Overview from the Standards Vice President

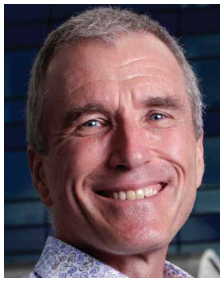
By Bruce Devlin

The year 2019–2020 has been dynamic for the Standards Community. We have been introducing more software tools and trialing methodologies for making the SMPTE Standards process more agile and more relevant to today's software-rich, cloud-first media ecosystem. I am greatly indebted to all of the Standards Community members for their hard work and passion who are helping in this journey. Our document maintenance groups using GitHub for issue tracking, our migration from technical specifications to a more formalized public committee draft process, and our software task force have all contributed to the improvement of our processes.

We held our first Standards meeting in India at the beginning of March, which was a huge success and resulted in the formation of new Student Chapters. Immediately afterward, the world was hit by the global COVID-19 pandemic, forcing us to conduct subsequent meetings virtually, of course, with some significant success. I thank our Headquarters team who really worked hard to retain the social aspects of the Standards Community work while participants were scattered across the globe.

I am sure the ensuing years will be witnessing a lot of changes in the media industry. I am confident that SMPTE's new initiatives in microservices, artificial intelligence, metadata, and Internet protocol (IP) working will keep us at the cutting-edge of media technology.

About the Author



Bruce Devlin is the SMPTE Standards Vice President, founder of Mr MXF, and has prestigiously held C-level positions at media companies over the years. His expertise in media files and formats is of global renown and the book on Material Exchange Format (MXF) is a testimony for his writing skills. His video series (Bruce's Shorts) improving one's skills in the business of file-based technology can be downloaded free of cost.

Essence (10E)

Co-Chairs: Lars Borg and John F. Snow

Overview

The scope of the 10E technology committee spreads over a wide range of applications such as 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.

Recent Publications

In the past 12 months, 10E has published the following documents:

- ST 2122:2020 Spectral Similarity Index (SSI)
- RP 2093:2020 Television Lighting Consistency Index (TLCI)
- ST 2094-40:2020 Dynamic Metadata for Color Volume Transform—Application #4
- RDD 51:2020 High Density Image Encoding for ARRIRAW Files.

Work in Progress

VC-2 Video Compression

VC-2 mezzanine video compression is based on the BBC's DIRAC pro. All parts of the document suite have been published, and a revision of RP 2042-3 Conformance Specification is in progress.

VC-3 Picture Compression

A project is underway to create an amendment to ST 2019-1:2016 VC-3 Picture Compression and Data Stream Format to add alpha support for high-definition (HD) profiles.

Digital Object Identifier 10.5594/JMI.2020.3010175
Date of publication: 2 September 2020

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VC-5 Video Essence

VC-5 is based on the Cineform/GoPro video compression system. All parts have been published. A revision of RP 2073-2 VC-5 Conformance Specification is underway—ST 2073-7:2019 VC-5 Video Essence Part 7. Metadata has been revised and will be published once RP 2073-2 is ready.

VC-6 Picture Compression

The VC-6 project is a new codec that uses hierarchical representation of compressed data to allow decoders to flexibly re-create uncompressed imagery. This will be published soon, like the ST 2117 VC-6 document suite.

Reference Display and Environment for Critical Viewing of Television Pictures

This project is developing a suite of documents dealing with the use of fixed pixel matrix reference displays. The documents in this suite are:

- ST 2080-1: Reference White Luminance Level and Chromaticity (published and currently in revision)
- ST 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)
- RP 2080-4: Full Measurement/Calibration (in progress).

Measurement Methods for Resolution Characteristics of Camera Systems

The previous standard for measurement of television camera resolution was IEEE 208. This document was recently withdrawn as it became outdated and did not apply to HD television (HDTV) or ultrahigh-definition television (UHDTV) systems. The new project will create a replacement document for IEEE 208 that reflects current measurement technology and is independent of the image format.

Academy Color Encoding Specification Revision

This project is revising several of the Academy Color Encoding Specification (ACES) document suites to address issues reported since their publication. The documents being revised are:

- ST 2065-1:2012 ACES
- ST 2065-2:2012 Academy Printing Density (APD)
- ST 2065-3:2012 Academy Density Exchange Encoding (ADX).

