Essence (10E)

Co-Chairs: John Snow and Michael Zink

Overview

The scope of the 10E technology committee applies to electronic capture, generation, editing, mastering, archiving, and reproduction of image, audio, subtitles, captions, and any other master elements required for distribution across multiple applications.

Organization

The committee is organized into drafting groups (DGs) and study groups (SGs) covering specific tasks and areas of activity. Typically, more than 20 projects have been active throughout the year. All project groups report directly to the technology committee.

Recent Publications

Over the past 12 months, 10E has published the following engineering documents and registered disclosure documents:

- ST 2080-3:2017 Reference Viewing Environment for Evaluation of HDTV Images
- ST 2073-1:2017 VC-5 Video Essence—Part 1: Elementary Bitstream
- ST 2042-1:2017 VC-2 Video Compression
- ST 2100-1:2017 Definition and Representation of Haptic-Tactile Essence for Broadcast Production Applications
- RP 2047-5:2017 VC-2 Level 66 Compression of Ultrahigh-definition (UHD) Video Sources for use with a High-Definition Infrastructure
- RDD 32:2017 XAVCTM Material Exchange Format (MXF) Mapping and Operating Points
- ST 2042-2:2017 VC-2 Level Definitions
- RP 2073-2:2017 VC-5 Video Essence—Part 2: Conformance Specification
- ST 2073-5:2015 VC-5 Video Essence—Part 5: Layers
- ST 2073-6:2015 VC-5 Video Essence—Part 6: Sections
- OV 2073-0:2018 VC-5 Video Essence—Part 0. Document Roadmap
- RP 2047-5 Am1:2018 VC-2 Level 66 Compression of UHD Video Sources for Use with a High Definition Infrastructure—Amendment 1
- ST 2086:2018 Mastering Display Color Volume Metadata Supporting High Luminance and Wide Color Gamut Images

Digital Object Identifier 10.5594/JMI.2018.2850380
Date of publication: 21 August 2018

Work in Progress

VC-2 Video Compression

VC-2 mezzanine video compression is based on the BBC's DIRAC pro. There are four VC-2 projects in 10E with the following status:

- SMPTE ST 2042-1 VC-2 Video Compression (Published)
- Revision of SMPTE ST 2042-2 VC-2 Level Definitions (Published)
- Revision of SMPTE RP 2042-3 Conformance (In progress)
- Amendment of SMPTE RP 2047-5 VC-2 Level 66 Compression of Ultrahigh-definition Video Sources for use with a High-Definition Infrastructure (Published)

All parts have been published, and a revision for RP 2042-3 Conformance is in progress.

VC-5 Video Essence

VC-5 is based on the Cineform/GoPro video compression system. The document suite comprises:

- Part 0—VC-5 Overview (Published)
- Part 1—VC-5 Elementary Bitstream (Published)
- Part 2—VC-5 Conformance Specification (Published)
- Part 3—VC-5 Image Formats (Published)
- Part 4—VC-5 Subsampled Color Difference Components (Published)
- Part 5—Layers (extensions to support the representation of multiple images in a single VC-5 bitstream) (Published)
- Part 6—Sections (a mechanism for implementing special functions without disturbing standard decoders) (Published)
- Part 7—Metadata (In progress)

All parts have been published, including the Part 0 (Overview), except for Part 7 on embedded metadata, which is in progress.

Reference Display and Environment for Critical Viewing of Television Pictures

This project group is developing a suite of documents dealing with the use of fixed pixel matrix reference displays. This is currently planned to consist of the following:

- ST 2080-1: Reference White Luminance Level and Chromaticity (Published, and currently in revision)
- RP 2080-2: Measurement and Calibration Procedure for HDTV Displays (Published, and currently in revision)
- ST 2080-3: Reference Viewing Environment for Evaluation of HDTV Images (Published)

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- ST 2080-x: Reference Display Characteristics (On hold)
- RP 2080-4: Measurement Procedures for Evaluation of HDTV Displays (In process)
- EG 2080-x: Engineering Guideline to provide context and background (On hold)

With the publication of ST 2080-3, "Reference Viewing Environment for Evaluation of HDTV Images," work is concentrating on RP 2080-4, "Measurement Procedures for Evaluation of HDTV Displays."

Dynamic Metadata for Color Transforms of HDR and WCG Images

A revision of the ST 2094-40 document is necessary and a project has been started.

Television Lighting Consistency Index

Work continues on the drafting of RP 2093, "Lighting Consistency," to define the measurement procedure for assessing the colorimetric quality of lighting when used in television production.

Coding of Tactile Essence

This project provides an essence technology to allow a remote viewer to receive and experience the haptic or tactile "feeling" and "impact" of a live event, regardless of the transmission means. The standard ST 2100-1, "Definition and Representation of Haptic-Tactile Essence," is published.

Revision of ST 2086 Mastering Display Color Volume Metadata Supporting High Luminance and Wide Color Gamut Images

The work on a revision of this standard was finalized and the document ST 2086:2018 Mastering Display Color Volume Metadata Supporting High Luminance and Wide Color Gamut Images was published.

P3 Colorimetry

This project will produce a normative reference standard or recommended practice(s) for the colorimetric attributes of P3 using chromaticity coordinates and unique metadata identifiers for the combination of P3 color primaries and common white points for use in metadata structures associated with RGB streaming or file formats. The ST 2113 document is currently going through the ballot process.

Free Scale Gamut and Free Scale Log Characteristics of Camera Systems

Professional camera signals are characterized with image sensor color gamut and logarithmic transfer functions. This project is to develop a new standard ST 2115 to specify the general application of Free Scale Gamut (FS-Gamut) and FS logarithmic (FS-Log) transfer characteristics for cameras used in broadcast production. It also specifies specific parameter values for FS-Gamut and FS-Log, and associated transfer characteristics for professional cameras that make use of FS-Gamut and FS-Log.

AR/VR Study Group

The 10E augmented reality (AR)/virtual reality (VR) SG was formed to study the current and projected approaches to capture and post produce images and the sound to create a distribution master for VR and AR distribution and display systems, and where possible recommend potential areas for standardization. The initial work has focused on defining the scope of the report, identifying relevant industry reports that have already documented aspects of the AR/VR ecosystem that may be valuable as a reference and creating an outline of the relative topics to be included in the report.

