

SMPTE Television Technology Committees Snapshot of Present Standardization Activities

Many broadcasters around the world work under challenging economic conditions; they are forced to further increase efficiency, reduce the costs of programming, and establish new businesses. Technology as the *enabler* to carry out the task of content production has therefore increasingly focused on users and industry, to permit them to meet the challenges mentioned. But each introduction of a new technology raises concerns about reliability, stability, and interoperability, which, in fact, is where the standardization work of the SMPTE Technology Committees plays a determining and significant international role.

It is obvious that a revolution in broadcast technology has taken place over the last years, characterized as a transition from analog to digital, from digital to software, and from video/audio centric to data centric. The latter, in particular, will lead to changes in workflows and consequently new user requirements. Examples are online search and browse, rough-cut at the workplace of the editorial staff, replacement of multiple tape cassette copies and their manual transfer by networks, handling of metadata, integration information services, storage on nonlinear media, and rights management.

Traditional broadcast technologies have increasing difficulties meeting these new requirements. For that reason, the industry and users have started to explore new technology sectors and it seems that, in particular, the IT world may offer attractive answers for the emerging requirements.

The standardization work of SMPTE reflects this new situation to a great extent in its technology committees. This kind of report will appear on a regular basis (at least twice a year) in the *SMPTE Motion Imaging Journal* to inform SMPTE members about the most important standardization activities in the Television Technology Committees.

Committee Working Rules

The Television Technology Committees meet four times a year for about one week. In contrast to the past, when participants left the meetings with about ten pounds of paperwork, today all paperwork is shared via file server, online during the meeting. Of course, most of the work is carried out between the meeting cycles in ad hoc meetings and via e-mail and FTP, both provided by SMPTE Headquarters. This clearly offers more effective and convenient working conditions for the active "drivers" in the engineering meetings and also permits non-regular attendees, in particular users, to keep track of the developments and recognize new trends and technologies by simply "observing" the e-mail reflectors of the different committees (subscription via SMPTE website). SMPTE has defined two levels for participating in standardization work: Observer or active Participant. Both conditions put different levels of duties on the attendee. Detailed information can be found in SMPTE's Administrative Practices (www.smpte.org/engineering_committees/).

Present Work of the Technology Committees:

The logistical structure of the engineering committees and the standards documents reflect the requirements of a more and more IT-influenced broadcast world, where useful and appropriate layered approaches for standard documents are adopted, similar to the rules of the OSI layer model.

At this point in time, the Television part of the SMPTE is organized into nine Technology Committees:

S22—System Technology Committee (William Miller, Chair)

The Scope of the S22 TC as given in the SMPTE Administrative Practices states: "The application of the General Scope as it pertains to the design, management, and control of systems based on the integration of the technologies of video, audio, data essence, compression, recording, meta-data, wrappers, file formats, and transfer protocols."

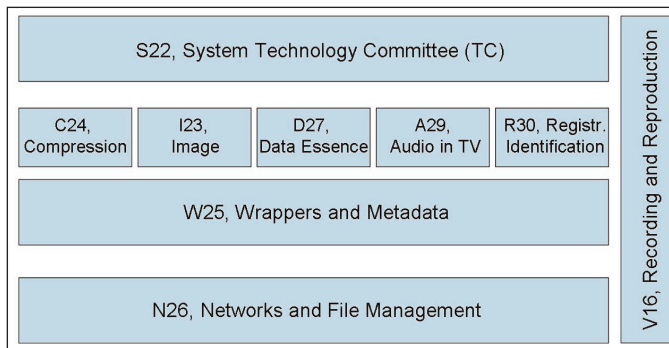
S22 therefore plays a significant role in SMPTE's television standardization. It must also maintain an overview of the work carried out in the other technology committees (see below) from a system point of view. Many times S22 discusses requests for new work items to be carried out by the Society and determines which technology committee should be given the task. Recently, S22 completed revision of Recommended Practice 168 on the Definition of Vertical Interval Switching Point for Synchronous Video Switching.

Owing to the requirements of the multistandard production environment, an Advanced Time Reference Standard has been developed and is nearing completion. The revision of SMPTE 318M, Synchronization of 59.94- or 50-Hz Related Video and Audio Systems in Analog and Digital Areas is also in its final stages. In accord with these two work items, the development of an Engineering Guideline on Advanced Timing Reference has begun.

