

Introduction from the Standards Vice President

By Bruce Devlin

I am immensely proud of the hard work of the SMPTE Technology committees during the unusual global business climate of 2020–2021. The global pandemic has accelerated many changes within the media technology industry, particularly the move to cloud-based processing and virtualized production. SMPTE has surveyed its members and the industry to find out about the needs in artificial intelligence and machine learning as well as the needs for the characterization of devices in PTP/IP systems. The responses help guide the work of different technology committees as well as the society in general.

Standards publishing continues to produce about one document a week across a range of technologies and committees. The success of the public committee draft (public CD) process has shown that SMPTE's new, nimble process to allow public consultation, implementation, and testing of documents prior to publication is a need in the industry that SMPTE is able to fulfill. A list of current public CD documents is freely available on the SMPTE website at <https://www.smpte.org/public-committee-drafts>.

A final note of thanks is due to the staff at SMPTE headquarters along with the entire Standards Community

for helping migrate the entire electronic back office of SMPTE's standards work on to the new SMPTE Knowledge Network (SKN). This initiative puts all our documents and work onto a Microsoft 365-based platform, allowing for better search, automation, and collaboration than was possible before. This move is just one step in the ongoing changes within SMPTE to deliver services to an industry that is more dependent on software, automation, and data than ever before.

I hope the reports from each of the technology committees will be informative and fill you with confidence for the skill and expertise of the Standards Community. For more details, get in touch via the SMPTE website, social media, or via svp@smpte.org.

About the Author



Bruce Devlin is the SMPTE Standards Vice President, founder of Mr MXF, and has enjoyed C-level positions in media companies over the years. He literally wrote the book on Material Exchange Format (MXF) and is a recognized world expert in media files and formats.

Essence (10E)

Co-Chairs: Lars Borg and John F. Snow

Overview

The scope of the 10E technology committee applies to electronic capture, generation, editing, mastering, archiving, and reproduction of image, audio, subtitles, captions, and 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

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

- ST 2122:2020 Spectral Similarity Index (SSI)
- ST 2117-1:2020 VC-6 Multiplanar Picture Format—Part 1: Elementary Bitstream
- ST 2065-1:2021 Academy Color Encoding Specification (ACES)
- ST 2065-2:2020 Academy Printing Density (APD)—Spectral Responsivities, Reference Measurement Device and Spectral Calculation
- ST 2065-3:2020 Academy Density Exchange Encoding (ADX)—Encoding Academy Printing Density (APD) Values
- ST 2094-10:2021 Dynamic Metadata for Color Volume Transform—Application #1.

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 revisions of ST 2042-1 VC-2 Video Compression and RP 2042-3 VC-2 Conformance Specification are in progress.

VC-3 Picture Compression

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

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 when RP 2073-2 is ready.

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 was 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.

IPT-PQ in Two Variants

Prior to the standardization of IC_tC_p in International Telecommunication Union-Radiocommunication (ITU-R) BT.2100, an alternative color representation was used by many major over-the-top (OTT) distributors. Consequently, there is a large volume of consumer accessible content on servers, which is expanding daily, using this representation. It is important to these OTT distributors that these assets are not only clearly and unambiguously labeled as utilizing the IPT-PQ-C2 color representation, but also that the characteristics of this representation are defined in a standard. This new project will create an engineering document to specify the IPT-PQ-C2 color representation.

About the Authors



Lars Borg is a principal scientist in digital video and audio engineering at Adobe. He is a SMPTE Fellow, 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 director of engineering.

Film Applications (20F)

Co-Chairs: Dave Schnuelle and John C. Miller

Overview

This committee supports all aspects of a 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 its 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)

This WG is responsible for 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: John C. Miller)

This WG is responsible for all phases of laboratory services, including preparation, processing, and duplication of motion pictures.

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

This WG is responsible for 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)

This WG is responsible for 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 9 December 2020, and the next will be during the August 2021 CinemaCon Conference.

Work in Progress

Our 2020 one- and five-year review process resulted in six documents being reaffirmed or made stable.

