

STANDARDS
OPEN

THE ROAD AHEAD IS NOW OPEN



Interoperability - at last we've broken through

The advantages of an IT-based broadcast infrastructure have been aggressively promoted for several years. Yet these advantages—which include more efficient workflow, improved asset management, lower operating costs and speedier time to air—have been difficult and expensive for broadcasters to achieve in real-world operations.

To date, designing and building an IT-based television facility has been a Herculean task due to the high cost and proprietary nature of available systems. In practice, broadcasters have had to purchase single vendor solutions because it has been difficult to build an interoperable IT-based broadcast plant using equipment from multiple manufacturers.

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However, due to a series of recent developments in both IT technology and broadcast industry standards, it is now possible to build such a facility using open standards-based equipment from a wide variety of vendors. This alignment of technology, standardization and high performance, generic IT hardware holds great promise for the future of broadcasting.

How did we get here?

It takes a historical look at the evolution of IT-based broadcasting in order to understand how this alignment occurred—and why the time has come for open standards IT-based broadcasting.

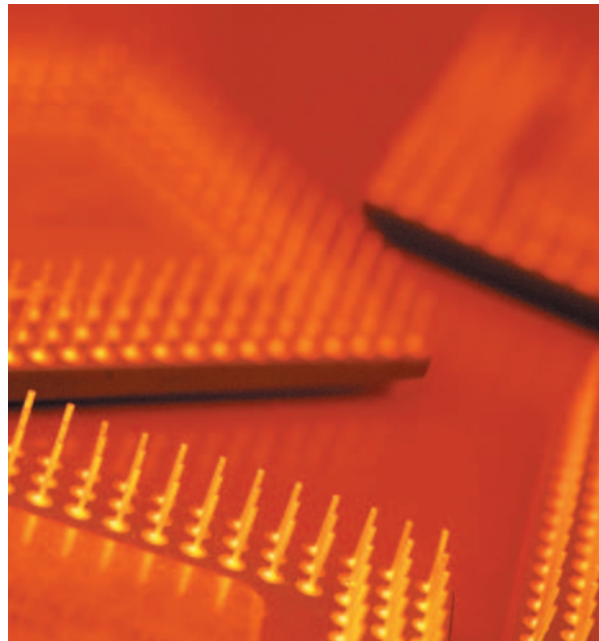
The difficulties experienced by broadcasters parallel those of other industries that tried to customize early computer hardware for specialty applications. Broadcast vendors had to work with the technology available at the time and were therefore forced to make modifications in order to make it perform in the unique real-time environment of a television facility.

To build early disk recorders, for example, it was necessary to “hot rod” computer hard drives to achieve stringent broadcast specs. Then, as the hardware improved, equipment designers still had to create proprietary file formats and file systems in order to achieve real-time video playback. Proprietary encoding technologies were sometimes needed to create robust and reliable broadcast systems from prior generations of computing equipment.

In addition, proprietary control protocols had to be developed limiting how one brand of equipment could be interfaced to another. This sometimes resulted in illogical restrictions within the broadcast plant. For example, standard MPEG2 files had to be converted back to baseband in order to be relocated from Brand A server to Brand B server. This despite the fact that both servers use MPEG2 as their native file format.

Similarly, early asset management systems were virtually all custom-designed, since there were few off-the-shelf systems or industry standards to guide the way. About a decade ago a few companies started delivering all-in-one proprietary broadcast media management systems that could ingest, playout, catalog, search and interchange custom metadata - but they came with a very high price tag.

Because metadata from these systems was proprietary, it could not easily be interchanged with other vendors' systems. Over the years there were numerous attempts to define common interchange formats to standardize metadata. These range from EDLs to Avid Log Exchange and Dublin Core—some of which are still in use today.