A new and important development in SMPTE is the standardization of Management Information Bases (MIBs). MIBs define the items managed by the Simple Network Management Protocol (SNMP) and comprise variables that maintain the status of equipment. These types of standard documents reflect the user requirements for achieving (software) interoperability between the server systems.

Regarding unique identification of content, SMPTE developed the widely used Unique Material Identifier, SMPTE 330M. This standard is accompanied by a recommended practice, RP 205, on the application of Unique Material Identifiers in Production and Broadcast Environments. This RP is under revision reflecting the recent new technology trends and applications.

While the work in the metadata and UMID areas has so far concentrated on defining the elements (standards) for the indi-



vidual “pieces” of future television production environments, S22 is about to begin a study of the overall impact of applying metadata, UMID, and essence and to investigate their flow through the full production chain.

SMPTE is also obligated for Five-Year Reviews of their standards: S22 is at the moment reviewing the following documents:

ANSI/SMPTE 298M-1997, Universal Labels for Unique Material Identifier of Digital Data

RP 159-1995, Vertical Interval Time Code and Longitudinal Time Code Relationship

RP 164-1996, Location of Vertical Interval Time Code

RP 196-1997, Transmission of LTC and VITC Data as HANC Packets in Serial Digital Television Interfaces

ANSI/SMPTE 207M-1997, Digital Control Interface-Electrical and Mechanical Characteristics

RP 113-1996, Supervisory Protocol for Digital Control Interface

RP 138-1996, Control Message Architecture for Digital Control Interfaces

RP 139-1997, Tributary Interconnection for Digital Control Interfaces

RP 191-1996, Routing Switcher Type-Specific Messages for Remote Control of Broadcast Equipment

C24—Compression Technology Committee (Dave Fibush, Chair)

The Scope of the C24 TC as given in the SMPTE Administrative Practices states: “The application of the General Scope as it pertains to the encoding, processing, switching, and decoding of video signals to, in, and from the compressed domain.”

Recent activities include encoding standards for DV-based and MPEG-2 data to be applied to video recording and equipment interconnections. These encoding standards support technologies such as DVPRO, DVPRO-HD, HDCAM, HD-D5, D10, and D11. Technology for minimizing artifacts when decoding and re-encoding MPEG data in studio multigeneration processing has been provided by development of standards for the “re-coding data set.” Work is presently nearing completion on a compressed form of re-coding data with approval of the standard expected by the end of 2003. Past activities included interoperability ranges for MPEG-2, macroblock alignment for MPEG-2 multigeneration processing, and seamless switching for MPEG-2 transport streams. While the

work of the committee is primarily contribution driven, presentations on new technologies, such as MPEG-4 and new coding schemes being developed by the ITU/ISO/IEC Joint Video Team (JVT), help set the direction for new work. The standards documents developed provide both manufacturers and users with information needed to ensure program interchange and compliance with equipment technical specifications.

I23—Image Technology (Dave Bancroft, Chair)

The Scope of the I23 TC as given in the SMPTE Administrative Practices states: “The application of the General Scope as it pertains to the generation, acquisition, form function, processing, interconnection, and presentation of video signals when those signals represent conventional images.”

I23 takes care of the interface between the optical domain and the electronic domain at the very beginning of the television imaging chain. It is here that the fundamental scanning and colorimetric parameters of the signals representing the captured image are specified. For example, the numbers of pixels per line and lines per frame of the scanned representation, as well as colorimetric factors such as reference primary colors and grayscale curves. The well-known 1920 x 1080 studio scanning standard came from I23. Currently this document is under revision to allow a greater range of bit depths, among other improvements.

Other work includes, for example, the recommendation on safe action and safe title areas to include widescreen production, and also a recommended practice for encoding information about telecine transfers into the ancillary data space on digital video interfaces.

Test signals and materials are also within I23’s scope. A recommended practice for a widescreen high-definition color bar signal has been issued that also provides a compatible image for down-converted standard definition 4:3 aspect ratio usage and also a set of test materials suitable for checking compression systems has been produced.

As the moving image industry migrates more and more towards “repurposing” the same images for use across multiple consumption media—with digital broadcasting and digital cinema joining the traditional outlets—there will be an increasing need to revisit some of the assumptions about the makeup of the “television image signal,” for example its color analysis parameters.

