Internet Protocol Media Experience (IPMX): The Emerging AV over IP Open Standard for Pro AV

By Andrew Starks

Introduction

With the recent availability of viable platforms, AV over IP technology in the Pro AV market has improved dramatically. However, extensive research with customers and consultants has revealed a predictable downside: a lack of interoperability that frustrates customers and limits adoption. That's why the Alliance for IP Media Solutions (AIMS) has developed IPMX, short for Internet Protocol Media Experience, an emerging open standard protocol for AV over IP in the Pro AV industry.

Since its inception, AIMS has understood the potential of an open standard protocol for interoperable video and audio over IP networks — one that could deliver the same benefits in the Pro AV world that SMPTE ST 2110 and AMWA's Networked Media Open Specifications (NMOS) API have done for the broadcast industry. The task of defining the scope of this protocol began with the AIMS Pro AV Working Group and grew to involve SMPTE, AMWA, the Video Services Forum (VSF), and the Joint Taskforce of Networked Media (JT-NM), which together represent more than 70 member companies. The Pro AV Working Group focused on identifying the needs of Pro AV and installed systems markets and meeting those needs by improving on elements of existing broadcast standards. At the same time, the team recognized the enormous potential of proposing a unified set of standards that could enable interoperability across both industries.

After surveying the market and demonstrating the value of SMPTE ST 2110 for Pro AV, AIMS launched the IPMX roadmap in 2019. IPMX outlines a unified set of open standards and specifications for multivendor AV over

IP to simplify system installation and administration, increase quality, and dramatically accelerate adoption.

This paper will present the business case for IPMX and offer an overview of its key elements. We will describe its technical benefits and how this emerging open standard protocol for interoperable AV over IP uniquely meets the requirements of the Pro AV industry.

When "Standard" Is Not Standard

There's no doubt that AV over IP is entering a new stage of maturity. It started with a few early products that had limited capability and adoption. Now, there are more than a dozen competing ecosystems that enable high-quality, low-latency, and affordable video and audio transport over an IP network. And yet, Pro AV providers and end-users are hamstrung by a lack of compatibility between different solutions.

Manufacturers of these solutions have tried to address the lack of interoperability by licensing their proprietary technologies to the market. However, without a truly vendor-agnostic standard for interoperability, AV over IP technology manufacturers face a quandary. If they hitch their wagon to a single proprietary platform, what is the assurance that their investment will pay off in the long run? And which platform should they choose? Likewise, AV integrators and their customers are wary of the uncertainties of locking themselves into a single provider's platform. For these customers, the flexibility to choose the best components from multiple providers is a more important factor than the choice of platform.

The Case for an Open Standard

Given all of this, there's general recognition that the Pro AV industry will not progress unless it can rally around a manufacturer-agnostic standard for interoperability forged in an open process that welcomes and includes participation from all interested parties. This requires a formal process for review and development in which the results are publicly available and publicly scrutinized — with real-world testing that validates the standard

on multiple manufacturers' implementations. The result is a standard that gives manufacturers the assurances they need to invest in the technology for the long haul, together with legal protection from patent infringement. Moving forward, all stakeholders share guaranteed, perpetual access to the standard and a voice in its ongoing evolution.

IPMX has emerged from this process. Building on the SMPTE ST 2110 broadcast industry standard and AMWA's NMOS APIs, IPMX is shaping up to meet the needs of Pro AV while also addressing the needs of both production and presentation workflows. As a single open standard protocol for low-latency video and audio over any network, for any purpose, IPMX has the potential to be much more than just a bigger version of existing AV over IP solutions — it will be truly transformative.

Why Base IPMX on SMPTE ST 2110, a Broadcast Industry Standard?

Early on, the AIMS Pro AV Working Group recognized that SMPTE ST 2110 for Professional Media Over IP Networks could offer the ideal foundation for Pro AV interoperability. First ratified in 2017, SMPTE ST 2110 is now past the early adopter stage and is well understood within the IT community, leveraging COTS IT solutions for packet-based signal transport. In the ensuing years, the broadcast and media industries resoundingly endorsed SMPTE ST 2110. Therefore, building on this success for the Pro AV world made sense, both technically and commercially.

However, because SMPTE ST 2110 is a broadcast-centric standard, it falls short of meeting the needs of AV over IP in several critical ways. First, the standard in its base form specifies only uncompressed video, which is too bandwidth-intensive for most Pro AV applications. Although SMTPE has released an extension for compressed video, SMPTE ST 2110-22, it does not offer guidance for individual codecs or specify a base codec, which interoperability requires.

Furthermore, because SMPTE ST 2110 is defined for the extreme timing requirements of broadcast, it can be challenging to implement, leading

some to conclude that it is “overkill” for many Pro AV environments. For example, few Pro AV applications require source synchronization or an expensive Precision Time Protocol (PTP) infrastructure.

The AIMS Pro AV Working Group zeroed in on these issues in its development of IPMX, intending to take SMPTE ST 2110 with AES67 audio as a baseline but making it more accessible and flexible for Pro AV use cases. The result is an emerging open standard that supports all the necessary capabilities for low-latency, time-synchronous video content over an IP network in a Pro AV deployment. In the following sections, we’ll take a closer look at these capabilities.