About the Authors

Lars Borg is the principal scientist in digital video and audio engineering at Adobe. Borg develops solutions and standards in the areas of high dynamic range, wide color gamut, digital cinema, digital imaging, color processing, color management, video compression, and metadata, and he holds 30 patents in these areas. He is a SMPTE Fellow, is active in SMPTE Standards committees, and chairs the SMPTE Group on dynamic metadata for color transforms.

John F. Snow represents Cobalt Digital, where he is a senior field-programmable gate array (FPGA) architect. He began his career at Evans & Sutherland Computer Corporation, where he held various positions including the director of engineering. In 2001, he joined Xilinx, Inc., as a video architect and was responsible for the development of serial digital interface (SDI) and other audio and video interfaces for Xilinx FPGA devices. He holds a BSc degree in electrical engineering from Brigham Young University, Provo, UT. He is a SMPTE Fellow and a Senior Member of the IEEE. He holds two patents related to high-speed serial interfaces. He also chairs the 32NF-80 Working Group.

Film Applications (20F)

Chair: Dave Schnuelle

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 WGs, each maintaining their own specific application with recommendations to 20F for action. Most standards are mature and 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)

Non-television presentation of motion pictures, including specifications for image areas intended for

projection and image measurement practices for theatrical presentation. Dimensions for projection reels and containers, and print identification and leaders are also included.

Our last Plenary was held on 3 June 2020, and the next will be during the September 2020 block meetings.

Work in Progress

Our 2019 one- and five-year review processes resulted in 13 documents being reaffirmed or made stable.

The DG for the on-screen light measurement is chaired by Dave Schnuelle, and Charles Flynn has taken over as the document editor. The pre-FCD (Final Committee Draft) review has been completed, with one point of discussion remaining on a test signal dimension. Final edits will be circulated prior to a second 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 the industry practices with new object-based sound systems and 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 practices. Currently, revision is underway to determine how far to go with harmonization with ST 2095-1.

RP 141—Background acoustic noise levels in theaters and review rooms. Ioan Allen worked with Neil Shaw to make revision and to update the current nomenclature and industry practices. The revised RP 141 has won the DP vote.

The 20F committee will move forward to have SMPTE maintain the availability of certain test films, based on their importance to the industry. A small ad hoc group (AHG), with John Miller as its chairman, has held several meetings to share film manufacturing resources and to design a survey of test film needs for distribution to the industry.

These test films are vital to supporting motion picture film audio and projection in the future. We have set up an institute that helps produce test films. The committee has drafted an initial list of critical films and will solicit the Board of Governors to support this effort. Moving forward, Bill Hogan and Glen A. KnicKrehm are currently working to establishing the path.

About the Author

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 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. Before joining 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—Episode 1 and Episode 2. He has received five patents for his work during that period. He is a Fellow of the SMPTE, and a member of the Academy of Motion Picture Arts and Sciences.

Digital Cinema (21DC)

Co-Chairs: Steve Llamb and Jack Watts

Overview

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

Organization

The committee is organized into DGs and SGs, each covering specific tasks and areas of activity. About four subgroups have been active at various times last year.

Recent Publications

In the past 12 months, 21DC has published the following documents:

- ST 429-2:2019 D-Cinema Packaging—DCP Operational Constraints
- ST 429-4:2020 D-Cinema Packaging—MXF JPEG 2000 Application
- ST 430-1:2017 Am 1:2019 D-Cinema Operations—Key Delivery Message.

Work in Progress

21DC Document Maintenance

Given the volume of documents under the umbrella of 21DC Technology, a document maintenance group has been set up to manage the varying one- and five-year revision cycles required. Meeting once a month, the focus of the group is on new feature requests, amendment reviews to documents, based on new technologies, reference dependencies, and interoperable issues encountered through practice in the field.

ST 428-7 Revision (Subtitle DCDM)

ST 428-7 specifies the format of a Digital Cinema Distribution Master (DCDM) subtitle file, an integral component of a subtitled D-Cinema composition. A DCDM subtitle file contains a set of instructions for placing rendered text or graphical overlays at precise locations on distinct groups of motion picture frames.

This revision focuses on improving the rendering of Japanese timed text subtitles during playback, and the group is currently working through positioning issues found in fielded equipment.

