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METADATA

MADNESS

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AAF & MXF

Metadata MADNESS OR Industry REVOLUTION

Wayne Cole

Organizations like SMPTE, AES, EBU and ITU have created standards that provide a high level of interoperability at the hardware, signal and display levels. When the convergence of media production with digital processing began, however, digital media and file compatibility were handled largely through proprietary formats and designs. The digital media production environment lost much of the platform and tool independence that existed in the analog production era.

With increasing pressure to “repurpose” the same raw content, developers, vendors and users have sought increasingly to streamline the production workflow from end to end while regaining freedom of choice over platforms and toolsets. Wouldn't it be nice, for example, if editors could open a project in the editing tool of their choice—not necessarily the tool with which the project was originally edited—and make changes that create a new project

directly from original source material? The quality of the original project could be maintained without the need to duplicate edits from the original project that would be “kept” in the new project.

This is exactly what the Advanced Authoring Format (AAF) and Material Exchange Format (MXF) promise: interoperability in media production, management and delivery using a variety of tools, from a variety of vendors, with any source media. These metadata standards, recently submitted to SMPTE for formalization, have been devised, revised and implemented in an open source environment by developers, users and manufacturers such as Sony, BBC, Snell & Wilcox, Avid, Microsoft, Quantel and Digidesign, to name just a few. There were no complex license fee agreements to slow the introduction of AAF and MXF into the marketplace.