VC-6 Picture Compression

The VC-6 project is introducing a new type of compression codec that uses a novel tree structure to reduce bitrates. The DG is progressing well and receiving excellent help from the VC-5 experts who have mostly completed their standardization work. Introducing the new nomenclature and concepts in a clear and concise fashion is the current focus of the work.

About the Authors

John F. Snow represents Cobalt Digital, where he is a senior FPGA architect. He began his career at Evans and Sutherland Computer Corporation, where he held various positions including director of engineering over a 19-year period. In 2001, he joined Xilinx, Inc. as a video architect and was responsible for the development of SDI and other audio and video interfaces for Xilinx FPGA devices. Snow holds a BSc degree in electrical engineering from Brigham Young University and is a Senior Member of the IEEE. He holds two patents related to high-speed serial interfaces. He has been an active member of the SMPTE Standards Community for over ten years, was a co-chair of the 32NF committee for five years, and now serves as a co-chair of the 10E committee and as a standards director.

Michael Zink is Vice President of Technology at Warner Bros. (WB), where he is responsible for exploring emerging technologies to enhance WB's capabilities for production, post-production, and distribution. This includes assessing new technologies; and assisting with the setup and integration of digital workflows. He also participates in several standards associations, including BDA, Consumer Technology Association, Digital Cinema Initiatives, SMPTE, among others; and also serves as a chairman for the UHD Alliance. Before joining Warner Bros. in 2014, he worked at

Technicolor for more than ten years, most recently as vice president of Technology Strategy, where he was responsible for launching the production efforts around various new optical disc formats. Additionally, he was responsible for the promotion and adoption of Technicolor technology solutions within industry groups. Earlier in his career, he worked for several media production facilities in Germany.

Film Applications (20F)

Co-Chairs: Dave Schnuelle and John C. Miller

Overview

This Committee supports all aspects of film and its applications including general audio and projection cinema presentation.

Organization

The work of the 20F committee has been organized into broad-based working groups (WGs), each maintaining their specific application with recommendations to 20F for action. Most standards are mature, and many have been made stable.

TC-20F.10 Film Production Technology (Chair: John C. Miller)

Dimensional specifications for cutting, perforating, and identification of motion picture films and components. This includes camera use, original image areas, sound application areas, and interchangeability.

TC-20F.20 Laboratory Services (Chair: Michel Golitzinsky)

All phases of laboratory services include preparation, processing, and duplication of motion pictures.

TC-20F.30 Audio Technology (Chair: Ioan Allen)

The production, processing, recording, reproduction, distribution, and presentation of sound records for motion picture systems, including the mechanisms and practices relating to acoustic issues for audio presentation of all media in screening rooms and commercial theaters.

TC-20F.40 Theatrical Projection (Chair: Jess Daily)

Nontelevision presentation of motion pictures, including specifications for image areas intended for projection and image measurement practices for theatrical presentation. Also included are dimensions for projection reels and containers, and print identification and leaders.

Our last Plenary was held on 24 April 2018, and the next will be at the SMPTE Fall Conference.

Work in Progress

The DG for the on-screen light measurement is chaired by Dave Schnuelle. Matt Cowan is the document editor. The pre-FCD review has been completed, and final edits are being made prior to FCD ballot.

RP 200—Relative and Absolute Sound Pressure Levels for Motion–Picture Multichannel Sound Systems. This 20F.30 document is under revision. Julian Pinn is chairing this effort and is the document editor. This revision is to accommodate industry practice with new object-based sound systems. To offer a minor revision of the provisions that define the level relationships between surround channels and the reference level in object-based immersive sound systems to bring the document in line with modern practice.

The 20F committee will move efforts forward to have SMPTE maintain the availability of certain test films based on importance to the industry.

These test films are vital to supporting motion picture film audio and projection in the future. We have an institute interested in helping produce test films. The committee has drafted an initial list of critical films and will solicit the Board of Governors for support of this effort.

Our 2017 five-year review process resulted in ten documents being made stable, and one document reaffirmed.

EG 9-2005, Audio Recording Reference Level for Post-Production of Motion Picture Related Materials has been withdrawn.

The IEEE digital library has been corrected and is up to date, and 206 documents were verified in this process.

New Items of work

RP 141—Background Acoustic Noise Levels in Theaters and Review Rooms

Ioan Allen will work with Neil Shaw to make a revision and to update to the current nomenclature and industry practice.

About the Authors

Dave Schnuelle is the Vice President of Technology for Dolby Laboratories, where he is responsible for guidance and outreach in Dolby's efforts in both the digital cinema and consumer imaging areas. At Dolby, he has received awards for the development of the Dolby Professional Reference Monitor and the Dolby 3D stereoscopic cinema system. Prior to joining the Dolby Laboratories, he was the director of technology for Lucasfilm Ltd.'s THX Division, where he established the THX Digital Mastering Program for quality assurance of home video masters and duplicated software, and designed the international digital cinema exhibition of the new *Star Wars* movies—Episodes 1 and 2. He has received five patents for his work during that period, and is active in image technology research and the perception of images. He participates in several standards organizations—SMPTE for image characteristics and interface standards, IEC TC100 and TC110 for display standards, and is the U.S. National Committee Chair for ISO TC36 on cinema technology. He is a Fellow of SMPTE, and a member of The Academy of Motion Picture Arts and Sciences.

John C. Miller is a technical support specialist in the Consumer and Film Division of Eastman Kodak Company. He has 40 years of experience with motion picture films. He started his career in film manufacturing, where he quickly moved into process and product quality. His work contributed to the introduction of "Keykode" barcode print as seen on the edge of Kodak motion picture films, which dramatically simplified film editing for the industry. Miller also participated on many film product development teams including the Kodak "Vision" family of films. He has been active in SMPTE standards work since 2003, and has chaired the 20F.10 Film Production Technology working group since 2005. He became an SMPTE Fellow in 2008. He is also active in ISO TC36 Cinematography standards work.