The DG for the on-screen light measurement is chaired by Dave Schnuelle, whereas 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. Consensus had not been achieved since the last meeting, so the chair took a strawman vote of the two options. The option favored by the majority will be included in the next 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 practices with new object-based sound systems and also 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. The COVID-19 pandemic had a considerable effect on the ability of the proponents to work on this project. Pinn asked that the project continues without waiting for 25CSS action on the pink noise standard ST 2095-1. There was no objection, and Pinn will carry on.

The 20F committee will move forward to have SMPTE maintain the availability of certain test films based on the importance to the industry. These test films are vital to supporting motion picture film audio and projection in the future. A small ad hoc group (AHG), with John Miller chairing, has held several meetings to share film manufacturing resources and to design a survey of test film needs for distribution to the industry; the committee has drafted an initial list of critical test films. In our December meeting, we had guests from the Association of Moving Image Archivists (AMIA), who expressed their frustration with the difficulty in finding test films. At the same time, SMPTE headquarters receives few requests for test films. Jess Daily and our AMIA guests stated that the reason SMPTE did not see requests for test films is that it is common knowledge in the industry that SMPTE has no stock and cannot

supply test films. Certainly, a chicken and egg problem. Following this discussion, Thomas Bause Mason stated that he saw “quite an interest in maintaining test film capability” at SMPTE and that he would report that to SMPTE leadership.

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 digital cinema and consumer imaging areas. He is a SMPTE Fellow, 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 Co. He has 40 years’ experience with motion picture films. Miller’s work contributed to the introduction of Kodak’s “Keycode” barcode print, which dramatically simplified film editing for the industry. Miller also participated in the development of the Kodak “Vision” family of films. He is a SMPTE Fellow.

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 drafting groups (DGs) and SGs covering specific tasks and areas of activity. Four subgroups have been active at various times during the past year.

Recent Publications

Over 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 21DC Technology Umbrella, 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 includes new feature requests, amendment reviews to documents based on new technologies, reference dependencies, and interoperable issues encountered through practices 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 D-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 (DG)—RDD 53 DCP Hybrid Tone Mapping

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

ST 430-17 SMS OMB Comm. Protocol

Work has completed on ST 430-17, which standardizes an interoperable communications protocol and syntax between a screen management system (SMS) and an outboard media block (OMB) 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), status, and other commands between an SMS and an 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 aux 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 adds support for messaging that allows the processor to indicate the ability to accept plaintext or encrypted data items in addition to correcting outstanding issues identified through 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. He serves as a top-level subject matter expert for both Deluxe's internal personal and Hollywood clients, as well as within various industry standards organizations and technology committees.



Jack Watts is an independent media solutions consultant. Based in London U.K., and operating under the name Trench Digital, he provides training and consultancy to businesses operations 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).

Recent Projects

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. The work of the group resulted in six documents:

ST 2112-10, Open Binding of Content Identifiers (OBID), SMPTE RP 2112-11, Open Binding of Content Identifiers (OBID)—Conformance Test Materials, SMPTE ST 2112-20, Open Binding of Distribution Channel IDs and Timestamps (OBIDTLC), SMPTE RP 2112-21, Open Binding of Distribution Channel IDs and Timestamps (OBIDTLC)—Conformance Test Materials, SMPTE RP 2112-1, Audience Measurement Using OBID and OBID-TLC, and SMPTE EG 2112-2, Audience Measurement Ecosystem. All of these documents were revised and published in 2020. No technical changes were made, but the text of each was revised, in some cases extensively, to improve clarity and usability.

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 revision was published as ST 2035:2020, Audio Channel Assignments for Digital Television Recorders (DTRs).

Upcoming Projects

24TB is responsible for the maintenance 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 practices is on the committee's agenda.

