

Reports from the SMPTE Technology Committees

Essence (10E)

Chair: Frederick G. Walls

Overview

The scope of the 10E Technology Committee applies to the electronic capture, generation, editing, mastering, archiving, and reproduction of images, 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 2117-1:2023 VC-6 Multiplanar Picture Format

Work in Progress

VC-5 Video Essence

VC-5 is based on the Cineform/GoPro intra-frame video compression system. The RP 2073-2 conformance specification underwent an administrative update to a URL, and a patent statement was updated with issued patent numbers.

VC-6 Multiplanar Picture Format

VC-6 is an intra-frame video compression system proposed by V-Nova. A Revision to ST 2117-1 VC-6 Elementary Bitstream was published.

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).
- Proposed new document regarding display screen reflectance.

Measurement Methods for Resolution Characteristics of Camera Systems

RP 2130 Measurement Methods for Resolution Characteristics of Camera Systems will define procedures, conditions, and rules applicable to measuring the spatial resolution of camera systems. It will reflect current measurement technology, independent of the image format, and replace IEEE 208.

IPT-PQ-C2

ST 2128 Colorimetry of IPT-PQ-C2 Color Space for High Dynamic Range and Wide Color Gamut Images will define an alternative color representation similar to IC_{1C_p} , used by some over-the-top (OTT) distributors. Comment resolution is finished.

Common LUT Format

ST 2136-1 will define a common LUT format that communicates an arbitrary chair of color operators. Broadcast profiles are expected to be standardized as ST 2136-10.

Other Projects

ST 96 Scanned Image Area is being revised to improve usability and allow for future maintenance.

Revisions to ST 2046-1 Safe Action Area and Safe Title Area for Television and RP 2046-2 Safe Areas for Protection of Alternate Aspect Ratios are underway.

Revisions to the ST 2048 series of documents have been completed and are awaiting publication.

A project has been initiated to standardize diffuse/reference white metadata for HLG workflows.

About the Author



Frederick G. Walls is a Fellow at Advanced Micro Devices working on display system architecture. He is an active standards contributor in SMPTE and other organizations.

Cinema (27C)

Co-Chairs: Steve LLamb and C.J. Flynn

Overview

The scope of the 27C Technology Committee applies to the application of the General Scope as it relates to theatrical distribution, reproduction, and operations, both analog and digital.

This TC, created in 2023, combines the work and membership from three previous TCs: 20F (Film), 21DC (Digital Cinema), and 25CSS (Cinema Sound Systems).

Organization

The committee is organized into two main working groups (WGs) focused on Document Maintenance (27C-10) and Sound (27C-20), each with multiple drafting groups (DGs) and study groups (SGs) covering specific tasks and areas of activity.

Recent Publications

Over the past 12 months, 27C has published the following documents:

New Standards:

- SMPTE ST 429-20:2023 (D-Cinema Packaging – MXF Constraints)

Revisions:

SMPTE ST 429-2:2023-09, Revision of SMPTE ST 429-2:2020
SMPTE ST 429-3:2023-09, Revision of SMPTE ST 429-3:2007
SMPTE ST 429-4:2023-05, Revision of SMPTE ST 429-4:2020
SMPTE ST 429-5:2023-09, Revision of SMPTE ST 429-5:2017
SMPTE ST 429-6:2023-05, Revision of SMPTE ST 429-6:2006
SMPTE ST 429-10:2023-09, Revision of SMPTE ST 429-10:2008
SMPTE ST 429-14:2023-09, Revision of SMPTE ST 429-14:2014
SMPTE ST 429-16:2023-09, Revision of SMPTE ST 429-16:2014
SMPTE ST 429-18:2023-09, Revision of SMPTE ST 429-18:2019
SMPTE ST 429-19:2023-09, Revision of SMPTE ST 429-19:2019
SMPTE ST 430-1:2023-09, Revision of SMPTE ST 430-1:2017
SMPTE ST 430-5:2023-09, Revision of SMPTE ST 430-5:2011
SMPTE ST 430-12:2023-09, Revision of SMPTE ST 430-12:2014

Work in Progress

27C WG—Document Maintenance

Meeting approximately once every couple of months, the group's focus includes new feature requests, amendment reviews to documents based on new technologies, reference dependencies, and interoperable issues encountered through practice in the field.