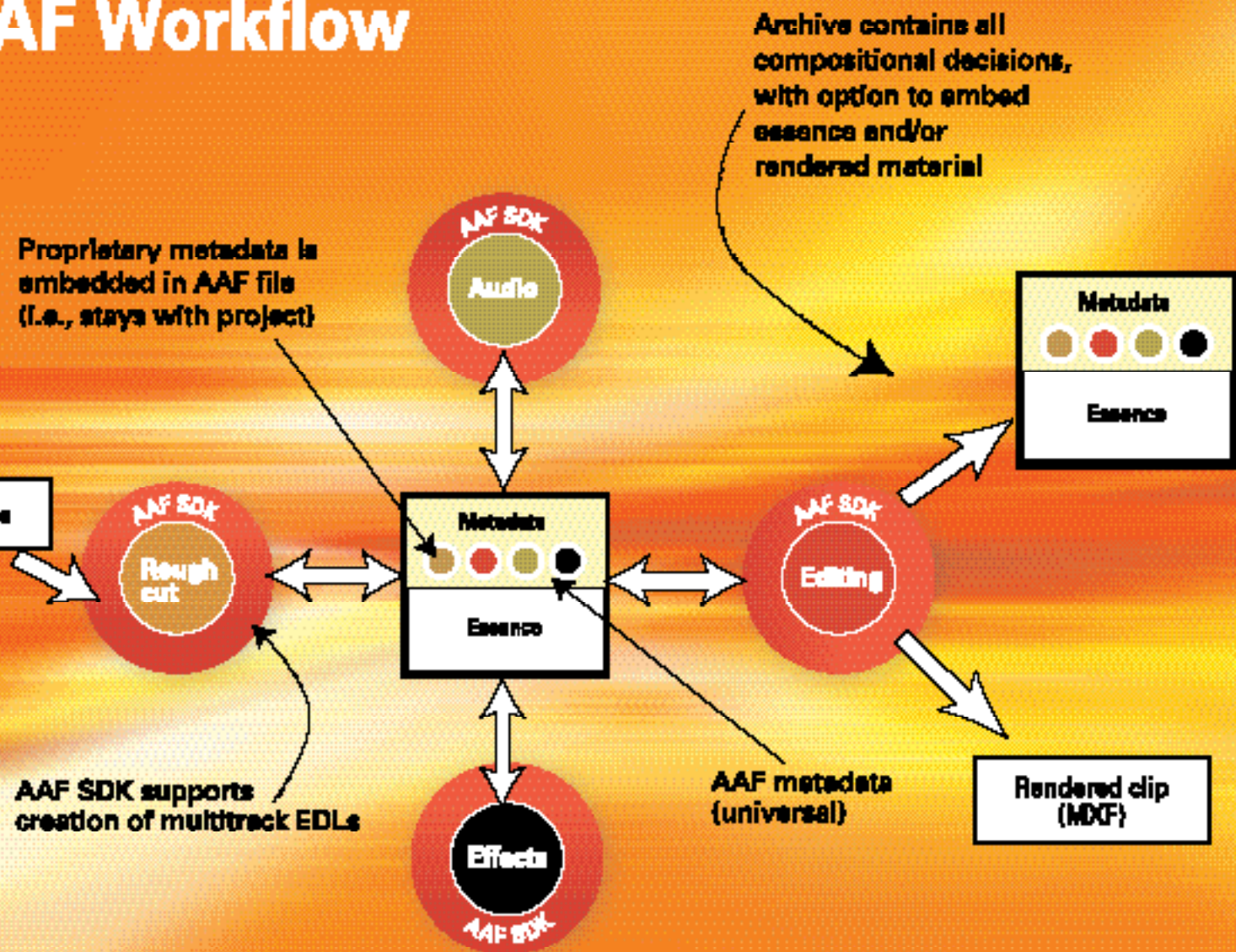
AAF and the Mobs

AAF is a metadata standard that

abstracts the editorial process that created a project and separates it from the material, or “essence,” on which it was performed. To linear editors this may seem like much ado about nothing more than an EDL (edit decision list), but AAF specifies the structure for a super EDL, one that could load and perform edits of a previous project with little or no operator intervention. AAF exerts this control over the editing process via Mobs. No, not Tony Soprano's crew—rather, data structures called “Material Objects,” nicknamed Mobs.

AAF defines eight types of Mobs that have similar structures but do different jobs. The Composition Mob, for example, identifies a composition, which could be an entire project from a nonlinear editor timeline or an effects stack like that produced by After Effects. A Film Source Mob, on the other hand, would define a specific piece of “essence” within a composition that exists

AAF Workflow



on celluloid. Other Mob types are Master, Sub-Clip Composition, Tape Source, Import File Source, File Source and Adjusted-Clip Composition. As you might guess, the Composition Mob heads a chain of Mobs that together define the sequence of actions, and to what essence those actions are applied to complete the composition. This Mob chain, or "derivation chain," is spliced together by pointers within one Mob that lead the process to another Mob in the chain.

The Mob itself contains the Mob ID, a unique identifier that distinguishes one Mob from another. Each Mob also contains a variety of "tracks" or data slots.

These tracks specify descriptive metadata (DM), and, usually by reference or pointers to essence or other Mobs, any number of visual tracks (V1...Vn), audio tracks (A1...An), auxiliary content (Ax) and time-code tracks (TC1...TCn), which can use SMPTE timecode or film edgecode. Mobs can also include information on transition effects, multi-layered effects and other compositional metadata.

Mob pointers are interesting in that they may contain file pathname locators or URLs; Mob pointers also may refer to essence or to other Mobs within the AAF file or external to it. Herein lays the power of AAF for repurposing existing programming or

media. This structure allows AAF to support program preparation, not just for traditional film and video projects but also for interactive television, consumption over a network or on a computer.

MXF

MXF, developed largely by the Pro-MPEG Forum in cooperation with the AAF Association, is a proper subset of AAF. Because of this commonality, AAF applications can utilize MXF files directly, or they can filter or "flatten" AAF metadata to produce MXF-compliant data. MXF was designed primarily to contain single-layer or linear (e.g., cuts-only) essence. This "leaner" format, ideal for news cutting, broadcast

and streaming operations, provides an efficient way to move essence from point to point or to stream it while keeping the metadata intact.

MXF specifies an open source, standardized wrapper for "essence." The wrapper concept is not new. AVI and QuickTime, for example, are wrapper formats within which essence exists in a wrapper-compatible codec like CineForm, Indeo or Sorenson. MXF, however, is "codec agnostic." Its separation of metadata from essence allows MXF to identify and contain media encoded with virtually any codec.