Digital Cinema (21DC)

Co-Chairs: Dean Bullock and Chis Witham

Overview

The scope of 21DC technology committee applies to the application of mastered essence to theatrical digital distribution, including compression, encryption, wrapping, marking, packaging, media, logging, playout, projection, reproduction, and related topics.

Organization

The 21DC technology committee is currently working on active projects in five subgroups in addition to work that reports directly to the technology committee.

Work Report

Digital Cinema Stereoscopic Subtitling

Work on subtitles for D-Cinema has been conducted in the 21DC AHG Stereo Subtitling DG chaired by Jean-Philippe Violet. Pending final procedural steps for ST 492-2, this work has completed. The completed work includes a revision of ST 429-5, a revision of ST 429-2, and the new ST 429-17 XML Constraints standard.

FLM and FLM-X

Work on facility list message (FLM) and FLM exchange (FLM-X) has been conducted in the TC-21DC FLM-X DG chaired by Chris Witham. This paper is completed and resulted in the publication of two new documents and the withdrawal of one document. Newly published, ST 430-15 FLM-X Protocol, defines a standard for exchanging facility records standardized in the newly published ST 430-16 Extended FLM. During the course of the work, the members withdrew from publication ST 430-7 FLM. ST 430-16 should be used instead of ST 430-7.

21DC Support for IMF

The 21DC technology committee has completed two projects in support of the Interoperable Master Format (IMF) work in the 35PM Technology Committee. ST 429-6 has been amended to allow it to be normatively referenced by the IMF document suite. Changes to ST 429-5 were published as part of the stereoscopic subtitle work. Future work for IMF includes similar modifications to ST 429-8.

21DC Support for Immersive Audio in Digital Cinema

Work on the following four projects is conducted in the TC-21DC DG Immersive Audio DG chaired by Steve Lamb and previously chaired by Florien Schleich. The members are working to define DC standards to support the use of the new immersive audio essence format defined in the Cinema Sound Systems (25CSS) technology committee. In addition to the work in the DG, a project is under way to revise RDD 29.

21DC DCP Operational Constraints for Immersive Audio

The scope of this project is to define all necessary constraints for a Digital Cinema Package (DCP) that carries ST 2098-2 essence. This paper includes, for example, constraints on ST 2098-2 essence, as well as Composition Playlist (CPL) requirements, the usage and requirements of an ST 430-12 frequent shift keying (FSK) sync track, CPL metadata, and any other constraints required. The final document will reference ST 429-2 as needed and will not redefine any constraints that are already defined by ST 429-2.

21DC Immersive Audio Track File

The scope of this paper is to create one or more standards that define the D-Cinema track file that will wrap immersive audio essence defined by ST 2098-2. This project is tightly coupled with the 21DC DCP Operational Constraints for Immersive Audio project.

21DC KDM Amendment for Immersive Audio

The scope of this paper is to amend ST 430-1 to include a new Key Type and a new Forensic Flag to be used when creating Key Delivery Messages (KDMs) containing encryption keys for the track file standard defined in the 21DC Immersive Audio Track File project.

21DC ST 430-12 FSK Sync Amendment

The scope of this paper is to amend ST 430-12 to add a definition for an associated Universal Label (UL) and Label for the FSK sync signal. This will allow the FSK sync signal to be identified by the MCA framework defined in ST 429-2.

Standards for Interoperability of Digital Cinema SMS and OMB

Work on the following two projects is conducted in the TC-21DC DG Screen Management Servers (SMS) Outboard Media Blocks (OMB) Comm. DG chaired by Brian Claypool. The members are working to define standards

that allow for interoperability between DC SMS and OMB. The work is focused on supporting the specific case of an OMB implementation of an immersive audio decoder.

21DC SMS OMB Comm. Reference RP

This project will document potential ambiguities and issues when implementing ST 430-14 and ST 430-10 for transfer and synchronization of Immersive Audio Track File data and detail steps to resolve any ambiguities when ST 430-14 is used to convey the ST 2098-2 bitstream from the SMS to the OMB and to synchronize its playback between the IMB and the OMB. It will also resolve any nomenclature that needs to be added specifically for object-based audio essence, sometimes known as immersive audio.

21DC SMS OMB Comm. Protocol

This project will document an interoperable communications protocol and syntax between an SMS and OMB. Standard commands may include but are not limited to: Key-Length-Value (KLV) syntax definitions, KDM exchange, device identification, error messages, secure log retrieval, and system status messages.

Digital Cinema Frame Rates

Work on the following three projects is conducted in the TC-21DC DG Frame Rates DG chaired by Peter Wilson and is directed by the TC-21DC WG Integration of D-Cinema Additional Frame Rate Documents WG chaired by Kommer Kleijn. The members of the groups are working to integrate the Additional Frame Rate standards into the base standards that they extend.

21DC ST 428-1 Revision—Frame Rate Integration

The scope of this project is to integrate ST 428-11 Additional Frame Rates for D-Cinema into ST 428-1 D-Cinema distribution master—Image Characteristics.

21DC ST 429-4 Revision—Frame Rate Integration

The scope of this paper is to update the Joint Photographic Experts Group (JPEG) reference in ST 429-4 D-Cinema packaging—MXF JPEG 2000 Application to the latest version to allow for additional frame rates.

21DC ST 429-2 Revision—Frame Rate Integration

The scope of this project is to integrate ST 429-13 D-Cinema packaging—additional frame rates for DCP Operational Constraints into ST 429-2 D-Cinema packaging—DCP Operational Constraints.

About the Authors

Dean Bullock has been working in the cinema industry since joining Dolby Laboratories in 1996, as an embedded systems engineer working on the Dolby D-Cinema processor product line. As an engineering director, he led Dolby's Digital Cinema engineering team and then the cinema engineering quality assurance group. Currently, he is the director of technology strategy for Dolby's Cinema Group. He has worked to implement SMPTE and other standards since starting at Dolby, and since 2009, he has been actively participating in SMPTE committees. He holds a BS in computer and electrical engineering from Purdue University.

