



Avid® Media Toolkit

Version 1.5

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Overview

As with the great majority of editing and post production solutions Avid uses a combination of technologies for the storage of media essence and its associated metadata. In 2003 Avid was the first manufacturer to publicly commit to the use of MXF for the storage of media essence, thus underlining its commitment to the use of Open Standards. Consistent with the need to deliver high performance cooperative solutions in networked storage environments Avid uses the OP-Atom MXF variant (SMPTE-390M) in which the different media tracks (video, audio) are stored as discrete files rather than being interleaved in a single container as with many transmission examples. All Avid media is typically stored in this fashion irrespective of whether local or shared storage solutions are used.



As well as the media essence itself such assets typically have a rich set of metadata associated with them, metadata that will be displayed by Avid Interplay applications and also in the bin columns of the Avid editor. Unlike their (interleaved) transmission counterparts OP-Atom MXF files are intended to be as lightweight wrappers as possible, so although able to include metadata this is typically kept to a minimum. Also the metadata set required to support the post production process is a necessarily rich one, particularly when compositional data is taken into consideration. For this reason Avid decided to standardize on another Open Standard for its metadata, in this case the Advanced Authoring Format as managed by the Advanced Media Workflow Association (<http://amwa.tv>).

Both the MXF and AAF formats share a number of concepts as well as some fundamental aspects such as basic object models; in fact in many ways MXF can be considered a subset of AAF. Avid has used this commonality to implement a well integrated media essence and metadata solution. This has however led to some difficulties for third parties anxious to exchange material with Avid at the fundamental essence level because its OP-Atom clips are constructed in an "AAF Aware" fashion; in fact Avid makes full use of the publicly available AAF Toolkit both for the handling of metadata files and those for media.



Until recently third parties have had two possibilities for exchanging media with Avid. The first is through the well established workgroup transfer process, as typified by Avid Interplay Transfer and discussed in the "[Avid Open Solutions](#)" whitepaper. The second approach is to use one of the publicly available Open Source solutions to create or read such files, for example the AAF Toolkit as described above. (Although there are a number of commercially available MXF toolkits few support Avid compatible OP-Atom files, and most only support wrapping/unwrapping of existing essence rather the direct creation of media files). Because the AAF Toolkit is primarily concerned with managing production rich metadata many developers would prefer a simpler solution for exchanging their media with Avid. This is one of the principal factors behind the Avid Media Toolkit (AMT) which is the subject of this whitepaper.

Avid Media Toolkit

Avid Media Toolkit is designed to greatly ease the process of creating and reading Avid OP-Atom media files and exchanging them with an Avid Interplay workgroup environment. The toolkit will be particularly useful to those third party developers looking for an alternative to Interplay Transfer for material ingest, for example as part of a file-based workflow. Similarly the toolkit could be used to access Avid media for other purposes, for example to bring material captured using Avid AirSpeed[®] or similar into a graphics environment or to access consolidated sequences. A number of example solutions based on the toolkit are described later in the section "[Example AMT Solutions](#)".

AMT Clips

As explained earlier, within an Avid environment each media asset typically consists of a collection of files including the OP-Atom files corresponding to the audio and video tracks together with their AAF metadata. In order to maintain the relationship between these components outside the Avid environment the Avid Media Toolkit utilizes the concept of the AMT Clip.

Essentially an AMT Clip is a container for the files which constitute the asset itself. Virtually all the routines exposed by the Toolkit act upon an AMT Clip. Depending on the user's requirements the container can take one of two forms, a folder (directory) or a TAR archive, which, in addition to the MXF and AAF files discussed earlier, also includes an XML file describing the essential structural metadata (image dimensions, frame rate, compression, etc.) for the media clip. Figure 1 illustrates a typical AMT Clip.