There were a significant number of documents going through the revision process utilizing the new SMPTE HTML publication, and those document revisions are now fully published in HTML as noted above. More document revisions are in the queue and project proposal planning, the first batch being:

- ST 430-2:2017
- ST 430-3:2012
- ST 428-11:2013

ST 428-24

This document specifies a mapping of DCDM images, as specified in SMPTE ST 428-1, into mathematically lossless JPEG 2000 codestreams, each called a packed image (pDCDM). Currently entering the DP ballot phase.

Revision of RP 200:2012

This project is meeting with the purpose of incorporating the required audio channel information for auditoriums with Immersive Audio systems, as well as harmonizing (as appropriate) the several Standards and Recommended Practices more recently developed such as ST 2095-1 Calibration Reference Wideband Digital Pink Noise Signal, and RP 2096-1 and -2, Cinema Sound System Baseline Setup and Calibration and Cinema Sound System Maintenance Calibration, and ST 202 Motion-Pictures—Dubbing Stages (Mixing Rooms), Screening Rooms and Indoor Theaters—B-Chain Electroacoustic Response (which like RP 200, an ISO Standard), all which have some overlapping information. It is currently entering the FCD phase.

EG 428-23

Creation of a guideline document for XML DCDM mastering of Japanese Timed Text to achieve desired results in current ST 428-7 renderers. It is currently entering the FCD phase.

RP 428-22

The recommended practice to create a “blank” ST 428-7 DCDM Subtitle file (Minimal Timed Text XML Requirements). Passed FCD, currently addressing a comment to continue the balloting process.

D-Cinema Origins Study Group Interim Report Archival Effort

As there was no published Final Report of the Digital Cinema Study Group, or any collected components of the work of the sub-committees, primary source documents and details of the milestones of technology involved in the creation of D-Cinema standards are often not available. These are needed for consideration of future standardization as well as a historical reference document.

The work of this group is to gather the latest iterations of those reports, then create a document that SMPTE can publish and make available as a historical reference document.

27C WG—Sound

The former B-Chain Characteristics and Expectations Working Group is now 2 B-Chain Characteristics and Expectations Drafting Groups, one compiling all relevant Technical Documents found that can inform the In Situ Testing Group, which is testing variations of new ideas to develop modern Cinema-centric measurement techniques that make objective several of the characteristics that have typically been judged subjectively.

The expert seminars that were held early in the process detailed various methods that could potentially use modern algorithm techniques and modern, but accessible,

portable computers and software to enable cinema technicians—designers, manufacturers, installers, maintenance staff—to be able to measure what they hear and better portray the Director’s Intent with their sound systems.

Research and separate regular meetings are being held focusing on linearity and coherence, coverage, and dialogue intelligibility, with other characteristics to follow. Experts join from around the world remotely, and tests in studio and commercial facilities are held as new concepts are developed and time is available.

From this research, future engineering groups will be able to specify the parameters and values required for a cinema sound system to faithfully play back modern movie soundtracks in dubbing theaters and cinemas, currently often stressed by the now common sustained high levels and transients. The eventual planned output is an RP and possibly an EG for cinema audio systems similar to ST 431-2 D-Cinema Quality—Reference Projector and Environment, to define like it does the characteristics necessary for consistent quality reproduction of D-Cinema content.

About the Authors



Steve LLamb is currently the VP, Technology Standards & Solutions, Cinema Worldwide at Deluxe.



Charles ‘CJ’ Flynn began in the mid-1970s in recording tech, later managing and supporting digital cinema innovations globally.

Metadata and Registers (30MR)

Chair: Bill Redmann

Overview

The scope of the 30MR Technology Committee applies to the definition and implementation of the SMPTE Registration Authority, used to identify digital assets and associated metadata. Additionally, it seeks to identify a common definition of metadata semantic meaning across multiple committees.

Recent Publications

ST 2123 SMPTE Metadata Registers

ST 2123 is the normative publication of the SMPTE Metadata Registers, which are accessible at www.smppte-ra.org. This version, codenamed “Jalapeno,” is published as ST 2123:2024-05.

