www.evertz.com

ASPEN

What is ASPEN and Why Should I Care?

As we evolve away from SDI, many of the rigid constructs such as ancillary data space inherited from legacy analog blanking become unnecessary overhead. Embedded audio and ancillary metadata provide a tidy solution that has served well for a quarter-century, but are limited in their flexibility, particularly in the binding of audio to video.

SDI over IP

SMPTE ST 2022-n is a family of encapsulation standards for the transport video with embedded audio and ancillary metadata over WAN networks using IP. SMPTE 2022-6 addresses the encapsulation of uncompressed video signals for transport over IP networks.

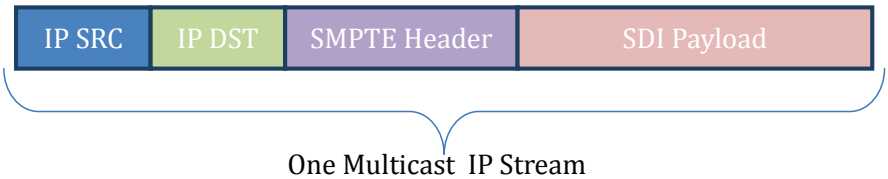

Figure 1 - SMPTE 2022-6 Packet Format

Figure 1 illustrates how the SDI payload is packetized into RTP/UDP/IP packets according to SMPTE ST 2022-6. The entire SDI signal, including full field/frame video, embedded audio, HANC and VANC, is transported without any option to separate individual elements. While this is a straightforward solution which can work well for simple A-to-B transport applications, it is very inflexible in the production environment. Moving to IP should not mean being constrained to 25+ year old concepts.

SMPTE 2022-6 for Production Environments?

Instead of encapsulating and transporting the entire SDI signal, transporting the video and audio essence and necessary VANC metadata separately along with a means of synchronization is a more effective solution. This flexibility is extremely useful in live production environments where independent video, audio, and VANC shuffling and processing are required. Additionally, this separation simplifies signal processing by removing unnecessary embedding and de-embedding functions.

ASPEN Explained

ASPEN is an encapsulation format that takes uncompressed SD, HD, 3G and Ultra HD signals and packetizes them into an MPEG-2 Transport Stream. This encapsulation method is documented in SMPTE RDD-37. MPEG-2 Transport Streams are already widely used today to transport compressed formats such as MPEG-2, H.264, HEVC, and JPEG2000, to name a few. MPEG-2 Transports Streams are carried over DVB-ASI or IP, typically at either 270 Mb/s (DVB-ASI) or 1 Gb/s Ethernet using SMPTE ST 2022-2. ASPEN completes the transport of video by defining uncompressed SD, HD, 3G and Ultra HD formats. With 10GbE (and higher) having become commodity interfaces, the transport of uncompressed video becomes a reality.

SMPTE standards already exist for audio and ancillary data over MPEG-2 Transport Streams. Embedded or discrete AES audio is processed according to SMPTE ST 302, and VANC metadata such as AFD, ATC, CC, etc. are handled according to SMPTE ST 2038. Any number of audio channels can be accommodated, as can any or all VANC services. The resultant Transport Streams are formatted into RTP/UDP/IP packets according to SMPTE ST 2022-2 for IP network transport. ASPEN video transport using SMPTE RDD 37 completes the suite of transport services required for building uncompressed network infrastructures of any scale.

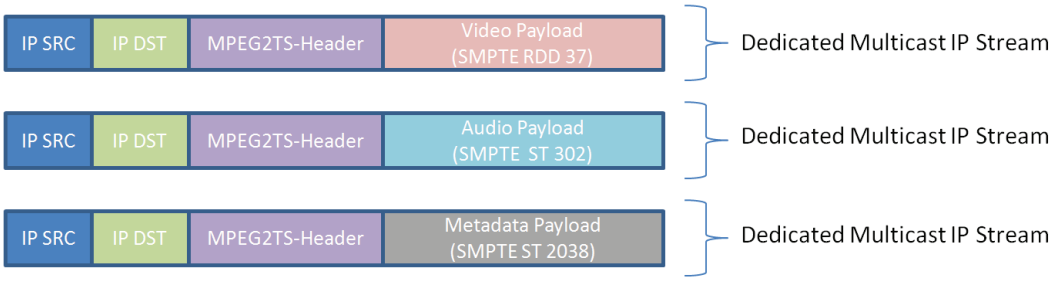

Figure 2 – ASPEN Packet Format

Figure 2 illustrates the three types of streams utilized: SMPTE RDD-37 for video, SMPTE ST 302 for Audio, and SMPTE ST 2038 for Metadata. Each is a dedicated IP Multicast stream.

The individual Transport Streams are self-describing, allowing adaptation by receiving devices, such as identifying and selecting an audio channel. Because each element of the source is conveyed separately, only the elements of interest need be delivered at any particular point in the system, eliminating the need to multiplex and demultiplex audio and metadata as is necessary with SDI. By not sending the empty elements of the SDI signal, bandwidth savings are realized, and separate routing of audio and video become straightforward. ASPEN provides extremely low processing latency of only a few lines.