Chris Witham has been involved in many aspects of post-production since 1986. Witham was a chief engineer at Technicolor Video Services and Vidfilm International Digital. He launched D-Cinema mastering operations at Technicolor before moving on to head mastering operations at Ascent Media and Deluxe Digital Cinema. He is presently the director of emerging technology at The Walt Disney Studios.

Television and Broadband Media (24TB)

Chair: Michael A. Dolan

Overview

The 24TB technology committee covers the application of mastered essence for television and broadband distribution (both separately and for hybrid television/broadband environments), including compression, encryption, wrapping, marking, packaging, media, tracking/control, presentation, reproduction, and related topics.

Organization

The current work is organized as individual projects, and project-oriented DGs.

Work in Progress

Lip Sync Standards and Practices DG (Chair: Paul Briscoe)

This project is developing standards to enable distribution systems to keep video and audio tracks time synchronized. This technically difficult but important industry project previously completed its work on its core standards: Fingerprint Generation (Part 1) and Fingerprint Stream Transport (Part 2), which includes Vertical Ancillary Data (VANC) in SDI/HD-SDI, Internet Protocol (IP), and Motion Picture Experts Group (MPEG) Transport. Those documents are undergoing their one-year review. Work is nearing ballot on a companion Engineering Guideline.

Open ID Binding (Chair: Chris Lennon)

The standards in this project define an open binding technology standard (e.g., watermarks, fingerprints, metadata sidecars, etc.) for embedding persistent content

identifiers into audio/video essence in a way that survives compression and distribution through the supply chain. After two RFPs and evaluation of responses, the selected technology is nearing conclusion in the form of various SMPTE publications. The following have been published: ST 2112-10:2018, "Open Binding of Content Identifiers (OBID)," SMPTE RP 2112-11:2018, "Open Binding of Content Identifiers (OBID)—Conformance Test Materials," SMPTE ST 2112-20:2018, "Open Binding of Distribution Channel IDs and Timestamps (OBID-TLC)," and SMPTE RP 2112-21:2018, "Open Binding of Distribution Channel IDs and Timestamps (OBID-TLC)—Conformance Test Materials." Undergoing balloting at this writing and expected to publish shortly are: SMPTE RP2112-1, "Audience Measurement Using OBID and OBID-TLC" and SMPTE EG 2112-2, "Audience Measurement Ecosystem."

AFD Revision (Chair: Bill Miller)

This is a maintenance revision of ST 2016-3:2009, "Format for Active Format Description and Bar Data" to add support for UHD formats. Liaisons are being exchanged with the Advanced System Television Committee, Consumer Technology Association, and Digital Video Broadcasting. Past investigation is focused on the impact of defining some previously reserved bits. This activity has spawned discussion about older formats using interface standard line numbering starting at "1" and newer formats using image line numbering starting at "0" which may result in a new project to sort this out.

About the Author

Michael A. Dolan is a founder and the president of Television Broadcast Technology, providing specialized professional encoders, test tools, and technical consulting in the field of digital television and internet media. He holds a BSEE degree from Virginia Tech 1979 and has worked for and founded various leading-edge computer graphics and realtime systems companies since then, including early foundational work in World Wide Web Consortium (W3C) technology and analog data broadcasting. He has been involved in digital television engineering for many years, including data broadcast system architecture, digital receiver design and compliance. In addition to chairing the SMPTE Committee on Television and Broadband (24TB), he also chairs the Advanced System Television Committee (ATSC) Technology Group 1 (TG1) and a TG3 group on DASH. He is the U.S. Head of Delegation for IEC TC100, and is an active representative in ISO/Motion Picture Experts Group, Consumer Technology Association (CTA), and W3C. He was part of SMPTE and W3C teams awarded a Technical Emmy in 2016 for closed captioning, is an SMPTE Fellow, and a former SMPTE Governor for the Hollywood Region. He is a recipient of the ATSC Bernard J. Lechner Award, and the CTA Technology Leadership Award. Dolan is also a recipient of the SMPTE Excellence in Standards Award. He has authored the SMPTE Journal Almanac column for over 15 years, is a coauthor of a foundational textbook, *Data Broadcasting*, and holds several patents in computer web technology.

Cinema Sound Systems (25CSS)

Co-Chairs: Brian Long and Bill Redmann

Overview

The TC-25CSS technology committee is addressing new standards for cinema sound and the interoperability of immersive sound systems in D-Cinema. Topics include measurement techniques, calibration specifications, sound system architecture and performance, theater acoustics, immersive audio, and immersive sound systems. The overall goal is to improve the quality and consistency of sound in cinema spaces while improving the efficiency and interoperability of audio delivered to theaters.

Project Plan

The TC-25CSS project plan is as follows:

1) Optimize and codify current best cinema sound practices.
2) Lay the groundwork for new standards.
3) Ensure interoperability among sound systems.
4) Set a higher bar by creating new standards, recommended practices, and engineering guidelines.
5) Set the stage for the future.

Recent Projects

Immersive Sound Model and Bitstream Drafting Group (Chair: Pete Ludé)

The additional theatrical audio channels and sound field groups used in immersive audio, that is, those beyond the "common" ones found in digital cinema's ST 428-12, are specified in ST 2098-5, published in February 2018.

The metadata necessary to describe an immersive audio composition using these audio channels and sound field groups are specified in ST 2098-1. The bitstream for representation of an immersive audio composition in cinemas is specified in ST 2098-2. Both will have been published by August 2018.

Work in Progress

Interoperability of Immersive Sound Systems in Digital Cinema Working Group (Chair: Pete Ludé)

For the past four years, work addressing the interoperability of immersive sound systems in D-Cinema has proceeded responsive to the recommendations detailed in the

Immersive Audio SG report and requests from DCI and North Atlantic Treaty Organization (NATO).

For the past two years, this work has focused on a precise description of a single, interoperable bitstream. This is to alleviate the existing situation, where each brand of immersive audio mixing tool has its own proprietary audio format, requiring content providers to mix and deliver a specific audio format for each immersive sound system. Additionally, the present-day immersive sound systems each have proprietary methods for packaging and moving immersive audio data within the D-Cinema architecture. Even their sound calibration schemes are different. Each of these details is being addressed to ensure the true interoperability of immersive audio and immersive sound systems.