RDD 52 D-Cinema Packaging—SMPTE DCP Bv2.1 Application Profile

RDD 52 specifies requirements and constraints for an application of Digital Cinema Package (DCP) mastering and packaging for playback globally on the highest percentage of systems and applies to standard general release DCPs used in current studio distribution. It adds additional constraints to ST 429-2 and includes references to other documents to further define current mastering and packaging practices. It is currently in the publication queue.

Drafting Group—RDD 53 DCP Hybrid Tone Mapping

A WG has been formed to address the comments from the technology committee regarding project proposal and initial draft. This document aims to define the transportation mechanism for multiple image dynamic range in a DCP as used with a hybrid tone mapping (HTM) process.

ST 430-17 SMS OMB Comm. Protocol

Work has been completed on ST 430-17, which standardizes an interoperable communications protocol and the syntax between a screen management system and an outboard media block that supports the decryption and playback of an immersive audio track file from a compliant DCP. The document specifies the communication, messages, and syntax used to communicate Key Delivery Messages (KDMs), statuses, and other commands between Screen Management System (SMS) and an Outboard Media Block (OMB). The document is currently in ballot comment resolution.

ST 430-14 Revision—Digital Sync Signal and Aux Data Transfer Protocol

ST 430-14 defines a transfer protocol that allows data items from an auxiliary data track file to be transmitted to a processor for reproduction and a synchronization signal that allows a processor to reproduce data items synchronously with the D-Cinema presentation. This revision also adds support for messaging that allows the processor to indicate the ability to accept plain text or encrypted data items in addition to correcting outstanding issues identified by implementation experience. The document is currently in ballot comment resolution.

About the Authors

Steve Llamb is currently the VP, media technology standards and production systems engineering at Deluxe. In the past 16+ years during his time at both Deluxe and Technicolor, he has been heavily involved in the development and rollout of concepts, workflows, and standards for both D-Cinema and Interoperable Master Format (IMF) mastering, packaging, exhibition, distribution, and key management. He helped manage the global alignment of all of Deluxe's processes for D-Cinema delivery, including launching their global proprietary mastering and packaging toolset currently in use, CIPHER. In addition to serving as co-chair of SMPTE 21DC, he is the chair of the Document Maintenance Drafting Group in 21DC, and convenor of ISO TC-36/WG 1 (Production Technology).

Jack Watts is an independent media solutions consultant based in London, U.K. Having worked for globally recognized brands such as Technicolor and Deluxe, he has gained more than 12 years of experience in the media and entertainment industry and has aided in cultivating multiple workflows and implementations still relied upon even today. Based in London and operating under the name Trench Digital, he provides training and consultancy to businesses operating within the sector covering topics such as product design and implementation, strategic resolutions, and operations.

Television and Broadband Media (24TB)

Chair: William C. Miller

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 drafting groups (DGs).

Work in Progress

Open ID Binding (Chair: Chris Lennon)

The standards in this project define an open binding technology (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 has been documented in the 2112 series of SMPTE engineering documents. 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 (OBIDTLC), SMPTE RP 2112-21:2018, Open Binding of Distribution Channel IDs and Timestamps (OBIDTLC)—Conformance Test Materials, SMPTE RP2112-1, Audience Measurement Using OBID and OBID-TLC and SMPTE EG 2112-2, Audience Measurement Ecosystem. All of these documents were revised for clarity during one-year review; as of this writing, all but one have been published. The remaining document, ST 2112-10, is nearing publication.

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, for while SMPTE practice has been consistent on this issue, it has never been formally documented.

Revision of ST 2035:2009 with Amendment 1:2012 (Chair: Pat Waddell)

This is a maintenance revision to roll up the amendment with the standard and to update references. The Working Draft of this revision is currently under review prior to initial ballot.

Upcoming Projects

24TB is responsible for upkeep of SMPTE's videotape standards. One of these, RP 103-1995 (Archived 2005) Care, Storage, Operation, Handling and Shipping of Magnetic Tape for Television, needs to be updated to reflect advances in the art. A project to research these procedures and update the Recommended Practice is on the committee's agenda.

