world screen

Layered Scheme Compression for Digital Cinema
and Cross Media Conversion

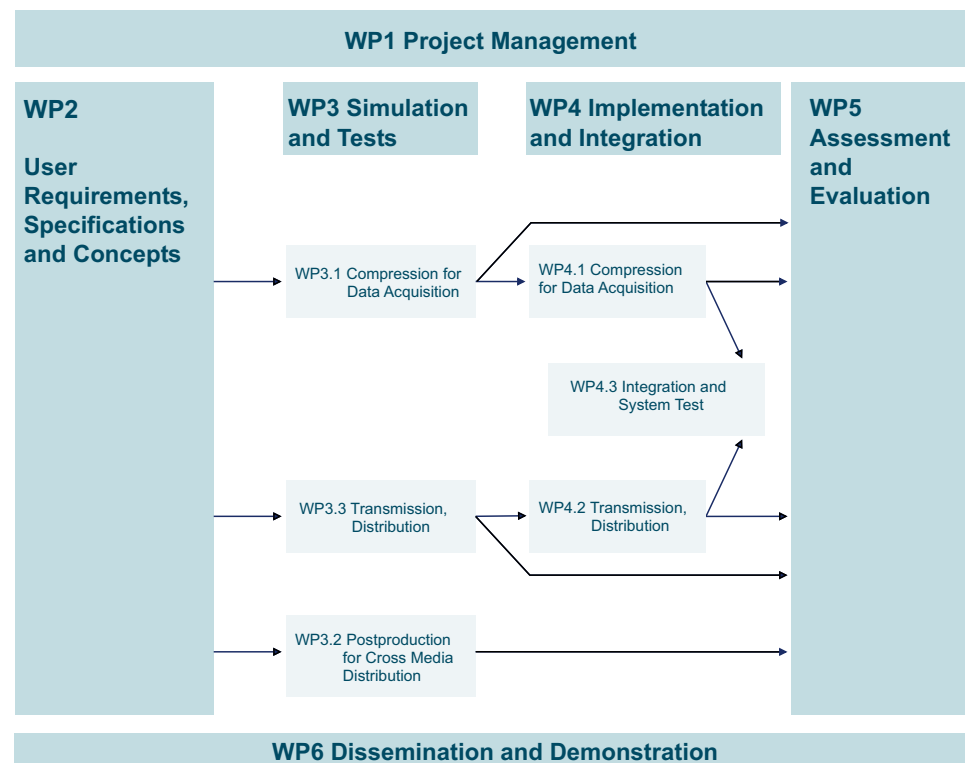# Layered Scheme Compression for Digital Cinema and Cross Media Conversion

Motivation

In the world of Digital Cinema and Digital Media there is still more than one missing-link. A complete and optimized 4k-workflow for Digital Cinema does not exist at the moment. Especially the effective and seamless handling of film data from acquisition to postproduction and transmission is still open. The demands for high quality of Digital Cinema applications lead to huge amounts of data, which still cannot be handled in an adequate manner.

The main focus of the project WORLD-SCREEN is to address these problems by using layered scheme compression (LSC) algorithms while preserving the highest quality possible at the same time.

The goal is to evaluate and develop viable compression systems for Digital Cinema workflows and rich media archives, regarding the usability and technical as well as economical aspects.

Workpackages

WP1 Project Management

WP2 User Requirements, Specifications and Concepts

WP3 Simulation and Tests

WP4 Implementation and Integration

WP5 Assessment and Evaluation

WP3.1 Compression for Data Acquisition

WP4.1 Compression for Data Acquisition

WP4.3 Integration and System Test

WP3.3 Transmission, Distribution

WP4.2 Transmission, Distribution

WP3.2 Postproduction for Cross Media Distribution

WP6 Dissemination and Demonstration

Standardization Activities

The WORLDSCREEN partners are actively contributing to important standardizing activities. They are members or partners of
— EDCF European Digital Cinema Forum
— DCI Digital Cinema Initiative
— ASC American Society of Cinematographers
— SMPTE Society of Motion Picture and Television Engineers W25 (MXF) and DC28 (D-Cinema)
— ISO SC29 WG1 (JPEG) and SC29 WG11 (MPEG)
— AAF Advanced Authoring Format Association

Project Goals

The consortium deals with the evaluation and testing of layered scheme data compression for D-Cinema, E-Cinema and rich media archives. Based on these results, systems and solutions are being developed.
Furthermore economic aspects concerning the value chain for all three areas are constantly accompanying the project.