Future Work

24TB is also responsible for the 2016 series of documents, which cover active format description (AFD) and pan-scan. The latter, as defined in SMPTE ST 2016-2, defines a mechanism for describing a viewport that can include any rectangular area of the source image, including a superset of the entire image. Recently, a request was received to define an extension of this mechanism to permit rearrangement of the elements of a typical horizontally oriented image into a vertically oriented one, as one might view on a mobile phone held vertically. The standards necessary to generate the metadata to implement this would fall within the scope of 24TB. At the time of writing, this is still a discussion item.

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 is a SMPTE Fellow and has served as an officer and governor of the Society for many years.

Cinema Sound Systems (25CSS)

Co-Chairs: Charles J. Flynn and Brian Long

Overview

The TC-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
- 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 technology committee 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.

Work in Progress

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

Cinema audio has never had a document similar to the defining documents of D-Cinema projection. As work on D-Cinema began, the definition of a reference projector was standardized as ST 431-2 D-Cinema Quality—Reference Projector and Environment. This established the characteristics necessary to properly display the D-Cinema image content.

The WG is working to specify the required parameters and values for a cinema sound system (a.k.a. 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.

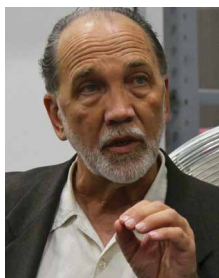
The TC-25CSS WG on Cinema B-chain Characteristics and Expectations formed after the SG finished its report, using that work as its input. The WG originally formed three ad-hoc groups. These ad-hoc groups have been converted to drafting groups as work and research continues:

- *B-Chain Characteristics Technical Documents DG*, 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 DG*, chaired by Brian Vessa, has collected and is analyzing clips from modern soundtracks to understand what they contain and what challenges they present to the B-chain to document exactly what a cinema sound system must reproduce. These clips have been made available to the in-situ DG.
- *B-Chain Characteristics In-Situ Analysis DG*, 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. Real-world exploratory testing of the signals and clips provided through the work the technical documents DG and clip analysis DG is underway.

Looking Forward

The technology committee remains busy with these projects. 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



The analog to digital transitions that evolved into D-Cinema began in earnest with recording studio technology in the mid-1970s, where **Charles ‘CJ’ Flynn** began his apprenticeship. Since then, he has managed companies, marketed, sold, installed, trained customers on, and supported high

tech audio, picture, and automation products, which have ridden upon that digital conversion wave—from Shenzhen to Sligo.



Brian Long has more than 20 years in professional audio with a diverse and extensive knowledge in the design and implementation of infrastructure for sound reinforcement and playback systems for scenarios ranging from simple single speaker events to massive show spectaculars and multichannel media presentations. Currently, he is a member of the engineering team at Skywalker Sound.

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.

Documents Published

WG Project: ST 2123 SMPTE Metadata Registers. ST 2123 is the normative publication of the SMPTE Metadata registers published at www.smp-te-ra.org. The “Tabasco” version was published as ST 2123:2021-1.

WG Project: RP 210 and RP 224 have been withdrawn. RP 210 and RP 224 were previously used to publish the contents of the SMPTE Element and Label metadata registers, respectively. They were last revised in 2012. Since then, all SMPTE metadata registers are now published as elements of a single document (SMPTE ST 2123) using a formal interchange format. As a result, SMPTE RP 210 and SMPTE RP 224 contain outdated information, which is likely to harm interoperability and therefore have been withdrawn. Implementers, users, and documentation should instead refer to SMPTE ST 2123.

Work in Progress

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 now achieving twice-yearly publication.

Status: Edition 4 “Sriracha” is currently in the ballot process. The next release, code named “Vindaloo,” is at the draft status and is expected to start moving through the ballot process shortly.

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 minimal interoperability issues.

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: ST 330 is completed and moved into the ST audit phase, however an error was noted by the editor. After discussions within the DG and the TC, the document was corrected, and a new DP ballot was started.

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 to normalize each of them 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 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. The project will also provide recommendations on 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 is currently the COO of CineCert, Inc. He started working in the cinema industry in 1996 as an electrical engineer on the Dolby cinema audio processor product line. He has been participating in SMPTE committees since 2009. He 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.