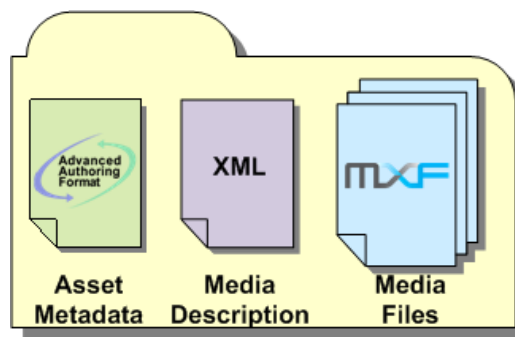


Figure 1A. Typical AMT Clip

AMT Clip Operations

The Avid Media Toolkit supports two principal sets of AMT clip related operations, those concerned with the creation of a clip and its population with media essence and those that provide access to the media essence contained within an existing clip. Two other operations are specifically related to Interplay environments and enable the

exchange of AMT clips between interplay and a local workstation. Additionally a number of utility functions are provided.

In many workgroup related operations however it will generally be more convenient if clips can be created directly on Avid shared storage, or accessed directly from their shared storage location. Starting with version 1.5 Avid Media Toolkit also supports these direct access operations. *Note that the Interplay workgroup must be running Interplay Web Services to support direct access.*

AMT Clip Creation

Clip creation is a straightforward process and consists of four steps:

- Creation of the basic AMT container
- Creation of the required media essence tracks
- Addition of media samples to the essence tracks
- Closing tracks and the container

Container Creation

This process creates the basic AMT Clip at a folder or archive location specified by the user, or directly in an Avid shared storage workspace. The process of creating the container also determines the format of the media that will be stored, e.g. 50Mb/s MPEG-IMX, DNxHD 185Mb/s, etc. Other key parameters such as frame rate, raster dimensions, etc. are also specified as part of the container creation process, the parameters being supplied in the form of an XML string.

An important factor that distinguishes AMT from other MXF and similar toolkits is that the media essence that will be stored in the clip does not need to be supplied in the target media format. For example most toolkits that might create, say, an MPEG-IMX clip, will require the media essence to be supplied in that format, all the toolkit then does is “wrap” the existing essence in the appropriate file. AMT includes an instance of the Avid Codec Manager so it is possible to encode, or re-encode, material as part of the clip creation process. This means that essence could be supplied as raw RGB or YUV data for example, AMT would then invoke the relevant codec to encode the essence in the desired format. Of course AMT supports the direct packaging of media that is already encoded in the target format. Also it is perfectly feasible for AMT to invoke a *decoding* operation at this point if, for example, an uncompressed clip is being created from compressed essence.

In order to take into account not only the format of the clip that is being created but also that of the media essence supplied, two XML strings are used, specifying the source and target formats respectively. *Note that the relevant XML definitions are supplied as part of the toolkit itself.*

Track Creation

This simple process creates the required video and audio tracks. In the current version of AMT one video track is supported together with a maximum of 8 audio tracks.

Sample Creation

Once the necessary tracks have been created they can be populated with samples of video or audio data as appropriate. It is during the sample creation process that any format conversion (encoding/decoding) takes place.

Closing Tracks and the Container

Once the clip is complete the tracks and container are closed.

Reading AMT Clips

Reading an AMT clip is to a great extent the reverse of the creation process. Again four steps are involved:

- Open the AMT container
- Open the relevant track(s)
- Read the media essence samples
- Closing tracks and the container

Opening the Container

This simply involves directing the appropriate routine at the AMT Clip folder or archive, or in the case of direct access to the appropriate Interplay location. Similar to the process of container creation an XML string is again used, this specifies the desired format in which the media essence should be delivered when reading the media samples. Once again this will invoke the appropriate Avid codec.

Opening the Tracks

Tracks are opened as required in order to make the media essence accessible.

Reading the Media Essence

Media essence is obtained on a frame by frame basis, with fully random access to any point in the clip. A utility routine is provided to enable the user to determine the duration of the clip.

Closing the Tracks and Container

Once all the read operations are complete the tracks and the container will be closed.