The anticipated result will be the ST 2098 suite of documents to specify all aspects of bitstream and the corresponding renderer behaviors, and ancillary engineering documents relating to content packaging, management, and auditorium calibration, as necessary to achieve the immersive sound system interoperability.

Immersive Sound Model and Bitstream Drafting Group (Chair: Pete Ludé)

This DG has created ST 2098-1 to describe an audio object model with common metadata schema, which was fundamental to the work on ST 2098-2, standardizing a single delivery bitstream to carry audio with this metadata for use by any immersive audio renderer and immersive sound system. This standardized bitstream will allow the interoperable creation and delivery of immersive audio soundtracks as well as foster a healthy market of D-Cinema equipment that can create and utilize it. Both will have been published by August 2018.

Immersive Audio Renderer Drafting Group (Chair: Scott Smyers)

An immersive audio renderer is the key audio processor that determines how audio objects and channels are reproduced in the sound system and speakers that are in a given playback theater and thus is key to translate the audio from the mixing theater to the exhibition theater. This DG is working on EG 2098-3, which defines the expected behavior of an immersive audio renderer and RP 2098-4, which describes how to test that a renderer's responses to a particular immersive audio metadata are the expected ones. Both documents are largely complete as of January 2018, but await harmonization following the finalization of ST 2098-2.

Immersive Audio Implementation Study Group (Chairs: Sven Mevissen and Brian Claypool)

This group concluded its examination of what implementation points had to be addressed in order to utilize the ST 2098-2 bitstream in a common DCP that can be played in any immersive audio equipped theater. The group recommended several projects, all presently under way, with the goal of producing the necessary engineering documents, including standards for the packaging of bitstream track files, their integration into CPLs and DCPs, secure communication of immersive audio content among the devices of the DC architecture, and calibration of the immersive audio B-chain. These additional engineering documents are being crafted in TC-21DC and TC-20F. The SG also reported on test materials and plugfests appropriate for interoperability.

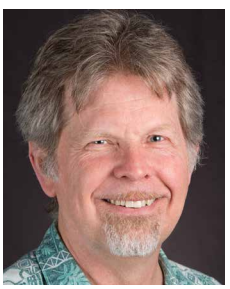
Looking Forward

The Technology Committee is busy with projects that are designed to bring the cinema sound industry up to date, with a focus on interoperability. A project to integrate ST 2098-2 into IMF is expected. Now under discussion are candidate projects, including: (1) cinema sound system performance parameters, (2) cinema acoustics standards, and (3) immersive sound system measurement and calibration methodology.

It is an exciting time for cinema sound, which is enjoying higher visibility than in many years. The standards that TC-25CSS is creating will play an important part in fostering the delivery of quality sound to the ears of appreciative moviegoers.

About the Authors

Brian Long has more than 20 years of experience in professional audio and a diverse and extensive knowledge regarding the design and implementation of infrastructure for sound reinforcement and playback systems for all types of scenarios ranging from simple single speaker events to massive show spectaculars and multichannel media presentations. He holds an MFA degree from the University of Southern California School of Cinematic Arts. He spent a number of years at Meyer Sound in systems design support along with product development and implementation. Currently, he is a member of the engineering team at Skywalker Sound.



Bill Redmann attended the University of California at Los Angeles, while working at Universal Studios as a special effects propmaker, and graduated with an ME degree, specializing in computer architecture and Artificial Intelligence. Rolling into Walt Disney Imagineering, he worked on interactive theme park attractions for cumulatively over a dozen years, including VR attractions that opened in 1998 and ran for almost 20 years.

At Technicolor, another dozen years was initially directed to digital cinema, but more recently working on the standardization of HDR technologies and, again VR. In the category of "missed it by that much," his 55th U.S. patent issued in June and was number 10,000,128.

Metadata and Registers (30MR)

Co-Chairs: John Hurst and Michael DeValue

The application of the general scope as it applies to definition and implementation of the SMPTE Registration Authority used to identify digital assets and associated metadata. Additionally, the common definition of metadata semantic meaning across multiple committees.

Topic: TC-30MR Documents Published in the Last Quarter

The second edition of the new XML-based Registers is available online at: https://smpte-ra.org/smpte-metadata-registry

ST 2102: SMPTE Core Metadata Set

Revision ST 336: Data Encoding Protocol Using Key-Length-Value

DG Project: ST 330 Revision

This project will produce an updated version of ST 330, titled "Unique Material Identifier (UMID)," based on the recommendation of "Study Report on UMID Applications Part 2-2" created by the TC-30MR SG UMID Applications. Specifically, it additionally defines new methods for the generation of UMID material and instance numbers. It also specifies an extension of the Source Pack to accommodate a shooting direction of a camera in addition to its position information.

Status: The group is working toward a Working Draft.

Topic: SMPTE-Core

DG Project: New Standard ST 2102: SMPTE Core Metadata Set

This group's scope is to define an interoperable minimum core set of descriptive metadata for professional motion imaging applications and users. The existing SMPTE metadata is application specific and is not supported right through media workflows.

Status: Published.

Business Impact: Potential foundation for descriptive Metadata.

DG Project: Draft ST 2088: SMPTE Essence Element Key Register Structure

This project creates a controlling standard for SMPTE ULs used as essence keys in MXF standards.

Status: The project is resolving FCD comments.

Business Impact: Completes the set of SMPTE UL Registers.

DG Project: Revision ST 336: Data Encoding Protocol Using Key-Length-Value

Revise ST 336 to update references and review whether its provisions reflect current register operation.

Status: The document has been published.

DG Project: Revision ST 335: Metadata Element Dictionary Structure

An error was introduced that was not present in previously published versions, and is in conflict with other standards.

Status: The document has passed FCD without comment.

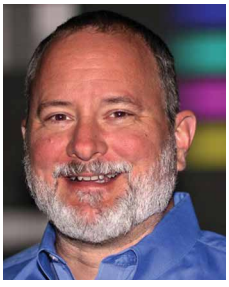
WG Project: Metadata Definition

This WG (30MR10) coordinates a number of DG projects for adding or maintaining metadata items in registers. The registers are updated frequently to maintain accuracy as new Engineering Documents are published. As the project matures, the group is projecting twice-yearly publication.

