MARQUISE
TECHNOLOGIES

Application Note

IMF - Interoperable Master Format

Industry Needs

Cinema and broadcast industries are facing a massive explosion of digital productions, now multiplied by the different versions and the various formats and resolutions required for a theater, web or TV screening.

The situation for an international movie release becomes even more challenging when you must consider up to 42 languages (subtitled and dubbed), various edits (Theatrical Cut, Director's Cut, Airline Edits, TV Censor Edits, etc.), various aspects ratios and frame rates.

If the storage and the asset management of all this data is already a bottleneck in today's digital workflow, the exchange of content between service providers and subcontractors has also become problematic.

In 2008 major studios had already defined a concept to solve all of these issues. The result is known today as IMF, Interoperable Master Format.

The Solution: IMF

To be a true solution for the industry, and successfully replace the tape-based workflows, the format of choice must fulfill numerous fundamental requirements.

First, it has to be a single and interchangeable master file format, and be interoperable through existing constrained standards. Second, it must minimize storage, by using mezzanine level compression, and by storing only the differences between an original version and a version file. Additionally the handling of the versioning must be flexible.

IMF has all that and more. Based on the existing and well acknowledged Digital Cinema standard, it is a high quality final master, containing assets (image, audio, subtitling and captioning) and metadata (technical data and playlists), whose aim is clearly B to B exchange: from content owners to service providers, to distributors and multiple final destinations such as: theaters, broadcast, OTT (e.g. Netflix), DVD authoring, mobile devices...
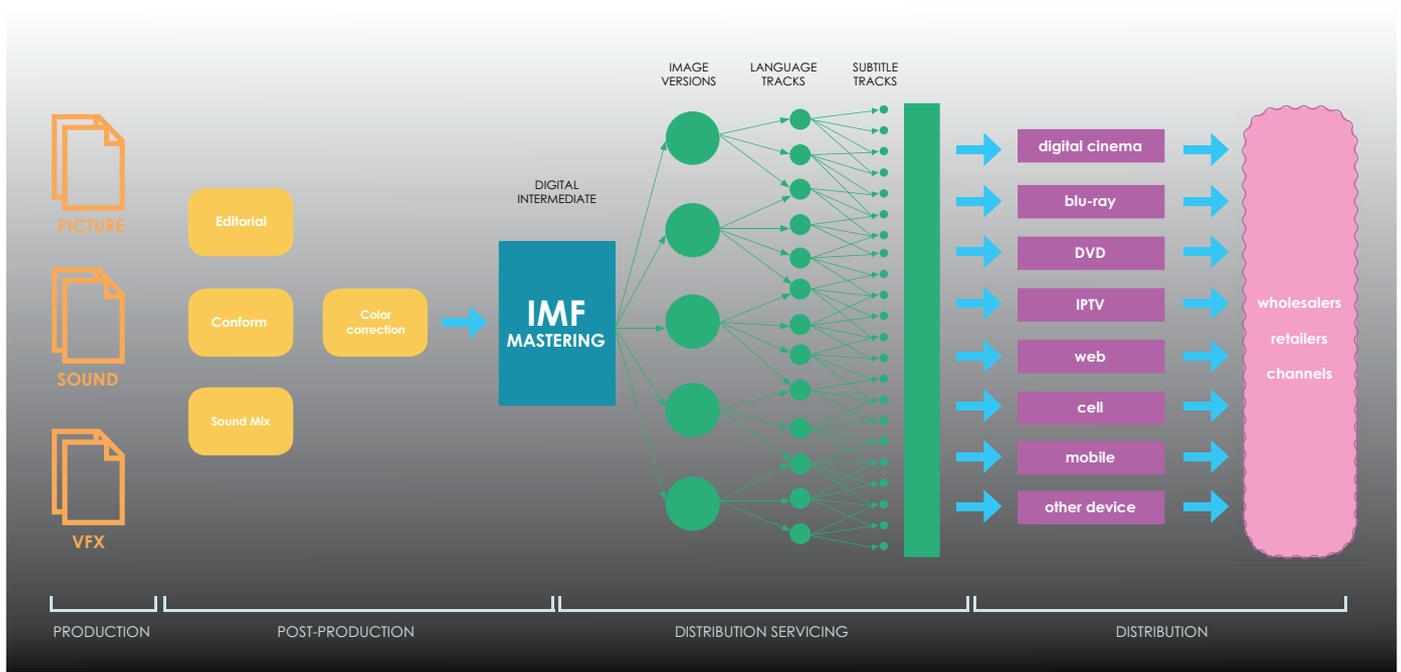

digital content workflow using IMF

The structure of IMF

The IMF structure consists of 5 essentials, encapsulated in an IMP (for Interoperable Master Package):