File Format and Systems (31FS)

Co-Chairs: Tatsuji Yamazaki and Fred Walls

Overview

Technical committee 31FS 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 DPX, MXF, GXF, AXF, and ACES have been studied within this TC.

Organization

TC 31FS has a number of subgroups, notably drafting groups for MXF mappings, KLV extensions for MXF, reference materials for HDR DPX, 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 381-5:2020—Material Exchange Format (MXF)—Mapping HEVC Streams into the MXF Generic Container
- ST 2124:2020—Material Exchange Format (MXF)—Mapping JPEG-XS Codestreams into the MXF Generic Container.

Work in Progress

Much of the recent work in the TC 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. Active projects include mapping VC-6 (ST 2117-1) codestreams into MXF and mapping next-generation audio (NGA) streams (and specifically S-ADM metadata) into MXF. A revision projects for ST 2019-4 is underway to add alpha support to the VC-3 mapping to MXF. Two ACES documents are being revised to conform to ISO guidelines: ST 2065-4, describing the ACES container file format, and ST 2065-5, describing the mapping of ACES images to MXF. A revision of ST 377-4—Multichannel Audio Labeling Framework is nearing completion along with companion documents ST 377-41 and ST 377-42, which define a controlled

vocabulary for MCA. RDDs are being developed that describe ARRI camera metadata and mapping ARRIRAW essence to MXF. Additionally, RDD 48 is being revised to support mapping FFV1 bitstreams to MXF. Revisions are in progress for ST 380 MXF Descriptive Metadata Scheme 1, ST 2057:2011 Text-Based Metadata Carriage in MXF, and ST 2094-2 KLV encoding and MXF mapping of DMCVT metadata.

Discussions are underway to fully revise the ST 377-1 MXF standard with the intention of breaking it up into smaller, more focused parts and utilizing the new online format for registers.

The AXF group 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 supporting workflows by providing methods for linking sets of files, enabling their use remotely, and expanding carriage of metadata related to them.

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 is currently the standards manager. He has worked as a hardware design engineer, a software design engineer, and a software project leader of professional video products.



Fred Walls is a master engineer at Broadcom, Inc. He has worked at Broadcom for over 20 years, focusing on edge-based inference, video algorithms, and architectures for ASICs.

Network/Facilities Architecture (32NF)

Co-Chairs: Thomas Kernen and Leigh Whitcomb

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 standing WGs, each focused on one of these four areas:

- All SDI interfaces and SDI-related standards
- Internet Protocol (IP) interfaces
- Time labeling and synchronization
- Data on AES3.

Work Completed

The following new documents were completed during the previous year:

- SMPTE ER 1004:2021—Report of the Study Group on Security in SMPTE ST 2059—Threat Landscape
- ST 2038:2021—SMPTE Standard—Carriage of Ancillary Data Packets in an MPEG-2 Transport Stream
- EG 2111-1:2021—SMPTE Engineering Guideline—SD-SDI and HD-SDI Standards Roadmap
- EG 2111-3:2021—SMPTE Engineering Guideline—10G-SDI Standards Roadmap
- ST 2059-1:2021—SMPTE Standard—Generation and Alignment of Interface Signals to the SMPTE Epoch
- ST 2059-2:2021—SMPTE Standard—SMPTE Profile for Use of IEEE-1588 Precision Time Protocol in Professional Broadcast Applications
- ST 2110-43:2021—SMPTE Standard—Professional Media Over Managed IP Networks: Timed Text Markup Language for Captions and Subtitles.

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 activities from 32NF-70 UHD-SDI interfaces are being merged into this WG. Five-year revisions of the 6G-SDI and 12G-SDI electrical standards are now required and are underway.

32NF-60 Video Over IP WG (Chair: John Mailhot)

This WG concentrates on live video-over-IP documents, including the ST 2110 suite for live production uncompressed elementary essence flows over IP. The group is currently working on the one-year review of many of the ST 2110 publications. Work has begun on the Protocol Implementation Conformance Statement (PIC) project.

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

The WG has been merged into 32NF-40. All SDI interfaces and related SDI standards are now under a single WG.