Reading directly from shared storage (non-Interplay)

Version 1.5 of the Avid Media Toolkit provides a method for reading directly from ISIS. This method requires that an AAF file specification be provided instead of an existing AMT clip. Essence MXF files referenced within the AAF will be accessed from their location specified within the AAF, including those stored on shared storage.

Interfacing with Interplay

Four Interplay related routines are provided:

- Import newly created AMT clips into Interplay
- Access (master clip) material already available in an Interplay environment
- Read a master clips directly from Interplay and shared storage via Mob ID
- Write media clips directly to Interplay and shared storage. This method supports Edit-While-Capture functionality.



Note that in order to exchange clips with Interplay the system must be running Interplay Web Services. For more information please see the [Interplay Web Services whitepaper](#).

Importing Into Interplay

As well as the obvious parameters such as user name and password two key pieces of information must be supplied for this function. One is the desired folder location within Interplay at which the asset should be checked in. The other is a reference to an ISIS workspace, the media files themselves will be copied there as part of the import operation. *Note that an ISIS client connection is required on the local workstation.*

Exporting From Interplay

This routine enables existing Avid master clip assets to be exported from an Interplay environment to an AMT clip on the local workstation. The only parameter required in addition to the basic login details is an Interplay MOB-ID URI. This URI will typically result from a call to one or other of the Interplay Web Services routines.

Writing Directly Into Interplay and Shared Storage

As well as the obvious parameters such as user name and password two key pieces of information must be supplied for this function. One is the desired folder location within Interplay at which the asset should be checked in. The other is a reference to an ISIS workspace where, the media files themselves will be created. *Note that an ISIS client connection is required on the local workstation.*



Reading Directly From Interplay and Shared Storage

This routine enables existing Avid master clip assets to be read from an Interplay environment and processed directly using AMT without the need for any intermediate media transfer. The only parameter required in addition to the basic login details is an Interplay MOB-ID URI. This URI will typically result from a call to one or other of the Interplay Web Services routines.

Integrating with Interplay WAN Browsing

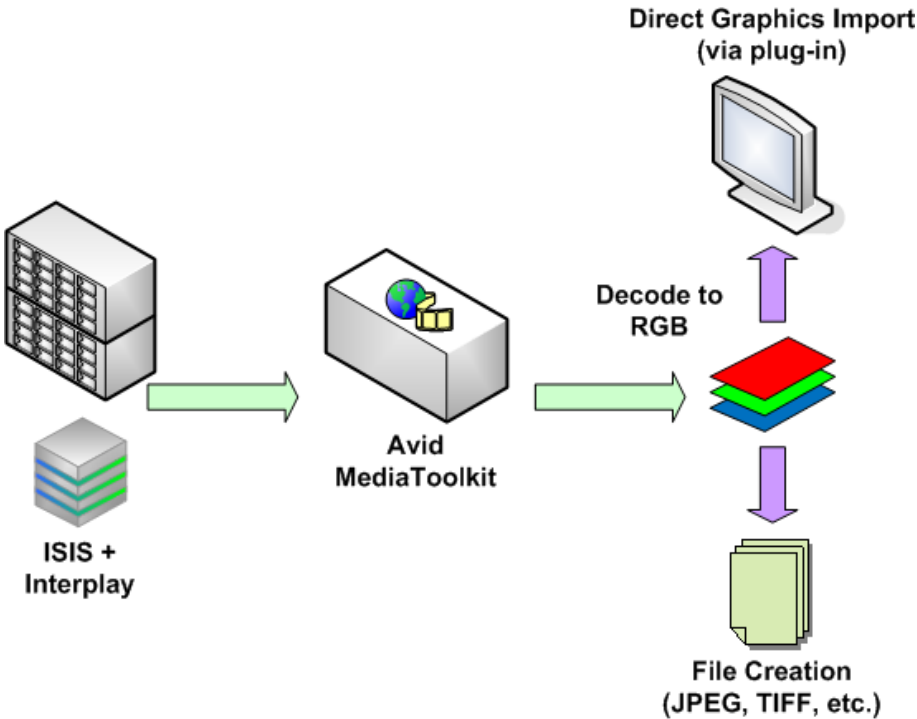
Interplay 2.0 introduced a new Wide Area Network browsing capability through the addition of a QuickTime based streaming server component. In order to publish material for streaming it must exist in an appropriate low resolution (aka "proxy") format, in the case of Interplay 2.0 this is based on MPEG-4 video with up to four tracks of MPEG-1 layer 2 audio. Starting with version 1.5 Avid Media Toolkit includes support for both audio and video proxy components.