DG Project: ST 331 Element and Metadata Definitions for the SDTI-CP

This amendment to ST 331, published in October, adds a definition for PTP Timestamp as specified in IEEE 1588-2019.

Applications producing essence and metadata created at times that cannot be represented using either SMPTE ST 12-1 or SMPTE ST 209 metadata but that could be represented using a standard PTP timestamp can now carry that timestamp as SDTI-CP metadata.

Work in Progress

WG Project: Metadata Definition

This working group (30MR10) coordinates several 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: “Balsamico” is currently a working draft (WD) candidate for the next ST 2134 revision and is undergoing review.

Business impact: Interoperable Material eXchange Format (MXF) dictionaries offer a vastly improved environment for a new generation of interoperable, table-driven MXF parsers and generators. Projects such as the IMF will be able to rapidly introduce new capabilities with minimal interoperability issues.

WG Projects: ST 335, ST 395, ST 400, and ST 2003 Revision

These standards must be revised to align with the revised registration process described in AG18, which was revised in 2017.

Status: ST 335 had previously achieved Draft Publication status and then served as a template for revising the other three documents. However, comment resolution on those later revealed an issue also present in ST 335, and the remedy will likely result in ST 335 being re-balloted. The plan remains for this set of four documents to advance to publication together.

Business impact: The published versions of ST 335, ST 395, ST 400, and ST 2003 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

The project to revise RP 205, “Application of UMIDs in Production and Broadcast Environments,” continues, providing important updates, clarifications, and alignment with ISO Directives. Contributions by SMPTE HQ’s technical editor, Ellen Ryan, have been particularly insightful regarding these latter two aspects. Updates include adding Unique Material Identifier (UMID) application examples in accordance with the 2022 revision of ST 330.

Status: A further round of edits made while achieving the highest quality document has been enough to necessitate a re-ballot of the document, which will be initiated soon.

SG Project: UUID File Naming

The SG is examining the use of Universal Unique Identifiers (UUIDs) in all SMPTE Engineering Documents that currently apply to them, developing an approach for harmonizing the use cases, and allowing the application of UUIDs as file names to the extent possible going forward. The project also provides recommendations for follow-up work to implement the approach developed in SMPTE Engineering Documents.

Status: The SG is meeting regularly to finalize their report.

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 file identifiers. Often, implementations of SMPTE Engineering Documents attach new UUIDs to files despite those files already associated with assigned UUIDs.

SG Project: UMID Applications

The SG examines the industry's current use of UMID and proposes projects to modify existing UMID standards, some of which are reported here.

Status: Work is ongoing.

About the Author



Bill Redmann is the Director of Standards for Immersive Media Technologies at InterDigital.

File Format Systems (31FS)

Chair: Wolfgang Ruppel

Overview

The 31FS Technology Committee is concerned 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 digital content components. Well-known formats such as Digital Picture eXchange (DPX), Material eXchange Format (MXF), General eXchange Format (GXF), Archive eXchange Format (AXF) and Academy Encoding Color System (ACES) have been studied within this TC.

Organization

TC 31FS has several subgroups, including Drafting Groups for MXF mappings, key-length-value (KLV) extensions for MXF, a Working Group concerned with defining and drafting the AXF, and a JavaScript Object Notation (JSON) representation of the SMPTE Register Data.

Recent Publications

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

- ST 268-2:2023—Digital Moving Picture Exchange (DPX)—Format Extensions for High Dynamic Range and Wide Color Gamut
- RP 268-3:2023—Digital Moving-Picture Exchange (DPX)—Reference Materials for DPX V2.0 HDR Implementations
- ST 377-41:2023—MXF Multichannel Audio Controlled Vocabulary: Content Property Values
- ST 381-5:2023—Material Exchange Format — Mapping HEVC Streams into the MXF Generic Container
- ST 385:2012 Amd 1:2023—SMPTE Amendment—Material Exchange Format (MXF)—Mapping SDTI-CP Essence and Metadata into the MXF Generic Container
- Amendment to ST 2019-4:2016—Mapping VC-3 Coding