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 a review of the published ST 2059 documents against IEEE 1588-2019
- Drafting EG 2059-14 on best practices for large-scale PTP implementations

- Drafting RP 2059-15 PTP Monitoring YANG data model
- Planning additional interoperability tests for ST 2059-based equipment
- Drafting the Extensible Time Label (TLX)

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. Current work is on the second report on threat mitigation.

32NF DG Inter Entity Trust Boundary (Chair: Daniel Lynch)

This drafting group was established in Q4 2020 to define a recommended practice to securely exchange IP flows between third-party networks in a predefined architecture using existing IP protocols.

About the Authors



Thomas Kernen is a senior staff architect at NVIDIA. His main area of focus is defining architectures for transforming the broadcast industry to an all-IP infrastructure. He is a SMPTE Fellow, serves as the co-chair of SMPTE's 32NF committee, and is a member of the IEEE Communications and Broadcast Societies.



Leigh Whitcomb is an architect for Imagine Communications, Toronto, ON, Canada, having joined the company in 1991. He participates in SMPTE, Alliance for IP Media Solutions (AIMS), Institute of Electrical and Electronics Engineers (IEEE), and Video Services Forum (VSF) standards committees.

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 currently covers four main areas of activity. Three drafting groups are dealing

with the Broadcast Exchange Format (BXF), Media Microservices, and a UMID Resolution Protocol, respectively. In addition, there is an SG on Required Application Protocol Standards for IP-based media production.

Recent Publications

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

- OV 2021-0:2020 BXF Roadmap for the 2021 Document Suite
- Public CD ST 2125 IMF Registration Service API
- Public CD ST 2126 Microservice Status Reporting and Logging.

The two public CDs have been made freely available on SMPTE GitHub to seek wider industry review and feedback.

Work in Progress

After a hiatus following the publication of BXF 7.0, the BXF DG is back to conducting fortnightly meetings, focused on a long list of enhancements, constituting BXF 8.0. Its work is currently largely focused on several aspects of commercial content delivery.

Work is ongoing to create a standardized suite of microservices standards and related resources including related registers and controlled vocabularies to target interoperability of media systems in conjunction with the Open Services Alliance for Media (OSA). We are anticipating the vocabulary work to be contributed to 34CS shortly. Other new initiatives underway in the OSA and expected to ultimately end up in 34CS include jobs, services, infrastructure and platforms (JSIP), and privacy & security.

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.

With a business focus in mind, the study group on Required Application Protocol Standards for IP-Based Media Production is exploring prospective media industry layering models and standards requirements for interoperability of production applications running on IP-based media networks.

About the Authors



John Footen is a leader in Deloitte's M&E practice with more than 30 years of experience in the industry. He was a recipient of the SMPTE medal for workflow systems and is a Fellow of SMPTE.



Paul Gardiner studied electronic engineering at the University of Southampton, Southampton, U.K., before joining the U.K. Independent Broadcasting Authority in 1974. He is a chartered engineer and a member of the U.K.'s Institution of Engineering and Technology and is a SMPTE Fellow.

Media Packaging and Interchange (35PM)

Co-Chairs: Florian Schleich and Mitch Jacobs

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 Interoperable Master Format (IMF), a suite of standards for the worldwide interchange of high-quality, component-based audiovisual masters. IMF is specified in the ST 2067 family of documents.

TC 35PM has ~270 members.

New Projects

- ST 2067-70 IMF Application of ST 2019-1 (VC-3): IMF Application with support for image essence that conforms to VC-3 as specified in SMPTE ST 2019-1 and ST 2019-1 Amd1.
- RDD 59-1/59-2 IMF Application Constraint DPP: Given the success of the public CD process, SMPTE discontinued the Technical Specification (TSP) document type. The TSP 2121 document series, which specifies IMF Applications that satisfy the business requirements of the DPP membership, is transitioning into a series of RDDs.

Public Committee Drafts (Public CD)

Pioneered by 35PM, the public CD process was established to allow for a public review period before engineering documents reach the Final Committee Draft status (after which making substantial changes becomes increasingly complex).