Plug-and-Play Video Discovery and Connectivity

An essential goal of IPMX is to deliver the same type of pluggable video experience that users expect with HDMI or DisplayPort. For example, IPMX provides standard device discovery and connection with seamless handling of Extended Display Identification Data (EDID), a core technology that enables timing negotiation between baseband sources and displays. At the same time, IMPX goes beyond what EDID supports by accommodating multiple mismatched monitors, delivering the ideal video resolution for the group. Furthermore, with official support for HDCP 2.3, IPMX will ensure that HDCP-encrypted content can be displayed seamlessly and consistently on every monitor while providing manufacturers a straightforward and legal path to compliance. In addition, IPMX provides for USB virtualization and extension to enable interoperable KVM deployments.

Specialized Support for Compressed Video

After careful consideration of established and emerging codecs for video compression, the AIMS Pro AV Working Group adopted the JPEG XS compression specifications in SMPTE ST 2110-22. JPEG XS won out over other codecs for several key reasons. First, the primary goal of the codec is to offer visually lossless quality with low implementation complexity and low power. Second, JPEG-XS enables extremely low latency, potentially

under even a single scanline of video. Finally, video can be encoded and re-encoded with JPEG XS without any generational loss.

While IPMX specifies support for the JPEX XS codec, it does not preclude alternative codec support. If higher compression or some other trade-off is required for specific applications, manufacturers are free to meet that demand while remaining interoperable.

Pro AV-Specific Timing

As we mentioned, the SMPTE ST 2110 standard initially targeted broadcast requirements and therefore defines strict timing parameters for broadcast systems. One such parameter is PTP, critical for requirements such as keeping multiple cameras phase-locked and in sync within 200 microseconds. In compliance with those stringent parameters, a broadcast system requires highly specialized and expensive clocks and switches and a very precise and complex installation. Of course, there are Pro AV situations in which this degree of timing accuracy is necessary, but the cost and complexity aren't acceptable in most cases.

Therefore, IPMX includes timing specifications that support less expensive implementations, including software and less stringent network requirements. As a result, PTP is often not required at all in simple installations.

Uniform APIs and SDKs

In extending SMPTE ST 2110 for IPMX, the AIMS Pro AV Working Group chose to include a critical element for true interoperability among multiple vendors' solutions within its scope: an open API. NMOS APIs are built on standard, well-documented specifications that use HTTP and JSON in a way that is familiar to developers, installers, and end-users. Now anyone can create applications and tools to build new Pro AV solutions that seamlessly exchange video on an IP network.

The NMOS APIs make it simple for one vendor to discover and connect any other vendor's devices, but it does not replace the need for control

systems. Instead, control systems use NMOS to accomplish what is needed for interoperability, leaving it to developers to create the necessary applications for the industry. Furthermore, NMOS enables extension and unique capabilities by including guidelines on extending it and how it can coexist with existing protocols. This results in products that are innovative and simpler for customers to integrate and scale.

Over the years, Pro AV deployments have increasingly included software customization, and IPMX will help accelerate that trend through software and hardware implementations. In addition, future Pro AV product lines are likely to include much more software, virtualizing some equipment that was once hardware. As a result, Pro AV manufacturers treat software development kits (SDKs) and APIs as products. Including IPMX in their platform strategies will give them access to a vast, open ecosystem where customers can combine products to create unique solutions to complex problems. This software-based strategy is the best example of IPMX harmony with market trends, ensuring its growth in the marketplace and the protocol's success.

IPMX: Uniquely Meeting Pro AV Interoperability Requirements of Today and Tomorrow

What does IPMX mean for Pro AV manufacturers and their customers? In short, it's a stable, well-tested open standard protocol that will go the distance for video transport over IP, especially as IP adoption matures and product planners chart their product roadmaps for the next few years. Furthermore, because IPMX is built on core standards and specifications that have already been battle-hardened through their use in uncompressed broadcast environments, the critical toolsets are in place and ready to provide real value in Pro AV installations.

One interesting flip side to the emergence of IPMX is its growing use in live production applications. Video content creation is now commonplace in every corner of the Pro AV world, and it's driving convergence between Pro AV and broadcast. That's another reason IPMX is designed with ST 2110 interoperability in mind, and it creates bridges between the Pro AV

and live production arenas — with IPMX-compatible devices feeding broadcast systems. The NMOS APIs as a discovery and connection mechanism for both broadcast and Pro AV applications is part of that story, and it's creating new greenfield market opportunities for both industries.

Consider the AV activity happening in today's schools, stadiums, universities, businesses, and even the home. In every corner of life, people are using AV to produce, present, and consume content. The differences between broadcast AV, Pro AV, and even consumer AV tell us less about the customer and more about the context in which the technology is being used. At times, everyone is a producer of content, everyone wants to tell a story like a professional, and everyone wants to be immersed in its experience.

Before IPMX, these worlds did not mix — but now, Pro AV vendors' product lines can be integral elements. IPMX's broadcast origins mean that the features required for live and interactive presentations have been thought through. The work done to extend the protocol into Pro AV is focused on supporting asynchronous sources, presentation workflows and making things generally easier to deploy and use, filling the gaps while creating a much larger universe of opportunities.

As AIMS says, "IPMX is a proposed set of open standards and specifications that enable the carriage of compressed and uncompressed video, audio, and data over IP networks for the Pro AV market." As you can see, IPMX delivers on this promise, ensuring interoperability among AV over IP products and systems while also giving integrators a framework for open, easy-to-deploy solutions that meet market opportunities today and into the future.

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