D27—Data Essence Technology Committee (Mike Dolan, Chair)

The Scope of the D27 TC as given in the SMPTE Administrative Practices states: “The application of the General Scope as it pertains to the definition, coding, function, and application of data mechanisms other than those of video data, audio data, and metadata.”

The classic example of D27 works is closed captioning formats, although today’s work is focused on Interactive Television (ITV). Declarative Data Essence (DDE) has been defined recently, and includes EG39, SMPTE 363M, and some related standards and RPs, including bindings to NTSC and PAL/SECAM. This work is basically a profile of HTML,

ECMAScript, and synchronization suitable for enhancing standard video and audio with "data." It was, in essence, a codification of the ATVEF specification and has become known as DDE, Content Level 1 (DDE-1). Editorial finalization of the PAL/SECAM binding and an amendment to SMPTE 363M to add the previously omitted "javascript:" URI scheme will bring this work to closure and final publication of all components. The activity was primarily driven by the manufacturers of ATVEF receivers to bring harmonization to their field implementations. It has also been published as IEC/PAS 62292 with follow-up activity in IEC TC100.

The current and future work of the committee is focused on developing generic authoring and distribution formats for ITV standards that were developed by ATSC, DVB, and ARIB; also including DDE-1. This work includes an Ad Hoc Group on Application Metadata and Wrappers, and one on DDE-2, both focused on ITV packaging issues during distribution and XHTML-based "next generation" DDE, respectively. This work is primarily driven by the interest in getting ITV data bound to and distributed with video and audio.

In addition, it is expected that DDE-1 will evolve to address the current practice of more recent HTML-based receiver designs, as well as possible harmonization with other HTML-based standards such as the European Teleweb project (IEC/PAS 62298).

R30—Registration and Identification Technology Committee (S. Merrill Weiss, Chair)

The Scope of the R30 TC as given in the SMPTE Administrative Practices states: "The application of the General Scope as it pertains to the definition, content, transport, storage, and registration of data structures for identification of digital assets and associated rights, for identification of storage, transport, processing and similar systems, and as it pertains to operations of the SMPTE Registration Authority."

In consequence of this scope, R30 is responsible for the development of standards supporting the functional uses of many of the digital techniques being put into place across the television industry. It also has responsibility for the online publication of data from all SMPTE standards that will be automatically accessible to future equipment and systems.

All the work of R30 is intended to make practical and efficient the use of the new digital techniques for television and other motion imaging technologies. Given the potential complexities of the new digital systems and the fact that standards for digital systems will continue to evolve, it is important to make it possible for equipment and systems of the future to update automatically, without operator intervention. It will also be the case that the registration and identification functions will enable operation of production, post-production, and distribution systems more efficiently with respect to the workloads of operators.

Among the projects currently under way within R30 are development of a content identification system in conjunction with the International Organization for Standardization (ISO), harmonizing identifier systems in use for a variety of purposes throughout the television industry, and registering a multiplicity of labels and code points that determine how a variety of complex systems operate. R30 is also responsible for publication on the SMPTE Registration Authority website of the data for

standards that provide for updating on a dynamic basis, allowing those standards to keep up with the progress of technology without undergoing the inherent delay of the full standardization process.

Specific R30 projects include development of a registration number for identifying completed works such as television programs, commercials, and the like. The identifier, being developed jointly with a working group of ISO, is called the Versioned International Standard Audiovisual Number (V-ISAN). The V-ISAN will enable a wide range of metadata tracking and the automation of distribution and release functionality. Another activity is work on harmonization of the four major identifiers being developed on a worldwide basis, including V-ISAN, UMID, CID, and CRID. It turns out that the four identifiers do not overlap in their purposes and can be made to interoperate harmoniously.

Other activities of R30 include preparation of the SMPTE Registration Authority (RA) website (www.smp-te-ra.org/) for online publication of the SMPTE Metadata Dictionary and other metadata structures. The RA website will be the location from which all sorts of data updates will be served to online applications in years to come along with human-readable versions of the same information.

W25—Metadata and Wrapper Technology Committee (Mike Cox, Chair)

The Scope of the W25 TC as given in the SMPTE Administrative Practices states: "The application of the General Scope as it pertains to the definition of metadata and wrapper types and their structures for storage, transmission, and use."