- ST 2067-60 IMF Application #6 UHD TV program workflow: A specialization of the IMF framework to improve UHD TV program workflows in broadcasting stations.

Recent Publications

- ST 2067-21:2020 Am1:2020 IMF Application #2E Amendment 1: Adds support for the Hybrid Log-Gamma (HLG) color system to IMF App #2E.

- ST 2067-103:2021 OPL Common Audio Definition and Macros (Revision): Corrects the spelling of a registered symbol (MCALabelDictionaryID) used in the document.
- ST 2067-201:2021 Immersive Audio Bitstream Level 0 Plug-in (Revision): Updates normative references to the latest IMF core documents and lifts a problematic requirement regarding the use of the Channel-Count descriptor element.
- RDD 56 Track File for JPEG 2000 Codestreams with Time-Synchronous Metadata: Specification of an existing method for frame wrapping JPEG 2000 codestreams paired with time-synchronous metadata.

Document Maintenance

The document maintenance DG continuously tracks issues against published IMF documents and is currently preparing revisions for the following documents:

- ST 2067-40 IMF Application #4 Cinema Mezzanine: To support the preservation and interchange of Digital Cinema Distribution Master essence and timeline.
- ST 2067-102 IMF OPL Common Image Pixel Color Schemes: To support additional pixel color schemes introduced in the revision of IMF Application #2E.

Withdrawals

- ST 2067-20:2016 IMF Application #2: IMF App #2 was fully incorporated into ST 2067-21:2020 IMF App #2E and no legacy dependencies were identified.

Output Profile List (OPL)

The 35PM OPL DG has created the following study reports:

- AMWA AS-11 OPL Study: The report identifies and provides examples for the OPL macros necessary to transform certain IMF compositions to flat AMWA AS-11 MXF files.
- IAB in OPL Study: The report identifies requirements and provides examples for the OPL macros necessary to transform IAB track files into a variety of deliverables.

Plugfests

Plugfests are organized on an ad-hoc basis to allow verification of interoperability between implementations and to identify errors or ambiguities in specifications. The plugfest drafting group (DG) is accepting test vector submissions throughout the year.

About the Authors



Florian Schleich is a technical integrations manager at Netflix, where he supports Netflix's production technology partners in their efforts to implement innovative workflows.



Mitch Jacobs is an executive director at Disney Studios, where he guides mastering and finishing technologies, with a focus on enhancing existing and future production and post-production technologies/processes through engineering and technology innovation.

Software Task Force

Chair: Bill Redmann

Overview

The Software Task Force (SW-TF) was created by the Standards Committee (ST) to research software issues related to the work of the Standards Community (SC) and make recommendations for changes in policies and procedures to ST.

Organization

The SW-TF is at the same level as a technology committee, having the SC as the parent body, thereby allowing SC members to participate. We provide reports and presentations to ST, and the task force chair is an ST member. The SW-TF reports directly to the Standards Vice President (SVP) and copies all communications with the SVP to the Director of Standards Development.

Recent Contributions

Archival Formats Study for Drawings and Images was a study conducted and reported to the SVP and DoS. Numerous experiments were conducted to evaluate the appropriateness of specific drawing and image formats and corresponding drawing and conversion tools, to aid in identification of those suitable for providing future-proof archives for figures in engineering documents.

The *SMPTE Knowledge Network (SKN)* is the result of SMPTE's Standards Community transitioning from OLC to Microsoft Teams and is still a work in progress. The SW-TF contributed software engineering expertise to identify stakeholder roles, role requirements, and a test plan for verifying that such requirements had been met. Implementation was by largely HQ personnel, but testing drew on the volunteer efforts by task force members. Outstanding individual contributions included Dean Bullock's scrub of the migrated file structure from OLC, which generates a log of actions taken, thereby allowing files from OLC to be located within TEAMS; and Dr. Pierre Lemieux's standup of an "OLC doppelgänger" site, thereby ensuring that old links continue to resolve to the appropriate (static) documents.