Units into the MXF Generic Container

- ST 2065-5:2023—Material Exchange Format—Mapping ACES Image Sequences into the MXF Generic Container
- ST 2094-2:2023—Dynamic Metadata for Color Volume Transform—KLV Encoding and MXF Mapping

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, the revision of the mapping of HEVC into MXF (ST 381-5), the mapping of Audio Definition Model (ADM) and other audio metadata RIFF Chunks into MXF, and the mapping of DPX sequences into the MXF Generic Container. Drafting groups on data structures have been working on the KLV representations for Time Label eXtensible (TLX) labels and TLX items and defining a JSON representation of SMPTE registered data.

Revisions are in progress for ST 380 MXF Descriptive Metadata Scheme 1, ST 2057:2011 Text-Based Metadata Carriage in MXF, ST 381-3 Mapping AVC into MXF, and RP 268-3 Reference Materials for DPX.

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 has continued during the reporting period, particularly in the area of expanding carriage of metadata.

About the Author



Wolfgang Ruppel is a digital technology expert and industry consultant with more than 20 years of experience in broadcast and media.

Media Systems, Control and Services (34CS)

Chair: Karyn Reid

Overview

The 34CS Technology Committee manages and controls hardware devices, software systems, and media workflow processes, including associated signaling and control mechanisms.

Organization

The work of the 34CS TC currently covers four areas of activity. Three DGs deal with the Broadcast eXchange Format (BXF), media microservices, and a UMID resolution protocol. In addition, there is an SG on Required Application Protocol Standards for IP-based media production.

Recent Publications

ST 2021-4:2023 BXF Schema Documentation Package Revisions to BXF (BXF 8.1).

Work in Progress

BXF:

The BXF group is gathering requirements for the planned BXF 9.0 update, and work should begin soon. BXF 8.1 was recently published and is available in the SMPTE Standards store.

Media Microservices:

The 34CS DG on Media Microservices has been hard at work on several documents over the past year.

ST 2125: IMF Registration API

This document remains in Public CD (PCD) status. We await a revision from the document editor and plan to advance the document through the remainder of the standardization process in early 2025.

ST 2126: Microservice Status Reporting and Logging

This document has now moved beyond PCD status. It passed its FCD ballot unanimously and is now off to pre-DP review and the rest of the standards approval process.

Terminology Documentation

This resource is in the process of being posted to the SMPTE website after the DG has done much work on its development.

ST 2133: Job Processing Architecture

This document will soon be posted as a PCD to allow implementers to review, utilize, and provide feedback to the DG.

ST 2138: Catena

This project aims to provide an open standard and open-source approach to the challenge of connecting and controlling devices and services across any platform (on-prem or cloud) in a secure manner. This is proceeding well with bi-weekly meetings. The group has recently decided to re-factor its main document (ST 2138-10) to focus solely on the data model. Separate documents will focus on the various connection types (gRPC, REST, WSS) and be published as ST 2138-11, ST 2138-12, and ST 2138-13. Work has taken place in RIS-OSA, but the first of these documents is expected to transition to the Media Microservices DG shortly.

Required Application Protocol Standards for IP-based Media Production Study Group

The Technology Committee has approved the report from the Study Group and is in the queue for publication.

About the Author



Karyn Reid is the Vice President of Broadcast Systems at Fox/Tubi Media Group. Previously, she was the product manager for several broadcast software vendors. Reid worked at several TV networks and local TV and radio stations before moving to the broadcast vendors VCI and later Peter Storer and Associates.

Media Packaging and Interchange (35PM)

Co-Chairs: JoAnne Kim and Raymond Yeung

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 approximately 160 members.

New Projects

- **ST 2067-4 IMF Virtual Track Fingerprint:** A method for computing a unique identifier for the contents of a virtual track in an IMF Composition Playlist.

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 Final Committee Draft status (after which making substantial changes becomes increasingly complex).

- **ST 2067-72 IMF Application of ST 2073-X Suite (VC-5):** IMF Application with support for image essence that conforms to the VC-5 codec, providing high-speed encoding and decoding with visually lossless compression.
- **ST 2067-204 IMF Audio with ADM Metadata Plug-in:** IMF Plug-in for adding ADM (Audio Definition Model) metadata to PCM-essence as Virtual Tracks to IMF Compositions.