For further information about the Interplay proxy solution please see the whitepaper "[Supporting Proxy Workflows with Avid Interplay 2.0](#)".

Example AMT Solutions

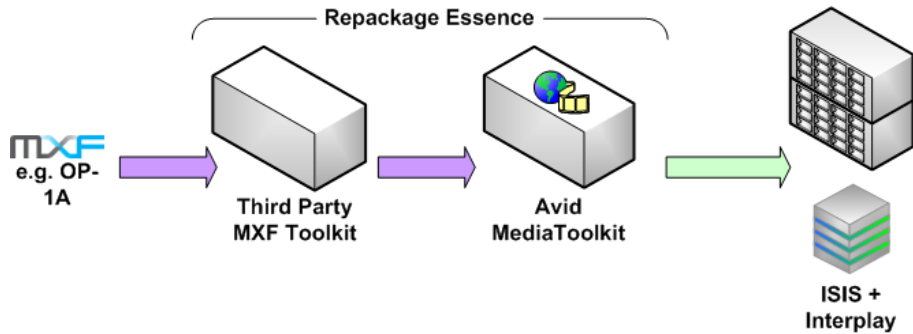
This section illustrates a number of possible solutions that can be engineered using the Avid Media Toolkit.

Accessing Frames for Graphics Applications



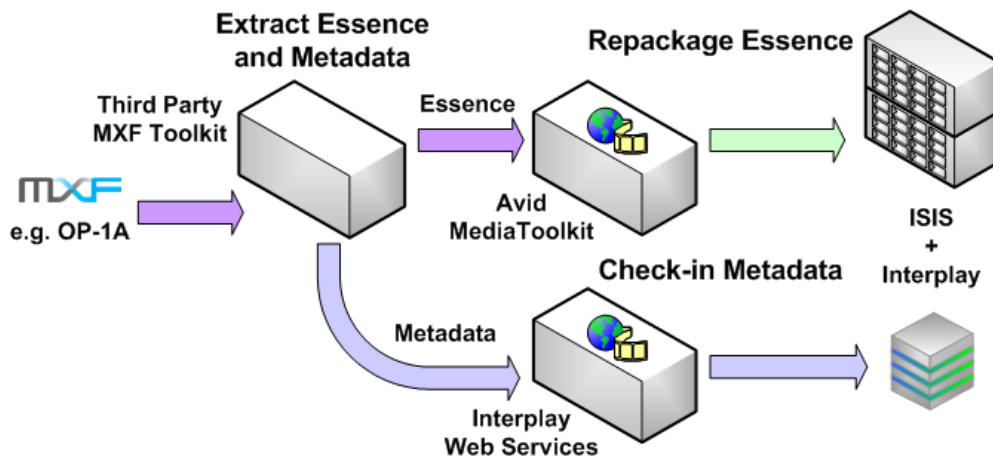
This example accesses media directly from shared storage, reads selected frames from the video track and decodes them to RGB. The resulting RGB data could be accessed directly within a graphics application such as Adobe Photoshop through the use of an import plug-in, or the data could be saved to disk as conventional graphics files.

