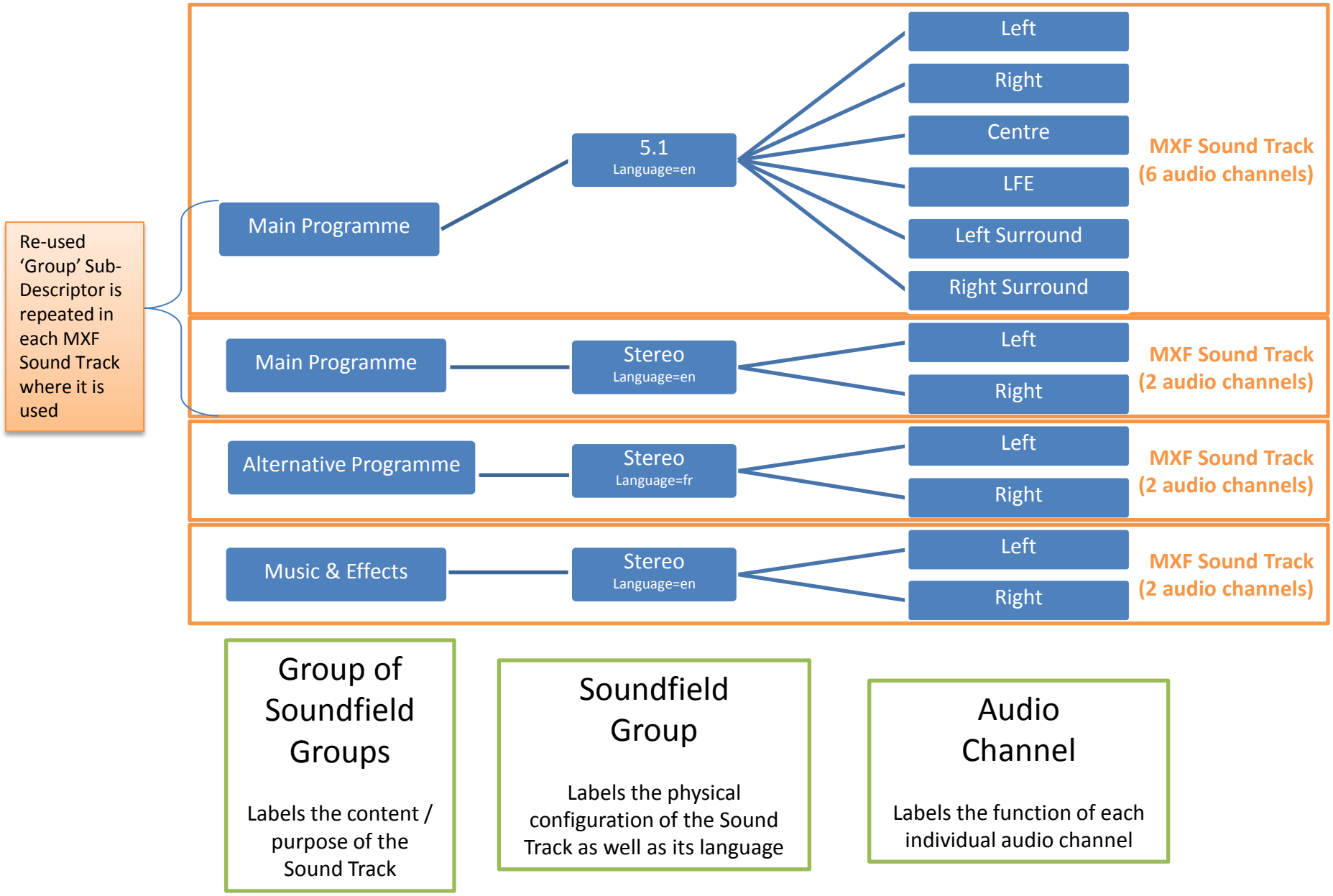
Programmes XML

Using Multichannel Audio Labeling

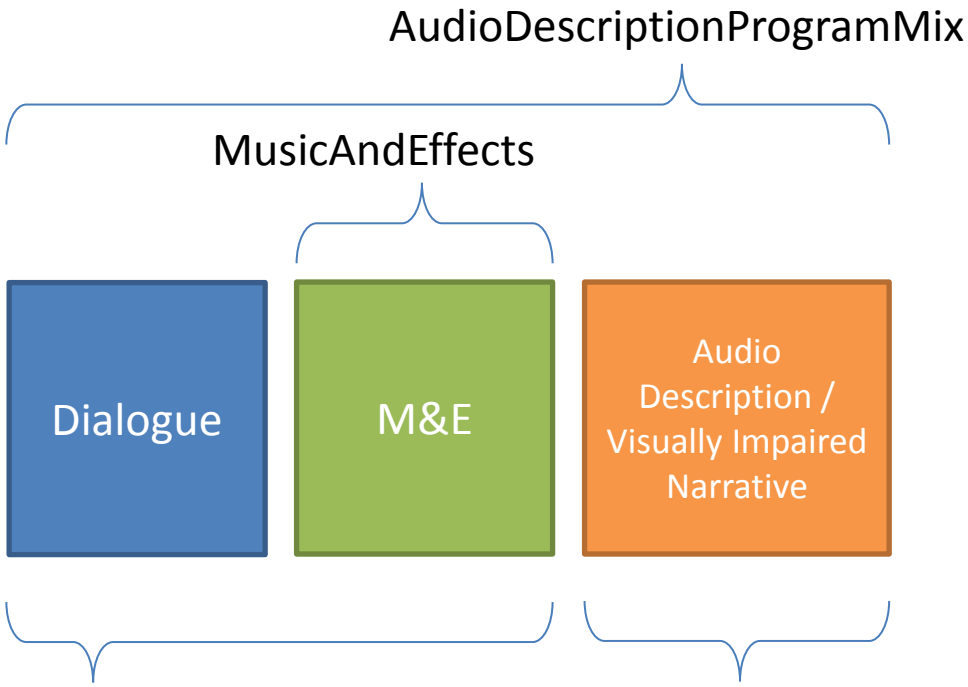
Overview of MCA Labeling

- The principle is that only those Sound Tracks that are needed are put into the MXF file
- Each Sound Track contains all of the Audio Channels for a “Soundfield” (e.g. Stereo)
- The Multichannel Audio (MCA) Labeling is used to describe the Audio Channels, how they fit together, and their purpose
- Mapping audio to outputs is done intelligently by the decoder, rather than using agreed (or assumed) audio track layouts
- Three levels of description:
  - Audio Channels
  - Soundfield Groups
  - Groups of Soundfield Groups

Multichannel Audio (MCA) Labelling Example



“Groups of Soundfield Groups” Labels – Simplistic Illustration of Audio Composition



For each kind of Soundfield (principally Stereo and 5.1) the intention is that there is a maximum of one Sound Track that references a SMTPE20678MainProgram *GroupOfSoundfieldGroups – in this way the “default” / “primary” audio can always be identified. However, exact usage is governed by a Delivery Document.*

Descriptive Metadata embedded as an XML Document

Split apart Technical Metadata & Descriptive Metadata and treat each appropriately

Split apart Technical and Descriptive Metadata

Technical Metadata

- Essential so that a decoder can understand what is in the MXF file: "Can this be decoded?" "How should I route the different components to the different (sub-) systems that I have available?“
- *–> Best handled by standard MXF structures that are used across the industry*

Descriptive Metadata

- Descriptive in nature and about the *content*. Much of this is only useful to a human or to systems operating at a higher (orchestration) level than an MXF decoder e.g. MAMs
- Often application specific
