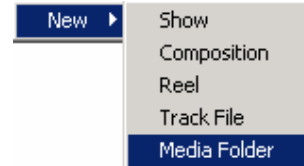# QubeMaster

Brief Description of the Workflow

The QubeMaster system is used to master content for digital cinema distribution. It is essentially a system to go from a *Digital Cinema Distribution Master* (DCDM) to a *Digital Cinema Package* (DCP) as defined by Digital Cinema Initiatives (DCI). The system encodes the media into the selected compression format and encrypts the *Essence* in MXF container files. The *Packing List* and the *Composition Playlist* are stored as signed xml files.

Source picture and sound *Track Files* are digitized into the system or provided as a sequence of image files from an external system. These Track Files are synchronized to each other based on a common Sync Point and In and Out Points are defined to form *Reels.* These Reels are ordered and combined into a *Composition* and one or more Compositions form a *Show.*

Source picture files maybe digitized from a tape deck for non-DCI material. Commonly used tape formats are the Panasonic D5 and the Sony HDCAM and HDCAM SR formats. For digitizing from such tape sources, QubeMaster uses a dual-link HD Input/Output card from Aja. *Machina,* a software application that controls the tape deck and digitizes the media in uncompressed form into the 10-bit Quicktime™ V210 or AVI formats is provided by Aja. A multi-drive SCSI disc array is used to store media as very high storage bandwidth is required for uncompressed HD media.

If the sound accompanies the picture on the tape, this is also simultaneously captured as uncompressed WAV files. Alternatively, audio can be brought in as WAV media from the mix master tape or audio workstation output.

For higher resolution masters from Digital Intermediate sources, QubeMaster can accept sequential picture files in the DPX, CIN (Cineon), TIFF, TGA(Targa) and BMP file formats. DPX and CIN files can be 10-bit log or linear with the log to linear conversion being performed by QubeMaster with user-defined white-point, black-point, gamma and soft-clip parameters.

While a DCDM should ideally be made for every project, this is sometimes not possible due to time and budget constraints and only the *Digital Source Master* (DSM) may be available. QubeMaster has powerful pre-processing capabilities in order to handle such situations. Source images can be cropped, re-sized and borders can be added as necessary to make the image dimensions conform to standards. The software can also perform necessary colour space conversions to and from YCrCb, RGB and XYZ.

The picture and sound source files are dragged and dropped into the QubeMaster application. For image sequences, the first file of the sequence is dropped into the QubeMaster application and this brings up the sequence import dialogue. A new Reel is created and the source picture and sound for this Reel are selected. The Sync Point for the picture and sound are marked in order to synchronize them and the Reel is then played to check sync. The usual procedure to sync picture and sound from different

sources is to utilize the Pop which is a single frame of 1 KHz tone on the audio with a corresponding sync mark on one frame of the picture. The Sync Points of picture or sound can be varied to alter the sync relationship of a Reel as required.

Subtitle files can also be similarly added to each Track. Subtitles are xml files in the TI CineCanvas™ format and must be created in an external application. Qube Cinema has a subtitling application that supports the CineCanvas™ format under development.
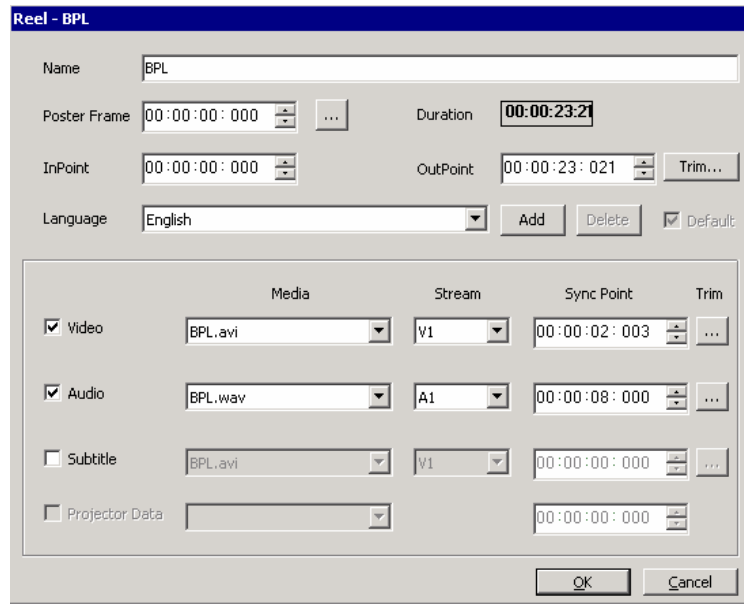
Once picture and sound have been synchronized, the first frame of action and the last frame of action of the Reel are marked. This process is repeated for each Reel that will form the film. Reels in the digital cinema environment are analogous to the reels of a film print.

A new Composition is created and all the required Reels are then ordered to form this Composition. Additional metadata to indicate the type of program, rating, etc. can also be entered at this point.

The Composition created by this process should be played to verify the audio sync and the Reel transitions. Once the Composition has been checked, it can be encoded and encrypted.
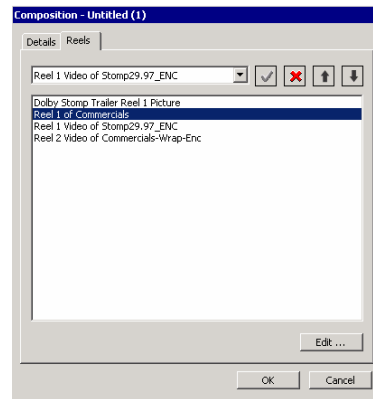
Compositions can be encoded and encrypted in a single step in the QubeMaster application. Various encoding parameters such as the compression format, profile, bit rate, etc. are set at the encoding stage. Commonly used encoder parameters can be saved for later re-use. The encoded media is packaged as *MXF* files with JPEG2000, MPEG-2, Windows Media 9, WAV or other *Essence*. The Composition itself refers to these track files and is an xml playlist file.

Once the Composition is encoded and encrypted, it should once again be played to verify picture quality, audio sync and Reel transitions. After this QC is complete, the Composition can be *Packaged* as a DCP to an external hard disk or network location. DCPs are a set of files that can be ingested by a Digital Cinema Server or Media Block at the theatre.

For all encrypted content, a specific *Key* for the target digital cinema server is necessary. With the *Device Certificate* of the target server, the QubeMaster application can also generate *Key Delivery Messages* or *KDMs* that will allow playback of the content on that specific server for a period defined by the user within the QubeMaster application when creating the KDM.