In detail, following aspects and developments for layered scheme compression will be realized:

— Workflow and meta data models for the entire motion picture production chain using LSC
— Mobile field recorder as storage and playback solution for D-Cinema cameras including a JPEG2000 encoder
— Efficient post production and transcoding methods e.g. also for HD-DVD, TV, streaming from LSC master
— DCI-compliant scalable distribution and decoding system
— Image quality assessment methods for D-Cinema
— Standardization of LSC (intra- and interframe based) for D-Cinema and E-Cinema

JPEG2000: „DCI-Selection" for Digital Cinema

JPEG2000 is an international standard defined by ISO/IEC and chosen for compression of D-Cinema distribution masters by the DCI-Initiative. It is a compression format, based on still image coding without compensating motion between successive frames. JPEG2000 uses wavelet transform for decorrelation. The format supports scalability in terms of SNR (Signal Noise Ratio) quality and resolution.

Focus on Workflow and Metadata

Fundamental work is done to identify user requirements and to specify suited workflows using LSC for D-Cinema and rich media archive applications. The evaluation objectives are to defining a meta data model for these applications and establishing a practical and standardized meta data dictionary to optimize and ensure effective working within the entire digital production chain.

LSC for Digital Acquisition

What is still lacking for „smooth working" on the film set and for completely benefiting from digital technology is a por-table storage media for 2k to 4k digital cameras and film scanners with (near) lossless LSC based coding. A prototype for such a JPEG2000 based field recorder will be specified and implemented. No longer film processing and transfer are necessary. Immediate previews and dailies´ extraction are possible. Direct use in post production without transcoding the material will be realized.

LSC for Post Production

Evaluation is done in respect to the usability of LSC for typical tasks in post production e.g. editing, compositing and color grading. The development of a plug-in for an 2k-JPEG2000-encoder is planned in order to use it for special effects´ composition and editing software. The great advantage of LSC will be to get previews, editing files, VFX, color correction on full resolution or a lower resolution layer out of the same compressed file.

LSC for Distribution

Together with the DCI, tests and specifications were realized for a distribution system with layered scheme compression. This resulted in the DCI specification including JPEG2000. Next step is the implementation of a real-time hardware decoder for JPEG2000 using MXF transport container. The encoder supports various resolution layers and quality levels. Different version in 2k or 4k can be created from a single distribution master.

LSC for Digital Archiving

The usability of LSC for content archiving and archive retrieval is also subject to further evaluation in WORLDSCREEN. The fact that LSC offers the access to different resolutions and qualities from a single copy of the image will be the „trump card" for digital archives.

Image Quality Assessment

For the development partners in WORLDSCREEN a look on compliant assessment methods to evaluate and quantify the quality of image is as important as the development of new systems for the production workflow. Therefore, a specification of methods for the subjective evaluation of image quality in compressed still and motion scenes is developed.
In fact, subjective testing is done during acquisition, post production and exhibition. The results of these tests are ad-ditionally compared with „computable" objective criteria like PSNR.

Test Methods

— Quality Ruler: Method to judge the quality of still images, especially for large quality differences

— Forced Choice Paired Comparison to judge small quality differences

A similar, new image quality assessment method for motion scenes will be developed, called MQR Motion Quality Ruler.

Roadmap

The WORLDSCREEN project is scheduled for a period of two and a half years. The final presentations of systems and results is scheduled for spring 2007.

The WORLDSCREEN Consortium

Ten international reputated research and cine-technology companies are working together to ensure highest quality and comfortable handling of data respecting a smooth integration into existing theatrical motion picture workflows.

Partners:

— Fraunhofer IIS
  Institute for Integrated Circuits
  (Consortium Leader)

— ARRI
— CinemaNet Europe
— Deutsche Telekom
— Digilab Srl.
— FLYING EYE
— Fraunhofer HHI
  Institute for Telecommunications, Heinrich-Hertz-Institute
— KODAK
— MOG Solutions
— Snell&Wilcox
— Warner Bros.

Contact:

WORLDSCREEN
Project Coordination

Dr. Siegfried Foessel
c/o Fraunhofer IIS
Am Wolfsmantel 33
D-91058 Erlangen
Germany

Phone   +49 (0) 91 31/7 76-5 43
Fax   +49 (0) 91 31/7 76-5 88
Email   info@worldscreen.org

www.worldscreen.org

Information Society Technologies

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