About the Author

William C. Miller is the president of Miltag Media Technology, LLC, a consultancy specializing in technical standards for television and related industries. He has been a broadcaster for nearly 50 years and has been actively involved in the development of television standards for over 30 years. He is a SMPTE Fellow and has served as an officer and Governor of the Society for many years. He was awarded the Society's Progress Medal in 2002 and its Presidential Proclamation in 2013. He and his wife sponsor the society's Excellence in Education Medal. He is a member of IEEE and of the IEEE Broadcast Technology Society (BTS). He serves as the chairman of the BTS AV Measurements Techniques Standards Committee.

Cinema Sound Systems (25CSS)

Co-Chairs: Brian Long and Bill Redmann

Overview

The 25CSS technology committee addresses new standards for cinema sound, including 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:

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

Recent Projects

Cinema B-Chain Characteristics and Expectations Working Group (Chairs: C.J. Flynn and Brian Vessa)

Cinema audio has never had what D-Cinema had. As work on D-Cinema began, the definition of a reference projector, standardized in ST 431-2, established the characteristics necessary to properly display the D-Cinema image content. No corresponding document has existed for cinema audio content. The WG is working to specify the required parameters and values for a cinema sound system (also known as the Cinema B-Chain) to faithfully play back modern movie soundtracks in dubbing theaters and cinemas with the sustained high levels and transients that are now common. The planned output is an RP and possibly an EG.

The TC-25CSS Working Group on Cinema B-Chain Characteristics and Expectations formed after the SG finished its report, using that work as input. The WG has formed three AHG:

- **B-Chain Characteristics Technical Documents AHG**, chaired by Neil Shaw, is bringing forward what measurement and perception work has already been documented in the audio literature, citing relevant text to inform the overall work.

- **B-Chain Characteristics Clip Analysis AHG**, chaired by Brian Vessa, is collecting and analyzing clips from modern soundtracks to understand what they contain and what challenges they present to the B-chain so that the documentation can exactly be done on what a cinema sound system must reproduce.
- **B-Chain Characteristics In-Situ Analysis AHG**, chaired by Andrew Poulain, is determining what relevant cinema sound system parameters can and should be measured and how to best perform these measurements on an installed system.

The AHGs are currently busy with their stated work, which will be reviewed when the WG meets later this year before advancing a draft of the recommended practices.

Work in Progress

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

Five years ago, following requests from Digital Cinema Initiatives (DCI) and North Atlantic Treaty Organization (NATO), the work suggested by the Immersive Audio Study Group on the interoperability of immersive sound systems in D-Cinema has proceeded.

For over two years, the work focused on a precise description of a single, interoperable bitstream to alleviate the situation where each brand of immersive sound system had its own proprietary audio format, requiring content providers to mix and deliver in each. Additionally, present-day immersive sound systems have different methods for packaging, moving immersive audio data within the D-Cinema architecture, and even audio calibration. These details have been addressed to ensure true interoperability of immersive audio and immersive sound systems.

Since then, the work product has grown to the four-document ST 2098 suite, specifying all aspects of bitstream and the corresponding renderer behaviors, along with necessary support in the form of a host of ancillary engineering documents relating to content packaging, management, media block operations, and auditorium calibration, as necessary to achieve immersive sound system interoperability.

Immersive Audio Renderer DG (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 translating the audio from the mixing theater to the exhibition theater. EG 2098-3 is expected to appear shortly and defines the expected behavior of an immersive audio renderer and describes how to test that its responses to particular immersive audio metadata are the expected ones.

Moving Forward

The 25CSS technology committee remains busy with these projects. It is an exciting time for cinema sound, which is enjoying rich recognition currently compared to previous 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 has 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 a Master of Fine Arts degree from the University of Southern California School of Cinematic Arts, Los Angeles, CA. 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 graduated from the University of California Los Angeles (UCLA), Los Angeles, CA, with a master's degree in engineering, having specialized in computer architecture and artificial intelligence (AI) which remains surprisingly relevant. At Walt Disney Imagineering, he worked on interactive theme park attractions for over a dozen years. At Technicolor, another 12 years was directed to the digital cinema rollout. His 66th U.S. patent was issued in May. One that is particularly satisfying, given the COVID specter, is 6,839,417 Method and Apparatus for Improved Conference Call Management, which lets a community of individuals to initiate, join, and participate in a conference call, yet retain collective and individual degrees of organizational control, something for which he would previously have had to apologize.