At the moment the W25 work concentrates on two major subjects: the SMPTE Metadata Registry, and File Formats for professional content creation, including the Material Exchange Format (MXF) and the Advanced Authoring Format (AAF). The user requirements for the SMPTE Metadata Registry stemmed from the work of the EBU/SMPTE Task Force (TFHS) in 1997-1998. These requirements have been reviewed and reaffirmed several times during the standardization work.

In the last few months, W25 completed review of the fourth installment of the Metadata Dictionary (RP210.4) and has started balloting of the fifth installment. This process will continue on a three to six-month cycle for the foreseeable future as new metadata items come to light.

Other elements of the Metadata Registry recently completed include the Registry of Groups (Set and Pack Encoding) and the Registry of Labels. The Registries of Types and Enumerated Values are now starting balloting. All these Registries will be open for new entries on the same cycle as the Metadata Dictionary.

In upcoming meetings, three tasks will be focused upon: Registration of EBU Descriptive Metadata (P/Meta); the revision of SMPTE 336M, Key-Length-Value Encoding for Metadata; and standardization of a KLV to XML mapping. Simultaneously, the project to standardize the Material Exchange Format (MXF) is nearing completion.

MXF was also the result of user requirements first spelled out by the joint EBU/SMPTE Task force, to which diverse

inputs from EBU members, MPEG broadcast users, the European Commission-funded G/FORS project, and the Hollywood community have been added. Major design efforts have been contributed by manufacturers working together in the AAF Association and the Pro-MPEG Forum, with the common goal of a compression-independent, transport-independent, server-independent file format with extensive metadata capabilities.

The majority of the documents that together define MXF are in the final stages of technical review before their trial publication. One or two documents are a little further behind, however, the suite now addresses: MPEG I frame and long GOP, all DV variants, uncompressed pictures, uncompressed and compressed audio formats, pluggable descriptive metadata schemes, ancillary data, and private "dark metadata," in any combination.

In the next meetings of W25, the focus for MXF will be upon long GOP MPEG-2, and descriptive metadata. At least three different descriptive metadata schemes are envisaged for different application areas, and the pace of work to harmonize these schemes has picked up tremendously in recent months. The project to review the Advanced Authoring Format itself has had to take a back seat during the last year while these other tasks were pursued. With the renewed attention being given to post-production and interactive television, demands are growing for this project as well.

N26—Networks and File Management Technology Committee (Johann Safar, Chair)

The scope of the N26 TC as given in SMPTE's Administrative Practices states: "The application of the General Scope as it pertains to the definition of file management and transfer protocols, their structures for storage, transmission, and use, and the physical networks that carry them."

Interfaces and their standardization are the enabling tools that assure interoperability of equipment for the industry. The major contribution of the N26 committee is in the development of new interface standards as the technology progresses and further evolves. The work on a new document that covers a specific subject takes approximately six to nine months from the start of a project. During the past two meetings of the N26, the committee worked on the following new documents:

- Mapping SDI signal interface into an ATM (AAL1) interface/stream.
- Mapping Ancillary packets (VANC packets) conforming to SMPTE 291 into three different DV-based streams: 25 Mbits/sec, 50 Mbits/sec, and 100 Mbits/sec. (Three separate documents.)
- Implementation guide document on how to implement Close Captioning in DTV systems.
- Transmission of MPEG re-coding data through a DV-based 50 Mbit/sec stream.

New Issues

The committee started to work on following new issues:

1. Resolution of inconsistencies in various SMPTE documents regarding passage for the Error Detection and Handling

(EDH) signal. Not every equipment can pass through an EDH signal; therefore, revision of various documents may improve the situation.

2. Discussing a pathological signal and addition of information into the RP 178 regarding a possible solution. While pathological signal in a field is quite limited, there are applications that may benefit from a proposed solution, for example, interference with transmitted data.

3. Revising the transmission document (SMPTE 299) for embedded audio data through an HDTV serial interface (SMPTE 292). The present transmission document is similar to SDTV audio mapping document (SMPTE 272), which has some minor implementation problems that require a solution.

4. Revising Serial Data Transport Interface (SMPTE 305) due to an error in the document.

5. A possible way to map the UMID data into vertical ancillary space as a separate ancillary packet. The intention is to make it easy to find and decode the UMID from a SDI stream. This document has already been balloted; due to objections it will be further debated.