Documents in Development

The following Engineering Documents are being developed as standards by the assigned drafting groups (DG).

- **ST 2067-4 IMF Virtual Track Fingerprint:** A method for computing a unique identifier for the contents of a virtual track in an IMF Composition Playlist.
- **ST 2067-72 IMF Application of ST 2073-X Suite (VC-5):** IMF Application with support for image essence that conforms to the VC-5 codec, providing high-speed encoding and decoding with visually lossless compression.
- **ST 2067-204 IMF Audio with ADM Metadata Plug-in:** IMF Plug-in for adding ADM (Audio Definition Model) metadata to PCM essence as Virtual Tracks to IMF Compositions.
- **ST 2067-205 IMF Auxiliary Image Sequence Plug-in:** IMF Plug-in for Auxiliary Image Sequences as Track Files in IMF Compositions intended for sign-language window to be composited onto the main video.
- **ST 2067-206 IMF Event-based, Text-based Metadata Plug-in:** IMF Plug-in for adding a textual metadata document and associated binary resources to an IMF Composition.
- **ST 2067-207 IMF Video Viewport Metadata Plug-in:**

IMF Plug-in for metadata defining video viewports intended for display—a rectangular region of the associated video. A liaison from the EBU has prompted this plug-in track project as a specialized extension of ST 2067-206 described earlier.

Recent Publications

- **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.
- **ST 2067-71 IMF Application of ST 2117-1 (VC-6):** IMF Application as a specialization of the IMF Framework to no-proxy workflow using the hierarchical properties of VC-6 to create workflow efficiencies through layered storage and transport while retaining the auditing and versioning capabilities of IMF.
- **ST 2067-202 Isochronous Stream of XML Documents Plug-in:** Conversion of SMPTE RDD 47 to a standard for frame-based XML documents as Virtual Tracks in IMF Compositions.
- **ST 2067-203 IMF Audio with Frame-based S-ADM Metadata Plug-in:** IMF Plug-in for adding MGA (Metadata Guided Audio) with Serial Audio Definition Model (S-ADM) metadata as Virtual Tracks to IMF Compositions.

Document Maintenance

The Document Maintenance DG continuously tracks issues against published IMF documents. Since the DG completed a review of TC 35PM documents one and five years after publication in 2023, the DG is preparing to conduct the next review based on current information provided by the SMPTE Director of Standards Development in late 2024.

The Document Maintenance DG also guides the communications in response to liaisons directed to the TC. In response to a liaison from the DCI regarding the NIST directive to deprecate the SHA-1 algorithm from its standards by the end of 2023, the DG issued an Advisory Note (AN) to clarify that IMF content, including digital signatures, should not be considered resilient to malicious attacks until the SHA-1 algorithm is replaced. Furthermore, the DG determined that IMF content, including its content integrity and identification features, remained resilient to non-malicious corruption.

Withdrawals

- None

Output Profile List (OPL)

The 35PM OPL DG is working on the following documents to extend the OPL system:

- **ST 2067-101 Common Image Definitions and Macros (Revision):** Add common image processing operators to the OPL suite of macros.
- **ST 2067-104 Composite and Blend Macros:** OPL image compositing and blending operators.

- **ST 2067-105 Output Macros:** OPL operators to export industry file formats such as ISO BMFF, TTML, AMWA AS-11, PCM essence in ISO BMFF, and immersive audio in BWF+ADM.
- **ST 2067-106 Essence Type Transform Macros:** OPL operators to transform essences such as timed-text rasterization and IAB rendering.

About the Authors



JoAnne Kim is a production technologist who has worked in Media & Entertainment for over 25 years in various roles on major Hollywood projects like *Dune* and *Rings of Power*. She is an immersive post-production producer at Apple, focused on innovative technology solutions to shape a new storytelling medium with top standards for immersive experiences.



Raymond Yeung is the head of tech standards at Amazon Studios Technology, where he serves in the Media Engineering and Innovation Group.

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