Metadata and Registers (30MR)

Co-Chairs: Dean Bullock and Phil Warren

Overview

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

DG Project: ST 2088 Essence Element Key Register Structure. ST 2088 defines the structure of a register of essence element keys as used by the essence container specifications coded according to ST 336 and related essence mapping documents.

Topic: Projects and Work in Process

WG Project: Metadata Definition

The 30MR-10 Working Group 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 now achieving twice-yearly publication.

Status: Edition 4 "Tabasco" has passed DP ballot and is entering the ST audit phase. Edition 5 "Sriracha" is being prepared to start the ballot process.

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.

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 DG has completed the revision of ST 330, the TC has approved the draft publication, and the document is entering the ST audit phase.

DG Projects: ST 335, ST 395, and ST 400 Revision

This set of projects will produce updated versions of ST 335, ST 395, and ST 400. The documents will be updated and normalized with the new process described in AG-18.

Status: The projects are approved, and work is ongoing.

Business impact: The current revisions of ST 335, ST 395, and ST 400 include prose that is no longer relevant and possibly confusing. Updating these documents supports the transition to the new register publication process.

DG project: RP 205 UMID Applications Revision. This project will produce an updated version of RP 205, titled "Application of Unique Material Identifiers in Production and Broadcast Environments." The document will be updated to add UMID application examples in accordance with the recent ST 330 revision.

Status: Work is ongoing.

SG Project: UUID File Naming

The SG will examine the use of Universal Unique Identifiers (UUIDs) in all SMPTE engineering documents that currently apply them and develop an approach for both harmonizing the use cases and providing for application of UUIDs as file names to the extent possible going forward. This project will also provide recommendations on the follow-up work needed to implement in SMPTE engineering documents the approach developed.

Status: The project has been approved.

Business impact: UUIDs are widely used as identifiers in SMPTE engineering documents and, in some cases, are prescribed to serve as file names. In other cases, they serve as unique identifiers of files. Often, implementations of SMPTE engineering documents attach new UUIDs to files despite those files already being associated with assigned UUIDs.

Project: UMID Resolution Protocol.

Status: The UMID Resolution Protocol project has been moved to the 34CS technology committee.

About the Authors

Dean Bullock (https://www.linkedin.com/in/dean-bullock-72231) is currently the COO of CineCert, Inc. (www.cinecert.com), the leading provider of D-Cinema packaging and validation software. He started working in the cinema industry in 1996 as an electrical engineer on the Dolby cinema audio processor product line. As an engineering director, he led Dolby's digital cinema engineering team and later the cinema engineering software quality assurance group. As the director of technology strategy for Dolby's cinema group, he worked to implement SMPTE and other standards. He also chaired the 21DC technology committee from 2015 to 2019.

Phil Warren is an engineer in the field of image research and has been with Dolby Labs since 2010. He is fascinated by the development of the visual medium as an art form via technology and enjoys exploring the application of hyperspectral capture in photography. He plays the role of a mentor in photography as a form of art therapy through a nationwide pediatric cancer foundation. He loves to fly kites sometimes, but probably not right now.

File Format and Systems (31FS)

Co-Chairs: Tatsuji Yamazaki 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, Graphics Exchange Format (GFX), Archive Exchange Format (AXF), and ACES have been studied within this TC.

Organization

TC 31FS has a number of subgroups, notably DGs for MXF mappings, KLV extensions for MXF, reference materials for HDR DPX, and a WG concerned with defining and drafting the AXF.

Recent Publications

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

- RDD 50:2019—Avid DNxUncompressed—Packing Definition and Mapping to the MXF Generic Container
- ST 377-2:2019—MXF KLV-Encoded Extension Syntax (KXS)
- ST 377-1:2019 (Revision of ST 377-1:2011)—Material Exchange Format (MXF)—File Format Specification
- ST 422:2019 (Revision of ST 422:2014)—Material Exchange Format—Mapping JPEG 2000 Codestreams into the MXF Generic Container.