Work in Progress

SKN Enhancements now take center stage in the wake of the switchover to SKN. The SW-TF now assists in identifying and describing most-needed improvements, standing ready to assist as before. Current activities

include another outstanding individual contribution, Steve Llamb's site index, and template repository, which, in conjunction with efforts by HQ, looks to be supported by a degree of automated maintenance. Additionally, requirements have been developed for improved ballot and comment tracking tools, to reduce the exertions presently required of chairs.

Software Licensing was identified last year as an unmet need, particularly as the increasing complexity of standards begets implementation challenges that could be minimized by a reference implementation, test materials, and the like. A study underway last year was set aside, due to the workload SKN migration, but this is expected to resume soon.

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About the Author



Bill Redmann is currently the director of Standards for Immersive Media Technologies at InterDigital. He holds 71 issued U.S. patents relating to digital cinema, virtual and augmented reality, media production, distributed network streaming, interactive systems, displays, online communities, mobile content distribution, exercise tracking, travel planning, and electric vehicle infrastructure.

ATSC/SMPTE Joint Task Force for NextGen Communication Architecture

Chair: Dave Siegler

A Joint Task Force has been created among SMPTE and the Advanced Television Systems Committee (ATSC) to identify and develop solutions that may be put into practice when implementing NextGen Broadcast Transmission systems. As the ATSC 3.0 Standard has been completed, the ATSC continues to refine the system to assist in real-world deployments and to accommodate burgeoning business models. The Standard was always meant to be extensible to allow future functionality.

The team is seeking workflow solutions while working with television station operators who are either planning, starting, or nearing completion of constructing an "ATSC 3.0/NextGen" facility. Our initial goal and focus is to seek solutions to simplify the management of ATSC 3.0 air chains and, in particular, to enable broadcasters to make configuration changes quickly and easily to their transport streams with negligible impact on the viewer. We believe that this may be accomplished through common control of several key devices and software required in the ATSC 3.0 broadcast transmission chain. Thus far, we have identified a number of functional blocks from the input of the encoder/packager through to the scheduler/gateway that can be controlled per

desired operational function. We also anticipate many other functions yet to be discovered as our work evolves.

The team has recently developed and circulated a whitepaper among U.S. broadcasters seeking example configurations at their stations that need simpler and faster switching methods. Once we gather these requirements, we will then collaborate with broadcasters as well as equipment and software vendors for input on opportunities for improvement. While ATSC 3.0 can utilize an almost unlimited number of operating parameters, there are, but a handful that are being used today.

The work of this team will not be limited to audiovisual television services as we know today but will also tackle new operating modes such as datacasting/core networks, interactivity, dynamic content security, and the myriad of new services enabled in the new Standard. The team also knows that the mission of the JTF is not to “steer” any specific business, competitive, or functional features. The team will only address and seek to improve the resolution of technical and operational challenges and workflows.

As the Joint Task Force continues to find solutions in these areas, I would like to acknowledge the collaborative work being done between both organizations. With technology moving so rapidly, we simply must find ways for more open discussions, such as these, to work together on standards implementations going forward.

Chair e-mail: atsc-smpte-chair@members.atsc.org

About the Author



Dave Siegler is the former vice president of technical operations for Cox Media Group (CMG); recently transitioning his deep experience as a Media Technology Consultant to advance the television broadcasting and production industry. He is a SMPTE Fellow.

Joint ETC Task Force on Artificial Intelligence and Media (JT-AI)

Co-Chairs: Yves Bergquist and Fred Walls

Overview

The Joint ETC Task Force on Artificial Intelligence and Media is an exploratory group interested in identifying and pursuing opportunities for standardization around artificial intelligence (AI) and its potential applications throughout the media ecosystem.

Organization

The Joint Task Force was formed in 2020 in cooperation with the Entertainment & Technology Center (ETC) at the University of Southern California. The ETC is a

research center that brings together senior executives, innovators, thought leaders, and catalysts from the media, entertainment, consumer electronics, technology, and services industries along with the academic resources of USC to explore and to act upon topics and issues related to the creation, distribution, and consumption of entertainment content. Participation in the Task Force is open to any interested standards-participating SMPTE members.