As an immediate new work item, the mapping of different DV-based streams into an IEEE interface has begun.

A29—Television Audio Technology Committee (Steve Lyman, Chair)

The scope of A29 TC as given in the SMPTE Administrative Practices states: "The application of the General Scope as it pertains to the mechanisms and practices used in the production, processing, recording, reproduction, distribution, and presentation of sound records for television systems, excluding digital cinema. Also excluded are the mechanisms and procedures used for the recording and the reproduction of television sound records on the same media with video records."

The main work of A29 concentrates at the moment on the Engineering Guideline on Audio Channel Assignments, which had been extended to reflect the common practice of putting uncompressed (PCM) stereo audio program on channels 1 and 2 and compressed (rate reduced) audio programs on channels 3 and 4 of four track video recorders. The document reflects the growing need of many users in the SMPTE community who include this channel assignment in their program supply requirements. This work is carried out in close cooperation with the Study Group on Audio Production and Post Production for Motion Picture and Television Entertainment Programming (A12.68).

A new proposal for a 16-channel audio transport, based on multiplexed AES3 digital audio streams is under consideration. Users are moving to multichannel audio from the stereo pair that has been the norm for many years; this proposal is one way of responding to that need. The need for multichannel audio is also being addressed by a new specification that will allow audio recorders, which may corrupt audio data, to record data streams transparently. This allows users to record compressed multichannel audio (or other data streams) in place of mono or stereo programs.

A complete revision of an existing document will allow users to accurately specify the performance of new control room monitoring systems for stereo or multichannel sound is also being undertaken.

V16—Television Recording and Reproduction Technology (Neil Neubert, Chair)

The Scope of the V16 TC as given in the SMPTE Administrative Practices states: "The application of the General Scope as it pertains to all phases of the recording and reproduction of television image, audio and ancillary signals, including editing and signal processing within the recorder."

V16 has, in the past year, added several new digital videotape recorder standards to the SMPTE library. These include the on-tape recording formats for Sony IMX, D-10, SMPTE 365M; Sony HDCAM, D-11, SMPTE 368M; and Panasonic DVCPRO 100, D-12, SMPTE 371M. In addition, the D-7 standard, SMPTE 306M, was revised to include the latest updates to the Panasonic DVCPRO tape recording format. Companion document SMPTE 307M, describing the D-7 tape and cassette, was updated to specify how it is used with DVCPRO systems operating at 25, 50, and 100 Mbits/sec.

The D-10, D-11, and D-12 standards are early examples of SMPTE's new method of developing "layered" standards documents. Companion standards exist for each of these recording formats that specify the compression techniques used in them and the interfaces available for them. These documents provide comprehensive technical information for those who wish to thoroughly learn and understand how these digital videotape recorders function. We anticipate that some new DVTR formats will be standardized by SMPTE and V16 in the near future.

SMPTE V16 has embarked on an effort to develop a standard for a digital videodisc recording system intended for broadcast applications such as newsgathering and program acquisition and production. One of the world's major broadcast networks made this formal request to SMPTE. There has been very good interest and participation in this activity by manufacturers and world broadcasters for the past year; nevertheless, it has become clear that disc recording technology for such purposes is not yet sufficiently developed and mature to permit the prediction of successful standardization in the near future. Instead, V16 will concentrate on the development of a comprehensive user requirements document to guide designers when the technology is ready.

Liaison and Other Activities

Today's technology standards can only be developed taking into account a global view. SMPTE maintains a very high international reputation through decades of close cooperation with the European Broadcasting Union, or more recently, via formal liaison status with the ITU-R, ITU-T, MPEG, and ISO/IEC. Often, SMPTE standards are directly adopted by those international organizations proving and underlining their value to users and the industry.

SMPTE is recognized by the American National Standards Institute as an accredited standards developing organization.

Summary

As many readers may have correctly identified, the work that is carried out in the technology committees is highly technical. Many times, when users have the opportunity to visit the technology committee meetings for the first time, they find

themselves overwhelmed by the highly technical discussions. But it is important to recognize that the technology and standard developments should always be based on concrete user requirements and problems in the area of interoperability to be solved. For that reason, it is of mutual importance that the experts in the technology committees and the actual users increase their communication. User input in the form of participation, written contributions, requests for work, or constructive critiques are very welcome.

The next update on the progress in the technology committees will be issued after the March 2003 meetings.

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