MXF metadata has been described as "structural and descriptive." That is, it is designed not only to describe essence in terms of codec, media type (visual, audio, graphic or text), and synchronized events (as for ITV), but it can also contain information that describes the scene, where and when it was shot, who or what appears, and even transcripts of recorded speech. This makes MXF very attractive to asset managers.

For postproduction or media repurposing, MXF provides several additional bene-

fits as they commonly exist today.

An MXF file has a header, body and footer. The body is simply the essence container. The file header and footer are more complex because they contain both file-relative and essence-relative metadata in a mix of required and optional sections. The file header, for example, can have a "partition" section, a "metadata" section and an optional "index" section. The partition section contains information about how the MXF file itself is built, including which optional sections exist in the file and the number of essence containers in the file body. The header metadata section has the structural and descriptive metadata pertaining to the essence. And the index can provide links for rapidly accessing any point of essence in the file body. The footer provides an end-of-file block but can also contain duplicate copies of the metadata header and index. There may even be an optional "RIP" (random index pack) after the footer, which provides pointers to the partitions or sections within the file.

Within this physical structure, MXF

data like a "plug-in." As other essence metadata standards evolve, MXF can accommodate them without needing to change its structure. AAF also provides "future-proofing" through special-purpose extensions that can support new metadata formats without the need for an AAF revision.

Since its initial release, AAF support has quietly appeared in a broad spectrum of products, from low-cost editing applications like Adobe Premiere and Avid Xpress Pro to high-end distributed media processing systems like those from Quantel. As attractive as AAF was alone, combined with MXF, it becomes very compelling for developers to implement and content producers to use. Proponents believe that to accelerate the implementation of these technologies, however, someone must provide developers a means to bring quality AAF/MXF products to market without expensive or lengthy development cycles. As Bruce Devlin, principal research engineer at Snell & Wilcox and major contributor to the MXF standard, said, "We want to jump start the industry. At the moment, we think the best way to

COMBINED WITH MXF, AAF BECOMES VERY COMPELLING FOR DEVELOPERS AND CONTENT PRODUCERS.

fits. First of all, taped or live-feed content can be encoded to MXF at the same time it is being captured. Previously digitized material can be wrapped in MXF as it is transferred to an editing station. Since MXF allows searchable, random access to the essence within the file or stream, MXF-compliant editing tools can improve upon the efficiency of editing and authoring process-

defines a number of logical elements, called packages, which help carry EDL-like information and indicate a pathway back to the source material from which the essence was derived. The Material Package defines what might be considered the output or final timeline of an edit session with a single continuous timecode track. The file package is more like an NLE timeline before output with multiple clip segments, each with its own timecode track, arranged in a sequence. The source package is like a bin or folder for all the file package elements; it includes information about where the source originated.

Flexibility and Extensibility

KLV (Key Length Value) refers to a data construct used to identify a unique quantity, determine how big its data field is and hold the quantity's actual value. UMID (Unique Material Identifier), a form of KLV metadata defined by SMPTE 303M, is used in MXF to describe the contained essence. This flexibility permits MXF to implement essence meta-

do that is to give away some tools that might help the transition."

For its part, Snell & Wilcox announced that MXF Express (see page 14), an MXF SDK (software development kit), and MXF Desktop, a PC-compatible MXF file player, will be made available at no cost around the time of NAB 2004. An open source AAF SDK, first released in 1999, has undergone several revisions and is available free of charge from the AAF association Web site.

With these open source SDKs, developers can build applications that will enable editors, asset managers, exhibitors, broadcasters and consumers to view or process the same material from the same files or streams in ways most meaningful to their unique needs. With the cooperative, "zero divergence" policy adopted by the Pro-MPEG Forum and AAF Association, media can be handled with platform, network and application independence. That is why many industry insiders consider AAF and MXF to be truly revolutionary. ▼

MORE INFORMATION

The AAF Association
www.aafassociation.org

The Pro-MPEG Forum
www.pro-mpeg.org

Snell & Wilcox
Knowledge Center
www.snellwilcox.com/knowledgecenter/mxf_aaf.html