Recent Publications

None.

Work in Progress

The Joint Task Force is primarily working toward two goals:

- Identifying areas where new AI standards might provide significant value as far as enabling greater or better use of AI in the media ecosystem
- Drafting and publishing an Engineering Report that details the findings of the Task Force.

In late 2020, the Joint Task Force conducted an industry-wide survey to assess application areas and pain points of AI and machine learning in the production, distribution, and consumption of media. Concurrently, the Task Force also reached out to a number of other standards organizations to assess what kind of standardization activities are underway in this area.

More recently, the ETC has conducted a number of roundtable discussions with industry thought leaders in the areas of data and ontologies, AI ethics, platform performance and interoperability, and organizational and cultural integration. Additional rounds of discussions are planned to explore more specific areas in greater detail.

It is hoped that the Task Force can also provide a launching point for future SMPTE standards and recommended practices related to AI and media.

About the Authors



Yves Bergquist is an AI researcher and the director of the “AI & Neuroscience in Media” Project at USC’s Entertainment Technology Center (ETC), where his team is researching new methods and applications drawn from AI and neuroscience for the media and entertainment industry.



Fred Walls has worked at Broadcom for over 20 years, focusing on edge-based inference, video algorithms, and architectures for ASICs.

SMPTE VC-6

By Fabio Murra

The SMPTE ST 2117-1 VC-6 standard was published by SMPTE in July 2020. Currently, the SMPTE 2117-10 project is mapping VC-6 within an MXF wrapper. Conformance is expected to follow.

Since publication of the SMPTE ST 2117-1 VC-6 standard, an implementation of VC-6 has been made available as a software development kit (SDK) for inclusion in many different applications, including live and file-based production, nonlinear editing, media asset management and archival, imaging and acceleration of AI-driven image, and video metadata extraction. The VC-6 SDK includes a VC-6 decoder and a VC-6 encoder, optimized specifically for parallelized GPU and CPU execution.

The one-year standard review will start soon in SMPTE. It is expected to correct typing mistakes and ambiguity in the text and syntax tables for the bitstream header as well as a few diagrams inconsistencies which ought to be tidied up.

The current implementation of VC-6 produces bitstreams and a decoding process, which conform to SMPTE ST 2117-1 for common choices of shortcuts. Shortcuts are, in a VC-6 bitstream, a set of bits in the header that allow a decoder to exploit a set of features fully, partly or not at all. Further development work is ongoing to enable decoding of the full range of bitstreams using different combinations of VC-6 shortcuts. On the encoding side, additional development is also taking place to further improve compression efficiency and visual quality metrics as well as leveraging the speed of VC-6 in traversing its


bitstream structure to enable unique features such as real-time partial decoding and region-of-interest decoding for resolutions including 4K, 8K, 16K, and beyond.

From a usability perspective, a VC-6 API has been integrated within the popular FFmpeg framework. A VC-6-enabled FFmpeg build, a patch for FFmpeg, and the VC-6 SDK are all available as part of an early access program. One early deployment announcement is that of VC-6 taking flight on a D-Orbit satellite carrier where the hierarchical nature of the VC-6 bitstream and its speed from an implementation perspective are being tested commercially. In this particular case, VC-6 allows a part of the bitstream to be initially transmitted and processed before any further decisions are taken to request and process other bitstream parts giving higher-resolution enhancement of appropriate regions of interest.

VC-6 has gained a Wikipedia citation available here: en.wikipedia.org/wiki/VC-6. Details of SDK availability and access to the software are available on the V-Nova website here: www.v-nova.com.

About the Author



Fabio Murra is SVP Product Marketing and Solutions at V-Nova, where he drives the definition and launch of new solutions for the digital television and media market. With over 20 years of broadcast and telecoms experience, Murra has been heavily involved in both the design and deployment of cutting-edge solutions across the entire media and television delivery chain. 



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