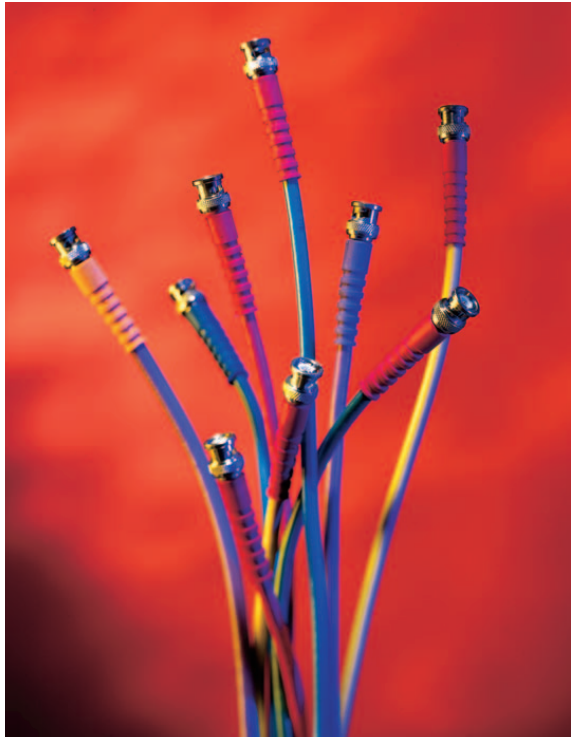


High cost - limited choice

Most early attempts to harness the power of computers for broadcast applications were extremely costly. Not only did Moore's Law drive years of constant change in computer hardware, but broadcast vendors were forced to keep up by continuously developing, refining, and supporting their proprietary systems.

The result was not only higher purchase and operating costs for broadcasters, but restricted choice in the marketplace. Once a broadcaster chose an IT solution it usually meant staying with the single vendor that created it. Limited interoperability with the technologies of competing manufacturers meant not always being able to take advantage of the best available products at a given time. The absence of widely acknowledged standards has prevented all but the largest broadcasters from enjoying the benefits of IT technology. The pioneers who have built IT facilities have tended to implement various designs, creating one-of-a-kind installations.

Open, non-proprietary standards represent a huge breakthrough for broadcasters. For the first time, they enable broadcast equipment produced by various manufacturers to “speak the same language.”



Assembling a complete broadcast plant from disparate systems has been an exercise in handyman creativity for engineers—demanding deep knowledge of both broadcast and computer technology.

Finally, open standards have arrived

Fortunately, the fog is lifting. High-performance generic disks, file systems and file formats are now available—all at historically low costs. After several years of tedious work by non-profit associations and standards-setting committees, the first essential open standard file formats and interchange languages have finally emerged. The objective of these new standards is to allow the transport of various audio and video files with associated metadata throughout broadcast facilities, and to provide interoperability between all the systems in the broadcast plant.

These open, non-proprietary standards represent a huge breakthrough for broadcasters. For the first time, they enable broadcast equipment produced by various manufacturers to “speak the same language.”

This results in the potential for true “plug and play” interoperability among devices. These standards will eventually erase proprietary pricing, allowing broadcasters to enjoy access to low cost general purpose IT components.

Without compromising the operational integrity of their overall infrastructure, broadcasters will soon be able to create an à la carte facility by combining the best available equipment from various manufacturers. Such a transformation to IT technology will lead a revolution in the business of broadcasting as well, generating endless new service opportunities and potential revenue streams.

Essential standards provide a common language

For the broadcast newsroom, **VDCP** (Video Disk Communications Protocol) has become the “de facto” standard for server control, while **MOS** (Media Object Server Communications Protocol), which was developed through cooperative collaboration among equipment, software vendors and end-users, extends the connectivity between newsroom computer systems and hardware such as video and audio servers, still stores and character generators. These technologies contribute to making general-purpose storage systems an intricate part of the newsroom.

Also critical for the overall broadcast infrastructure is **MXF**, the acronym for the Material eXchange Format. MXF is a major new standard that allows TV signals (audio, video and metadata) to be wrapped into a single file that can travel seamlessly along an IT broadcast infrastructure. MXF is important because it will not only facilitate true plug and play interoperability between systems, but it will enable these systems to be built on generic PC hardware using generic storage that is much less expensive than the proprietary systems available to broadcasters today. A sister standard **AAF**, for Advanced Authoring Format, is interoperable with MXF and is aimed at post-production applications, where more complex A/V constructions are required to represent sophisticated editing and effects work.