- the Composition Play List (CPL) which acts as the play list of the content like an Edit Decision List (EDL) would do;
- the track files containing assets and metadata, wrapped in an MXF-AS02 container;
- the Output Profile List (OPL) containing instructions for a further transcoding;
- the Asset Map
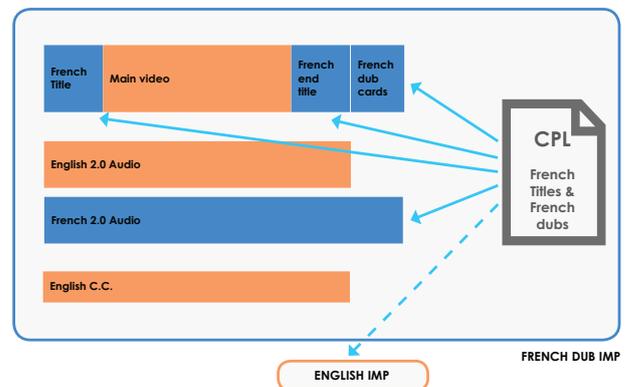- the Packing List for package content inventory.
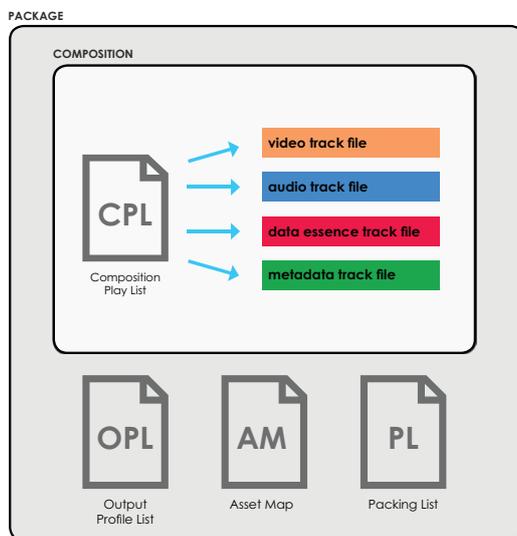
Interoperable Master Package

Versioning

A very strong benefit of IMF is its ability to handle versioning and supplemental packages, especially when they are not mastered at the same time as the original version.

An IMP can contain multiple CPLs (original version, and different language versions), or just a single version CPL, containing only what is different and referring to another IMP enclosed in the original version.

Versioning: French Dub CPL

IMF Core Framework
(metadata, packing, asset management)

APP. #1	APP. #2 Studio Profile	APP. #2e Studio Profile	APP. #3	APP. #4 Cinema Mezzanine
MXF Uncomp. ACES	MXF JPEG2000 Broadcast HD	MXF JPEG2000 IMF profiles UHD/4K HDR	MXF MPEG4 SStP Broadcast HD	MXF JPEG2000 Film up to 8K

Current standardised IMF Applications

IMF's Applications

Originally IMF was not intended to be a final delivery or a distribution format like DCP, it was designed for long term archival applications. However, the industry is already demanding and requiring more from the initial IMF standardization.

Therefore SMPTE has proposed, and is implementing, a modular system based on a Core Framework setting the wrapping constraints and the general parameters, on which different Applications allowing specific functionalities can be applied.

MIST Integration

If the transcoding of assets into an IMP is now clearly standardized (the SMPTE ST 2067 group), and easy to obtain, the battle for an efficient IMF workflow is win on two sides: the flexibility in creating and managing the different versions for a project, and the encoding performance.

The mastering workstation MIST is offering both. The encoding performance is a combination of encoding speed and quality of the result. MIST processes JPEG2000 with hardware acceleration (PCI Express board), allowing up to 3'000 Mbit/s.


MIST Master workstation

Versioning and Supplemental Packages

When it comes to the versioning, several cases may occur. For example a subcontractor receives the original version from another service provider and is in charge of its localization (audio tracks, subtitles, credits, titles, etc) for a foreign language.

In this case he needs to be able to edit and replace some video files, convert their frame rate and apply resolution downsizing, synchronize the new audio tracks, or edit subtitles if there is a mistake.

All these operations can be done on-the-fly only with a mastering system such as MIST. Then the finalized version can be either integrated in the original IMP, or packaged in a second IMP with references to the first one.
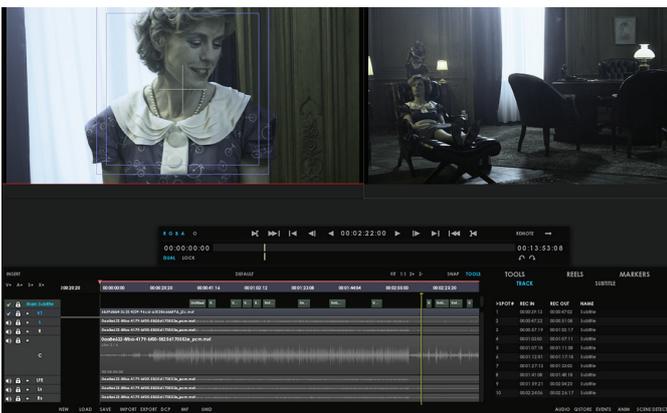
MIST' Time Line

Merging Packages, splits and reductions

Handling of the packages can be challenging due to the complexity of the different file names and their diversity. To help the different processes involved when merging different IMPs, or in the contrary splitting one IMP into several, MIST offers a unique visual interface for creating and modifying versions, the Assembler mode.

The Assembler gives an immediate and understandable overview of a content package: the different assets are displayed in bins for a better overall visualization. The assets can be copied, replaced or moved in one click, and directly packaged into either a supplemental package or in the existing IMP.

MIST' Assembler mode

IMF Deliveries

Another typical business use of IMF is the re-packaging of a master for various distribution purposes. An IMP containing all the available versions is then provided, and MIST is able to recreate all full flat versions, which can then be transcoded for a specific purpose.

A broadcast in UK will require a deliverable in AS-11 DPP, while in web streaming a transcode into H264 or HEVC. These multiple playouts can be described in the IMF's OPLs. MIST manages the OPLs through the Flowgraph, another visual and immediately understandable interface.

MIST' Flowgraph for OPL's render