Work in Progress

Much of the recent work in the 31FS technology committee has involved the mappings of various codecs and metadata into the MXF wrapper format, which continues to demonstrate the ongoing significance of SMPTE's MXF standard ST 377-1. Nearing completion are standards for mapping JPEG-XS codestreams and HEVC streams to the MXF Generic Container, and a project is underway to map VC-3 into the MXF GC. A revision of ST 377-4—Multichannel Audio Labeling Framework is in progress and is expected to be posted for public comment along with a companion draft ST 377-41 that defines a Controlled Audio Vocabulary. Revisions are in progress for ST 380 MXF Descriptive Metadata Scheme 1 and a constrained revision of ST 2057:2011 Text-Based Metadata Carriage in MXF.

A minor revision of the ST 377-1 MXF standard was published earlier this year with the expectation that work on a full revision will begin shortly to restructure the document into smaller parts and utilize a new format for registers.

The AXF continues to be an active, major project defining a standardized structure, semantics, and format for long-term archival of media. Work to extend and evolve AXF is ongoing, particularly in the area of expanding carriage of metadata.

New RDD projects have started to describe ARRI camera system metadata and carriage of ARRIRAW essence within MXF files. A project is also underway to provide a reference implementation and test images in support of the ST 268-2 HDR extensions to DPX.

About the Authors

Tatsuji Yamazaki has been working at Sony since 1990. He has worked as a hardware design engineer, a software design engineer, and a software project leader of professional video products. He has also led a team to develop media file formats for Sony professional video products including the XDCAM and XAVC formats, which are widely used in professional video content creation workflows. Since 2017, he has been an active member of the SMPTE standards community and has served as an editor of SMPTE 10E FS-Gamut and FS-Log Characteristics of Camera Systems drafting group and SMPTE 31FS HEVC into MXF GC drafting group. He also participates in Association of Radio Industries and Businesses (ARIB) and other standards organizations on behalf of Sony.

Fred Walls has been working on video algorithms and architectures for set-top box ASICs with Broadcom for over 20 years. He is recognized in the industry for his contributions to the VESA Display Stream Compression (DSC) 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 28 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.

Network/Facilities Architecture (32NF)

Co-Chairs: Thomas Kernen and Leigh Whitcomb

Overview

The 32NF technology committee covers matters supporting the infrastructure 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 standing WGs, each focused on one of these five areas:

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

Work Completed

The following new documents were completed during the previous year:

- ST 338:2016 Am1:2019—SMPTE Amendment—Format for Non-PCM Audio and Data in AES3—Data Types
- ST 2022-3:2019—SMPTE Standard—Unidirectional Transport of Variable Bit Rate MPEG-2 Transport Streams on IP Networks
- ST 2036-4:2019—SMPTE Standard—Ultra High Definition Television—Multilink 10 Gb/s Signal/Data Interface Using 12-Bit Width Container
- ST 2081-11:2019—SMPTE Standard—2160-line and 1080-line Source Image and Ancillary Data Mapping for Dual-link 6G-SDI
- ST 2081-12:2019—SMPTE Standard—4320-line and 2160-line Source Image and Ancillary Data Mapping for Quad-link 6G-SDI
- ST 2082-11:2019—SMPTE Standard—4320-line and 2160-line Source Image and Ancillary Data Mapping for Dual-link 12G-SDI
- ST 2082-12:2019—SMPTE Standard—4320-line and 2160-line Source Image and Ancillary Data Mapping for Quad-link 12G-SDI
- ST 2108-2:2019—SMPTE Standard—Vertical Ancillary Data Mapping of KLV Formatted HDR/WCG Metadata
- ST 2109:2019—SMPTE Standard—Format for Non-PCM Audio and Data in AES3-Audio Metadata
- ST 2110-22:2019—SMPTE Standard—Professional Media Over Managed IP Networks: Constant Bit-Rate Compressed Video
- RP 2110-23:2019—SMPTE Recommended Practice—Single Video Essence Transport over Multiple ST 2110-20 Streams
- EG 2111-2:2019—SMPTE Standard—3/6/12 & 24 Gb/s SDI Standards Roadmap
- ST 2116:2019—SMPTE Standard—Format for Non-PCM Audio and Data in AES3—Carriage of Metadata of Serial ADM (Audio Definition Model).

Work in Progress

32NF-40 SDI Interfaces WG (Chair: Kent Terry)
This WG creates and maintains engineering documents for SDI interfaces and SDI-related standards. The group is currently working on publication of engineering guides for SDI electrical interfaces and revision of ST 2036 for Carriage of Ancillary Data Packets in an MPEG-2 Transport Stream.