- Has a similar function to the label on a videotape or the VTRR paperwork – a place to capture a simplified snapshot of some of the key details about the content
- *–> Best handled by containing in an embedded XML document*

Move to XML-based Descriptive Metadata for new AS-11 Specifications

Problem: The Descriptive Metadata required nearly always needs to be different for each new application / scenario / workflow. This is problematic because:

- the MXF rules mean that for the existing (KLV) Descriptive Metadata even a very small change results in all of the metadata structure having to be regenerated

Proposed solution: Embed Descriptive Metadata as XML into the MXF file. This helps because:

- XML is a ubiquitous technology - it's easy to specify using standard tools and for OEMs to work with
- There is now a SMPTE mapping for XML into MXF (SMPTE RP 2057) – this did not exist in 2011 when the first AS-11 Specifications were developed
- XML is extensible and the mapping makes it easy to add multiple XML documents to an MXF file

DM Programmes XML Schema

Property names, definitions, data types, length restrictions and optional / mandatory

Many of these details are kept the same as in the KLV DM used in AS-11 UK DPP SD & HD, where possible

Language Properties

All language properties (including for sign languages) use IETF BCP 47 language tags (the language tag format is specified in IETF RFC 5646)

- Note that BCP 47 tags use the shortest ISO language code. So, English is “en” not “eng”
- Language tags intro: http://www.w3.org/International/articles/language-tags/
- Tag registry: http://www.iana.org/assignments/language-subtag-registry
- Performing XML Schema validation on an XML instance document is insufficient to confirm that language tags are valid: additional checks need to be performed