Rewrapping Interleaved Media



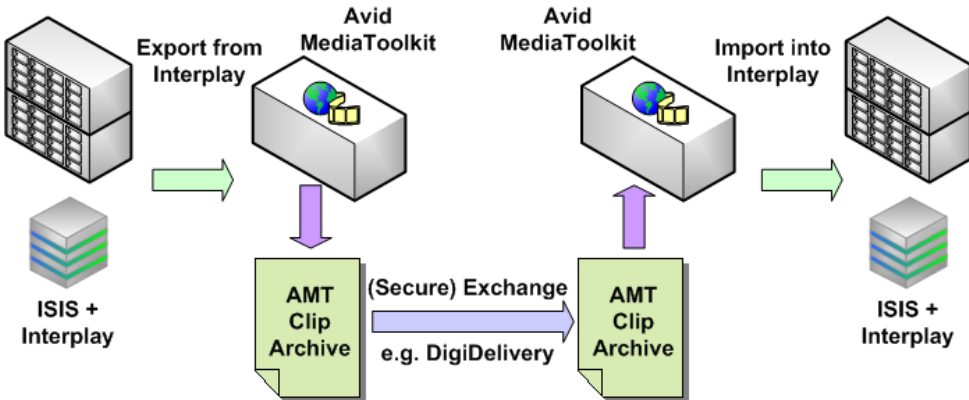
In this instance a third party, or Open Source toolkit has been used to read the essence from an interleaved MXF file. The resulting essence is retained in its native format, e.g. 50Mb/s MPEG-IMX, and the Avid Media Toolkit used to repackage the essence as Avid compatible material, in this case directly to shared storage with the media checked –in to an Interplay workgroup.

Implementing a File Based Ingest Solution



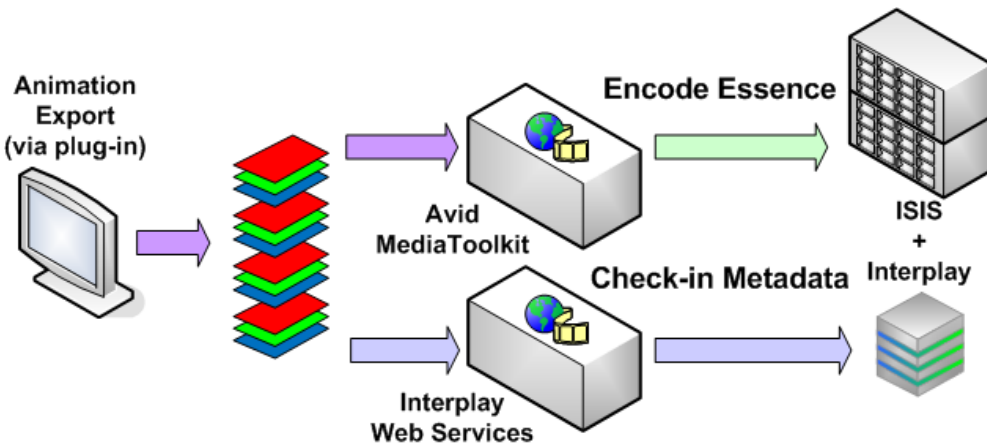
Starting this solution builds on the previous example by using the third party toolkit (or other solution) to extract the metadata which accompanies the incoming files. Through the use of Interplay Web Services calls the metadata is associated with the newly imported AMT clips.