32NF-60 Video over IP WG (Chair: Thomas Edwards)
This WG concentrates on live video over IP documents, including the ST 2110 suite for live production uncompressed elementary essence flows over IP.

32NF-70 UHD-SDI Interfaces (Chair: Nigel Seth-Smith)
The WG has completed and published all of the standards for single-image transport over single, dual, and quad-link 6G-SDI and 12G-SDI. It has also completed and published the standards to transport multiple lower-speed SDI links over single 6G-SDI and 12G-SDI. One-year revisions of all single-image standards have been completed. Five-year revisions of the 6G-SDI and 12G-SDI electrical standards are now required and will be undertaken shortly.

32NF-80 Time Labeling and Synchronization (Chair: John Snow)
This WG continues its efforts on the new IP-based studio synchronization system (ST 2059) by:

- Conducting the mandatory one-year reviews of the ST 2059 documents
- Drafting EG 2059-14 on Best Practices for Large-Scale PTP Implementations
- Drafting the Extensible Time Label (TLX)
- Drafting PTP Monitoring capabilities
- Planning additional interoperability tests for ST 2059-based equipment.

32NF-90 WG Data on AES3 (Chair: Kent Terry)
This WG is responsible for protocols utilizing AES3 for transport of data with a focus on the ST 337 family of audio interface standards. Work is pending on defining transport of MPEG-H audio data in AES3.

32NF SG on Security in ST 2059 (Chair: Rishi Chhibber)
This SG was established in Q4 2018 to study security issues in the IP-based studio synchronization system of ST 2059.

About the Authors

Thomas Kernen is a staff architect at Mellanox. His main area of study is defining architectures for transforming the broadcast industry to an all-IP infrastructure. He has served as an editor of the Digital Video Broadcasting (DVB) for the TS 101 154 "Specification for the use of Video and

Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream" supported by millions of digital receivers worldwide successfully for seven years. Additionally, he has authored more than 20 publications in leading journals and holds six patents that cover both network and video coding optimizations for media transport and delivery.

Leigh Whitcomb is an associate architect for Imagine Communications, having joined the company in 1991. He participates in Alliance for IP MediaSolutions (AIMS), SMPTE, and VSF standards committees, including active involvement on SMPTE ST 2110 Professional Media over IP Networks, the SMPTE ST 2022 family of standards, and SMPTE ST 2059 Genlock over IP. A manager in the Toronto SMPTE Section, Whitcomb's other professional affiliations include the VIdeo Services Forum (VSF), IEEE, and Professional Engineers Ontario (PEO).

Media Systems, Control and Services (34CS)

Co-Chairs: John Footen and Paul Gardiner

Overview

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

Organization

The work of TC 34CS has undergone a major transition to focus on significant new areas of activity. In addition to the existing DG on the Broadcast Exchange Format (BXF), the Media Microservices Drafting Group has been relaunched and a new SG formed on industry IP requirements for nontransport layers. There is also a new UMID Resolution Protocol Drafting Group.

Recent Publications

In the past 12 months, TC 34CS has published the following documents:

- RP 2021-1:2020—Broadcast Exchange Format (BXF)—Requirements and Informative Notes
- ST 2021-4:2020—Broadcast Exchange Format (BXF)—Schema Documentation.

This completes the seven-document BXF 7.0 suite, an XML-based system that standardizes exchange of schedule, as-run, content transfer instructions, content-related metadata, and agency instructions.

Work in Progress

Since the completion of BXF 7.0, BXF DG has been on hiatus but expects to start gathering work items toward a prospective BXF 8.0 later in the year. The group has already identified potential for new work around commercial content delivery.

There are plans to work toward a new SMPTE standard to specify a UMID resolution protocol as a method for converting a given UMID into the corresponding URL of its audiovisual (AV) material uniquely identified by the UMID.

Work is underway to create a standardized suite of microservices standards and related resources including any necessary registers and controlled vocabularies to target interoperability of media systems. One of the first projects is to develop a standardized registration service for IMF content.

With a business focus in mind, a new SG is aiming to facilitate the development of interoperable IP-based production tools by developing an understanding of the appropriate layers of an architectural model together with a common set of cross-industry terminologies.