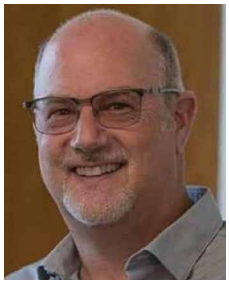
Status: Edition 2 of the XML registers "Brown Sauce" was published in July of last year. Edition 3 "Ponzu" is currently in FCD ballot. Edition 4 "Tabasco" is currently collecting new entries.

Business Impact: Interoperable MXF dictionaries offer a vastly improved environment for a new generation of interoperable, table-driven MXF parsers, and generators. Projects such as IMF will be able to rapidly introduce new capabilities with a minimum of interoperability issues.

About the Authors



John Hurst is co-founder and chief technology officer at CineCert, LLC, an internationally recognized developer of digital cinema technology. Hurst has more than 30 years of experience in entertainment technology, at first in the practical application of recording and post-production, then later following his interests in product development. He has been involved in developing technologies for D-Cinema since 2000. Under his direction, CineCert has produced several benchmark D-Cinema projects, among them the Waimea KDM authoring system, the DCI Compliance Test Plan, and the open source AS-DCP file access library. Hurst has developed many SMPTE standards for D-Cinema. He is a SMPTE Fellow.



Michael DeValue is Director of Technology Standards & Strategy at the Walt Disney Studios where he provides oversight and strategy for all standards efforts across the studio, including those related to the deployment of new technologies, such as 3D and high dynamic range (HDR). He has been an active participant in SMPTE since 2008, having chaired or co-chaired several standards groups within SMPTE. He is a current member of the Board of Governors and served as a SMPTE Education Director from 2014 to 2016. In addition to his standards work at SMPTE, DeValue has served as the Chair of the Digital Cinema Initiatives Technical Committee and served as the Chairman of the Advanced Imaging Society. He is also a member of the Board of Directors of the Blu-ray Disc Association, where he has chaired several technical committees and acted as liaison to MPEG, HDMI Forum, and the CTA.

File Format and Systems (31FS)

Co-Chairs: Paul Gardiner and Fred Walls

Overview

The 31FS technology committee concerns itself with File Formats and Structures. This applies to the definition of common wrapper and file structures for storage, transmission, and use in the carriage of all forms of digital content components. Well-known formats such as Digital Picture eXchange (DPX), MXF, GXF, Academy Color Encoding System (ACES) and ProRes have been studied within this TC.

Organization

TC-31FS has a number of subgroups; notably DGs for MXF mappings of constrained DPX for HDR, KLV extensions, a planned revision of the MXF standard, and a WG concerned with defining and drafting the Archive eXchange Format (AXF).

Recent Publications

Over the past 12 months, TC 31FS has published the following documents:

- ST 381-2:2018 MXF—Mapping MPEG Streams into the MXF Constrained Generic Container
- ST 381-3:2017 Mapping AVC Streams into the MXF Generic Container
- RDD 32:2017 XAVC MXF Mapping and Operating Points
- RDD 44:2017-11 MXF Apple ProRes in MXF (Revision of RDD 44:2017)
- ST 377-1:2018 MXF—File Format Specification (constrained rollup revision of ST 377-1:2011 and its Amendments)

Also completed is a collection of MXF UL Style Guidelines, designed to help SMPTE Engineering Document authors and editors when creating Universal Labels to be used in MXF Documents.

Work in Progress

Much of the recent work in the TC-31FS has continued to involve the mappings of various codecs and metadata into the MXF wrapper format, which demonstrates the ongoing significance of the SMPTE's MXF standard. Close liaison with other committees, particularly the 30MR Metadata Registries committee, ensures that the specifications form a coherent SMPTE ecosystem for media professionals.

A comprehensive five-year review of the underlying MXF standard, ST 377-1, has begun and the first step, a constrained rollup revision of ST 377-1: 2011 and its amendments, has been completed. The next step is a fuller revision that will align it with the new SMPTE registers.

The TC is working on a number of other projects. A constrained DPX application standard to support HDR imagery is under consideration. Also in progress is a mechanism for defining new MXF KLV labels within an MXF file. The AXF is an active, major project defining a standardized structure, semantics, and format for long-term archival of media. Work continues to extend and evolve AXF.

Revisions of documents in progress include ST 380 MXF Descriptive Metadata and a constrained revision of ST 2057:2011 Text-Based Metadata Carriage in MXF.

About the Authors

Paul Gardiner is standards manager at Sony European Professional Engineering within Sony Europe Ltd., based in Basingstoke, U.K. Gardiner's career in broadcasting spans more than 40 years. He studied electronic engineering at the University of Southampton before joining the Independent Broadcasting Authority in 1974. Activities have included television technical regulation and research and development project management with responsibility for international collaborative research projects. He is involved in the work of the ITU-R and is chairman of Working Party 6B—Broadcast service assembly and access. Since joining Sony in 2007, he has been an active participant in the SMPTE standards community and is an SMPTE Fellow.

Fred Walls has been working on video algorithms and architectures for set-top box ASICs with Broadcom for nearly 20 years. He is recognized in the industry for his contributions to the Video Electronics Standards Association (VESA) Display Stream Compression standard, a lightweight video compression standard that has enjoyed widespread adoption in MIPI, DisplayPort, HDMI, and other consumer electronic interfaces. He has authored eight papers and is a named inventor on 25 issued patents. He also chairs the SMPTE 31FS HDR DPX drafting group and participates in a number of other standards organizations on behalf of Broadcom. He received BS and MEng degrees in electrical engineering and computer science from the Massachusetts Institute of Technology. He enjoys volunteering with kids STEM activities and collects and repairs pinball machines.

Network/Facilities Architecture (32NF)

Co-Chairs: Friedrich Gierlinger and John Hudson

Overview

The 32NF technology committee covers matters supporting the infrastructures of content production and distribution facilities, including file management, transfer protocols, switching mechanisms, synchronization systems, and physical networks that are both internal and external to the facility, including final distribution methods.