Synchronization

ASPEN uses the proven synchronization mechanisms of the MPEG-2 Transport Stream to provide precise reconstruction of timing and alignment of video, audio and metadata. High-Frame Rate (HFR) and Ultra-High Definition (UHD) formats are inherently supported. The PCR timestamp is locked to source timing, and the same PCR is used across all streams. When sources are externally locked, fully synchronous systems can be built, and multi-link signal formats supported. ASPEN is fully compatible with SMPTE ST 2059 PTP-based synchronization, which itself is compatible with legacy analog reference systems, enabling the evolution of hybrid facilities with harmonized system-wide SDI and IP stream synchronization.

Advantages of ASPEN

The addition of ASPEN format to the existing MPEG-2 Transport Stream ecosystem opens more advantages for an IP-based facility. The ability to have separate streams for video, audio, and ancillary metadata can simplify movement of content throughout and between facilities. Figure 3 shows how the addition of ASPEN completes the ecosystem for various applications.

	Application				
	Live Production		Facility Distribution		Primary Distribution
	Compressed	Uncompressed	Compressed	Uncompressed	Compressed
Video Standard	VSF-TR01 JPEG2000 into TS or LLVC into TS	Uncompressed into TS (ASPEN SMPTE RDD 37)	VSF-TR01 JPEG2000 into TS	Uncompressed into TS (ASPEN SMPTE RDD 37)	ISO MPEG-2, H.264, HEVC into TS
Audio Standard	SMPTE ST 302	SMPTE ST 302	SMPTE ST 302	SMPTE ST 302	SMPTE ST 302
VANC Standard	SMPTE ST 2038	SMPTE ST 2038	SMPTE ST 2038	SMPTE ST 2038	SMPTE ST 2038
Audio/Video Shuffling	Yes	Yes	Not required	Not required	Not required
Latency	< 1 frame / field	< 1 line	< 1 frame / field	< 1 line	

Figure 3 – Standards/Formats for Various Use Cases

Two important benefits of ASPEN are bandwidth savings and complete signal routing flexibility. By transmitting the video, AES audio and all metadata elements as individual streams, the unused dataspace of SDI is never transported, only the elements required by the application. These bandwidth savings cascade throughout the system because at any point of usage, only the necessary streams need be acquired, thus saving bandwidth throughout the fabric and at each receiving endpoint. For example, by delivering only the desired elements, operations do not have to think about de-embedding a large number of audio channels from their respective video streams and mapping them to the console for a large mix.

Figure 4 provides a comparisons between SMPTE 2022-6 and an ASPEN approach, highlighting some additional benefits in an IP workflow.

Points of Consideration	SMPTE 2022-6 (SDI over IP)	ASPEN RDD 37 (Video) + SMPTE ST 302 (Audio) + SMPTE ST 2038 (VANC) + SMPTE 2022-2 (TS / IP)
Standard	Yes	ASPEN (SMPTE RDD 37). Others, Yes.
Extension to existing specifications	Yes, SMPTE 2022	Yes, MPEG-2 TS
Support for all video formats: Uncompressed and compressed (JPEG2000, HEVC, H.264, and MPEG-2)	No	Yes
Scalable for Uncompressed UHDTV, 3G, HD and SD	No (up to 3G)	Yes
Existing knowledge base and tool sets.	Yes	Yes
Low complexity processing for exchanging between compressed and uncompressed formats	No	Yes
Unlimited audio track capability	No	Yes
Synchronization mechanism between all elements of a flow (PCR/PTP)	No	Yes
Independent flows with video, audio, and VANC (in whole or in parts) per IP mulitcast address	No	Yes
Installed Base	Yes	Yes

Figure 4 - SMPTE 2022-6 vs ASPEN (TS and SMPTE 2022-2)

Conclusion: Why use ASPEN?

Within a Software Defined Video Network (SDVN), and combined with audio transport using SMPTE ST 302 and metadata transport using SMPTE ST 2038, ASPEN provides a missing piece to the practical implementation of an IP facility. Signals can be routed and seamlessly switched just like SDI, with the added benefits of being able to route source stream elements arbitrarily and independently. Low latency and built-in synchronization mechanisms complete the requirements for facility-wide use. ASPEN also allows for future expansion to include future formats as industry needs evolve.

HEAD OFFICE

Canada
5292 John Lucas Drive
Burlington, Ontario
Canada - L7L 5Z9

905-335-3700
1-877-995-3700
sales@evertz.com
www.evertz.com

INTERNATIONAL

Washington DC Sales	New York Sales	US West Coast Sales	UK Sales	South-East Europe Sales	Dubai Sales	Asia Pacific Sales	Australia Sales
+1 703-330-8600	+1 201-337-0205	+1 818-558-3910	+44 (0)118-921-6800	+385 1-2001-665	+971 4-422-9113	+852 2850-7989	+61 431-290-409
dcsales@evertz.com	newyorksales@evertz.com	uswestsales@evertz.com	uksales@evertz.com	SEeuropesales@evertz.com	middleeastsales@evertz.com	asiapacificsales@evertz.com	australiasales@evertz.com