About the Authors

John Footen is a leader in Deloitte's M&E practice with over 30 years of experience in the industry. In his role at Deloitte, Footen works with a wide variety of broadcasters, studios, telecom companies and the firms that serve them. His client work focuses on technology strategy, media systems architecture and design, roadmaps, innovation and digital. Prior to working with Deloitte, Footen was a recipient of the SMPTE Medal for Workflow Systems and was named a Fellow of SMPTE. He is also the co-author of the book, "The Service-Oriented Media Enterprise: SOA, BPM, and Web Services in Professional Media Systems," as well as numerous articles in industry journals and magazines.

Paul Gardiner studied electronic engineering at the University of Southampton, Southampton, U.K., before joining the U.K. Independent Broadcasting Authority in 1974. His roles in successor bodies ITC and Ofcom have included television technical regulation and managing international collaborative research projects. He has also participated in the work of the International Telecommunication Union—Radiocommunication (ITU-R) for many years and has been chairing the Rapporteur Group on HDR since early 2016. He is a chartered engineer and member of the U.K.'s Institution of Engineering and Technology and is a SMPTE Fellow.

Media Packaging and Interchange (35PM)

Chair: Chris Witham and Florian Schleich

Overview

The 35PM technology committee on media packaging and interchange oversees standards for the interchange of complete AV work in professional fields related to media creation, production, and post-production archiving.

The current focus of TC 35PM is on 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 300+ members.

Recent Publications

- ST 2067-201 IAB Level 0 Plug-in. Adds support for immersive audio to IMF applications by defining a baseline method for the carriage of SMPTE ST 2098-2 sound essence for use with IMF compositions.
- ST 2067-2 IMF Core Constraints (Revision). Specifies common provisions that may be used by multiple IMF applications. This revised version of the specification introduces support for W3C TTML Text and Image Profiles for Internet Media Subtitles and Captions 1.1 (IMSC1.1), discrete timed text tracks for forced narrative, and a number of minor tweaks and clarifications.
- ST 2067-3 IMF Composition Playlist (Revision). The composition playlist (CPL) defines the playback timeline for the composition. Introduced in this revision are additional CPL Marker Labels as well as a number of informative notes and examples for improved readability.
- ST 2067-5 IMF Essence Component (Revision). This document provides a common set of characteristics for these MXF files used by IMF. Only minor tweaks were introduced during the revision of this document.
- ST 2067-21 IMF Application #2E (Revision). Application #2E is targeted at studio applications. By way of updating the normative references, this revision supports new features introduced in ST 2067-2/-3.

TSP 2121-4 Application Constraint DPP (JPEG 2000). Defines constraints against SMPTE ST 2067-21 IMF Application #2E intended for use in the DPP domain.

Plugfests

In addition to developing engineering documents, TC 35PM is organizing plugfest events through its Plugfest DG that allow implementers to verify correctness and interoperability of implementations and provide SMPTE with an opportunity to identify errors or ambiguities in specifications. The most recent event was hosted by the Walt Disney Studios in Burbank, CA, in February 2020.

Document Maintenance

The Document Maintenance DG continuously tracks issues against published IMF documents and is preparing revisions and amendments for the following documents:

- ST 2067-21 IMF Application #2E—to add support for Hybrid-Log-Gamma (HLG) color system. A draft is currently offered for public review (https://github.com/SMPTE/st2067-21-2016-am1).
- ST 2067-40 IMF Application #4 Cinema Mezzanine—to support the preservation and interchange of Digital Cinema Distribution Master essence and timeline. A draft is currently offered for public review (https://github.com/SMPTE/st2067-40-2ED).
- ST 2067-102 IMF OPL Common Image Pixel Color Schemes—to support additional pixel color schemes introduced in the revision of IMF Application #2E.

Output Profile List

The 35PM OPL DG is currently working on identifying (new) output profile list (OPL) macros necessary to transform certain IMF compositions to one or more "air-ready masters," for example, AMWA AS-11 MXF files. The group will document their findings and recommendations in an engineering report.

About the Authors

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

Florian Schleich is a technical integrations manager at Netflix, where he supports Netflix' post-technology partners in their efforts to implement innovative workflows. He was with Fraunhofer for more than ten years, 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, Nuremberg, Germany, and the University of Hagen, Hagen, Germany.