Organization

The committee is divided into four standing WGs, each focused on one of these four areas:

- 6G-SDI and 12G-SDI interfaces (UHD-SDI)
- All other SDI interfaces and SDI related standards
- IP interfaces
- Time labeling and synchronization
- Data on AES3

Work Completed

The following documents were completed during the previous year:

- ST 292-1:2018—SMPTE Standard—1.5-Gbits/s Signal/Data Serial Interface
- ST 297-2:2017—SMPTE Standard—Multilink and Multichannel 1.5G, 3G, 6G, and 12G-SDI Using CWDM
- ST 372:2017—SMPTE Standard—Dual Link 1.5-Gbits/s Digital Interface for 1920 × 1080 and 2048 × 1080 Picture Formats
- ST 425-1:2017—SMPTE Standard—Source Image Format and Ancillary Data Mapping for the 3-Gbits/s Serial Interface
- ST 2036-3:2018—SMPTE Standard—UHD Television—Mapping into Single-link or Multilink 10-Gbits/s Serial Signal/Data Interface
- OV 2081-0:2018—SMPTE Overview Document—6G-SDI Bit-Serial Interfaces Roadmap for the SMPTE ST 2081 Document Suite
- ST 2081-10:2018—SMPTE Standard—2160-line and 1080-line Source Image and Ancillary Data Mapping for 6G-SDI
- ST 2081-30:2017—SMPTE Standard—Transport of Multiple 3- or 1.5-Gbits/s Signals on a 6G-SDI Link
- OV 2082-0:2018—SMPTE Overview Document—12G-SDI Bit-Serial Interfaces—Overview for the SMPTE ST 2082 Document Suite
- ST 2082-10:2018—SMPTE Standard—2160-line and 1080-line Source Image and Ancillary Data Mapping for 12G-SDI
- ST 2082-30:2017—SMPTE Standard—Transport of Multiple 6-, 3-, or 1.5-Gbits/s Signals on a 12G-SDI Link
- ST 2091-1:2017—SMPTE Standard—Ruggedized Fiber-Optic Connectors for HDTV and UHDTV SDI
- RP 2092-1:2015 Am1:2017—SMPTE Amendment—Advertising Digital Identifier (Ad-ID) Representations—Amendment 1
- ST 2110-10:2017—SMPTE Standard—Professional Media Over Managed IP Networks: System Timing and Definitions
- ST 2110-20:2017—SMPTE Standard—Professional Media Over Managed IP Networks: Uncompressed Active Video
- ST 2110-21:2017—SMPTE Standard—Professional Media Over Managed IP Networks: Traffic Shaping and Delivery Timing for Video
- ST 2110-30:2017—SMPTE Standard—Professional Media Over Managed IP Networks: Pulse-Code Modulation Digital Audio
- ST 2110-40:2018—SMPTE Standard—Professional Media Over Managed IP Networks: SMPTE ST 291-1 Ancillary Data
- SG on Flow Management in Professional Media Networks Report (ER-3:2017)

Work in Progress

32NF-40 SDI Interfaces WG (Chair: John Hudson)

Work is under way to create an engineering guide on SDI electrical interfaces and a standard for high dynamic range and wide color gamut signaling on streaming interfaces.

32NF-60 Video over IP WG (Chair: Thomas Edwards)

This WG is developing a new standard (ST 2110) for live production uncompressed elementary essence flows over IP.

32NF-70 UHD-SDI Interfaces (Chair: Nigel Seth-Smith)

This WG is drafting a set of standards for aggregating multiple HD-SDI or 3G-SDI streams onto single 6G-SDI interfaces and multiple HD-SDI, 3G-SDI, and 6G-SDI streams onto single 12G-SDI interfaces.

32NF-80 Time Labeling and Synchronization (Chair: Pat Waddell)

This WG continues its efforts on the new IP-based studio synchronization system (ST 2059) by:

- holding a series of interoperability tests ST 2059 based equipment;
- continuing to draft several engineering guides to help the industry adopt this new synchronization system;
- conducting the mandatory one-year reviews of the ST 2059 documents.

In addition, the WG is looking at future time labeling methods. Further to this effort, SMPTE conducted a series of timecode summits to gather user input on a future time label. A report of these timecode summits was published as SMPTE TR 2: Time Code Summit Report.

32NF-90 WG Data on AES3 (Chair: Stan Cossette)

This WG was established in 2017 and covers all the work regarding the data on AES3 including the work of DG focused on the ST 337 family of audio interface standards.

About the Authors

Friedrich Gierlinger has been working at the Institut für Rundfunktechnik (IRT), the Research and Development Institute of public broadcasting corporations of Germany (ARD, ZDF, and DRadio), Austria (ORF), and Switzerland (SRG/SSR), since 1979. As an employee of the IRT, he was involved in the development of different measurement techniques for analog and digital standard television for the public broadcasters and their standardization. He chairs the German system and measurement expert group and is a member of a working group of measurement and service department leaders of the Public Broadcasters in Germany. In the European Broadcasting Union, Gierlinger is a co-chair of the Quality-Control WG as well as a member of the Beyond-HD WG. In addition to the TC-32NF, he is a member of several other SMPTE groups.

John Hudson has spent more than 30 years in the broadcast industry beginning his career as a design engineer at Sony Broadcast and Professional Europe. He joined Gennum in 1999 and has been instrumental in developing the company's video and multimedia semiconductor business. As an active member of SMPTE, SMPTE Fellow, and past winner of the Excellence in Standards Award, Hudson serves as a co-chair of TC32NF, the chair of the 32NF40 Working Group on SDI Interfaces, and chairs the 32NF70 6G-SDI drafting group. He is the author of several SMPTE Standards, and actively contributes to the development of realtime streaming media interfaces for Television and D-Cinema production. Hudson attained an HND in electronics and communications engineering from the Farnborough College of Technology in 1988, is the author of 15 patents on video processing and signal integrity solutions for multimedia applications and regularly contributes technical papers and presentations to seminars and technology events.