Workgroup Exchange



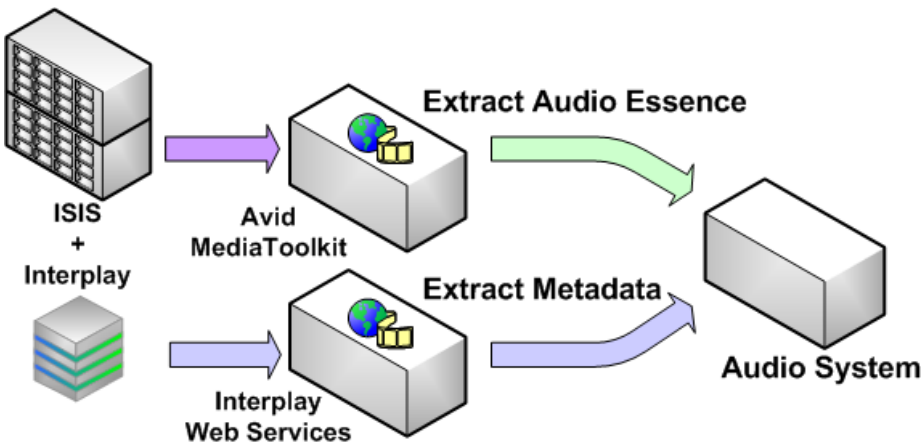
This example utilizes AMT clips packaged as archives. Media is exported from one workgroup and packaged as an archive. The archive can then be sent to a remote system by one of several techniques, that illustrated utilizes the secure delivery afforded by DigiDelivery. At the remote site the archive is imported to the workgroup.

Packaging Animation Sequences as Avid Clips



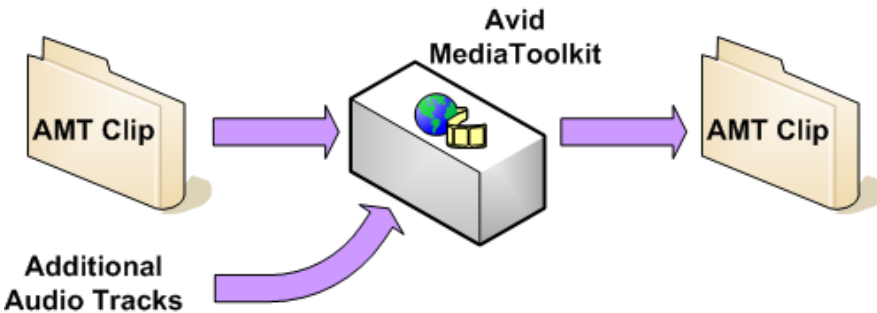
Transferring a sequence of graphics or even scanned film images to an Avid clip is an obvious application for the Avid Media Toolkit. In this example the sequential RGB images create frame samples in the AMT clip, which can also encode them to suit the production workflow (e.g. MPEG-IMX for standard definition operations, Avid DNxHD for HD). Through the addition of a call to Interplay Web Services metadata pertinent to the newly imported clip can also be included.

Obtaining Audio Only Clips for Radio Applications



Particularly in news operations there is frequently the need to exchange audio only material. This is easily achieved using the Avid Media Toolkit as any or all of the media essence tracks are easily accessible.

Adding Additional Language Tracks



Adding additional language tracks to a clip prior to distribution or transmission is a frequent requirement and one that is easily achieved using Avid Media Toolkit. Here the toolkit simply repackages the essence from one clip in another, without making any change to the format of the essence. At the same time additional language audio is added to the target clip. The additional audio could also be supplied as an AMT clip of course. A similar workflow, but without the additional audio tracks, can also be used to provide a transcode function.

Compression Formats Supported in Version 1.5

The following compression formats are currently supported in the Avid MediaToolkit:

- IMX 30
- IMX 40
- IMX 50
- DVCAM
- DVCPro 25
- DVPro 50
- DVPro 100
- DNxHD 1080i 145
- DNxHD 1080i 220
- DNxHD 1080i 220X
- DNxHD 1080p 120
- DNxHD 1080p 185
- DNxHD 1080p 185X
- DNxHD 720p 145
- DNxHD 720p 220
- DNxHD 720p 220X
- DNxHD 1080i 36
- 1:1 (HD codec support only – not able to wrap as MXF)
- VC3 pass-through of all DNxHD formats identified above.
- JFIF
- XDCAM MPEG2 Long GOP 50
- MPEG4 500kbs 59.94i and 50i
- MPEG1Layer2 Audio

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