Media Systems, Control and Services (34CS)

Co-Chairs: Chris Lennon and Karl Paulsen

Overview

The 34CS technology committee is responsible for matters in the areas of media services, methods of managing and controlling hardware devices and software systems, and the management of media workflow processes, including associated signaling and control mechanisms.

Organization

34CS currently has three DGs reporting to it, 34CS-10 Broadcast eXchange Format (BXF), Media Device Control over IP, and Media Microservices.

Work in Progress

The following documents are currently in progress within this committee:

- Revisions to:
  - 34CS-CD-EG 2021-4-2017 BXF Schema Documentation
  - ST 2071-3—Media Device Control Capability Interfaces
  - ST 2071-4—Media Device Control Capability Interface Registration

BXF DG (Chair: Chris Lennon)

The group, having published revisions to almost all of the documents in the SMPTE 2021 suite, is now working on BXF 6.0. This involves revisions of ST 2021-1 (Requirements and Informative Notes), EG 2021-2 (Protocol), EG 2021-3 (Use Cases), and EG 2021-4 (Schema Documentation), and the associated schema set. BXF 6.0 contains a host of enhancements to BXF, including significant work schema representations of specifications for ProRes and J2K over IMF.

Media Device Control Over IP DG (Co-Chairs: Andy Rosen and Steve Posick)

This group, working on standardizing the control of media devices in professional production and distribution systems, is in the process of revisions to two of its documents, 2071-3 and 2071-4.

The group is presently determining what action to take on the topic of RESTful or REST-like protocol for ST 2071.

Media Microservices DG (Chair: Chris Lennon)

The newly formed group had begun work on what is expected to be a suite of documents, specifying standardized microservices for media systems. Its first document is expected to cover the overall architecture for interoperable microservices. The group meets biweekly. All with an interest in this exciting new area are encouraged to join.

About the Authors

Chris Lennon serves as president and CEO of MediAnswers, industry experts in media software systems. MediAnswers assists suppliers, system integrators, media organizations, standards bodies, and nonprofit groups in creating, integrating, and optimizing complex software and workflow solutions. He is an SMPTE Fellow, and recipient of its 2009 Society Citation.

Karl Paulsen is a chief technology officer at Diversified, a full-service systems and media technology integration firm addressing the broadcast, audio/visual, IT, medical, and security market segments. He is an SMPTE Fellow, SBE Life Member, a Certified Professional Broadcast Engineer, and a feature columnist for TV Technology's section on Media and Storage Technologies.

Media Packaging and Interchange (35PM)

Chair: Pierre-Anthony Lemieux and Florian Schleich

Overview

The 35PM Technology Committee on Media Packaging and Interchange oversees standards for the interchange of complete audiovisual work in professional fields related to media creation, production, and post-production archiving.

The current focus of TC-35PM is the IMF, a suite of standards for the worldwide interchange of high-quality, component-based audio-visual masters. IMF is specified in the ST 2067 family of documents.

TC-35PM has more than 350 members.

Recent Publications

ST 2067-50 IMF Application #5 (ACES)

Adds support for uncompressed ACES images as picture essence. The application is primarily intended for long-term archiving of ACES-encoded final master files.

Amendment #1 to ST 2067-40 ("IMF Application #4 Cinema Mezzanine")

Clarifications and error corrections motivated by implementation experience, including an Application #4 plugfest held in March 2017 in Erlangen, Germany.

Revision of ST 2067-101 (IMF Common Image Definitions and Macros). Adds minor clarifications and error corrections.

Amendment #1 to ST 2067-102 (IMF Common Image Pixel Color Schemes)

Adds color schemes specified in ST 2067-21:2016 ("Application #2E"), and minor corrections and clarifications.

Plugfests

In addition to publishing documents, TC 35PM organizes plugfests through its 35PM IMF Plugfest DG. These plugfests involve the creation and processing of IMF content by participating implementations. They help identify errors in specifications, generate test content, and provide an opportunity for participants to exercise their implementations.

The next plugfest, in collaboration with IRT, is scheduled on May 29 in Munich, Germany.

Document Maintenance

The IMF Document Maintenance WG continuously tracks reported issues and feature requests against published IMF documents.

The group is preparing the revision of multiple documents and triaging issues and feature requests across these documents. In particular, adding support to ST 2067-21 (IMF Application #2E) for the HLG color system as specified in ITU BT 2100-1 is being considered.

New Documents

ST 2067-9 Sidecar Composition Map

Defines an XML document that allows arbitrary assets, for example, QC reports, to be associated with one or more compositions.

ST 2067-200 (DMCVT plug-in)

Adds support for Dynamic Metadata for Color Volume Transform (DMCVT) to IMF applications, improving the conversion of HDR images into SDR images.

ST 2067-201 (IAB plug-in level 0)

Adds support for immersive audio to IMF applications. The standard defines a baseline method for the carriage of SMPTE ST 2098-2 sound essence for use with feature and episodic content in IMF compositions.

Audio Content and Element Kind Definition

The accurate labeling of audio material is critical to allow automated processing of masters into deliverables. This effort intends to create a controlled vocabulary describing the contents of audio material, for example, music and effect.

About the Authors

Pierre-Anthony Lemieux is a partner at Sandflow Consulting, where he works with both Hollywood and Silicon Valley clients on worldwide standards, proof-of-concept development, and product architecture. His expertise covers the entertainment technology ecosystem, from content authoring to playback, including audio and video and timed text, file formats, and content protection. His recent engagements include representing clients at industry forums (including SMPTE and W3C), developing standards for file-based post-production workflows and implementing audio processing algorithms. He is an SMPTE Fellow and currently serves as a document editor in multiple SMPTE projects, in addition to chairing TC 35PM. He has a PhD in physics from the University of California at Los Angeles and a BSc from McGill University.

Florian Schleich is a technical integrations manager at Netflix, where he supports Netflix' post technology partners in their efforts to implement innovative workflows. He previously spent more than ten years at Fraunhofer, where he developed software for Digital Cinema and IMF mastering, worked with industry forums like ISDCF and IMF User Group and contributed to efforts within SMPTE TC 21 dc and TC 35PM. He holds degrees in Computer Science from the Nuremberg Institute of Technology and the University of Hagen.