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MXF, whose development was supported by a group of more than 150 users and equipment manufacturers, offers several key features: platform independence including compression, network protocols and operating systems; packetized and streaming file-based capability; and, of course, extensive support for metadata. Put simply, MXF ensures that the equipment from various broadcast manufacturers will interconnect and work together in an uninhibited way. Thus MXF promises to eliminate one of the most significant problems facing broadcasters today; lack of interoperability between servers with proprietary file formats.



A good analogy to MXF is the common BNC connector used to interconnect television signals with virtually every piece of professional video equipment. A non-proprietary connector, the venerable BNC has become an essential industry-wide standard that “just works.” It’s in no one’s interest to create an incompatible BNC connector because the ubiquitous signal link that we now use benefits everyone in the broadcast industry. It’s the same with MXF, whose standardization was essential in order that IT equipment from different manufacturers be completely interoperative with and transparent to each other.

There is sometimes a misperception that MXF represents a new video format. That’s not true. MXF is a file format, not a video format. Existing video formats, defined by such compression schemes as MPEG and DV, are inherently compatible with MXF and can reside untouched within its file wrapper.

As a file format, MXF can contain and transport metadata. This is where another important new standard comes into play. Until recently, metadata between manufacturers was incompatible. This caused broadcasters to be locked into a single manufacturer’s family of systems for such metadata-sensitive applications as asset management and archiving.

With the release of the **SMPTE Metadata Dictionary** (SMPTE RP-210), metadata is elevated to a common language that expands throughout the broadcast and post-production industries. This will enable all compliant systems to speak the same language and easily interchange metadata.

Creation of this dictionary is a breakthrough. It has been compared to the Rosetta stone, the basalt slab found in 1799 in Egypt that was a crucial breakthrough in deciphering Egyptian hieroglyphs. Just as with the Rosetta stone, the metadata dictionary allows the translation of silent symbols into a living language.

The extensive language in the RP-210 dictionary features about 2,000 “tags” that cover concepts ranging from the acquisition to the delivery phases of broadcasting, allowing users to set-up workflow tasks with common expressions. The standardized dictionary is also extensible and interoperable in terms of format and support.

MXF tools to speed adoption and ensure interoperability

Snell & Wilcox had a leadership role in helping develop the new standards. The company’s engineering staff played a critical role in the definition and standardization of MXF and Snell & Wilcox is a board member of the AAF Association. As part of that standardization effort, the company developed a comprehensive package of software tools that enable the creation of products that conform to the MXF and AAF specifications.

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Snell & Wilcox is now offering these MXF software tools to the broadcast industry at no cost. The goal is to introduce end users to the new technology and to enable broadcast equipment vendors to design products that are completely interoperable with the industry standard.

For Internet download, the company is providing two software packages: one includes an **MXF Desktop** player with sample files, so that anyone can play an MXF file on a Windows personal computer. MXF Desktop also lets users explore the properties of MXF files with a simple “right click” of a mouse; and to create compliant MXF files as easily as a word processing document.

Also being released is the **MXF Express** SDK. This software toolkit shares what Snell & Wilcox has learned about MXF with other vendors with the objective of making a smoother IT transition. These tools represent an investment of more than 15 man-years and \$1 million.

MXF developers who use the SDK are invited to publicly share information, questions and solutions on an interactive online resource forum at www.snellwilcox.com. Experts from Snell & Wilcox will moderate and contribute to this online community.

The **MXF Express** SDK should be particularly useful to smaller broadcast equipment manufacturers who do not have the resources or time to fully comprehend and implement the nearly 500 pages of specifications encompassed in the MXF technical standard. It will also help to avoid the kind of mistakes made in the early release stages of MPEG-2 when broadcasters were plagued with interoperability issues between vendors who each interpreted the MPEG-2 specification in a slightly different way.

The standardization of metadata and file interchange for broadcast IT has arrived. High performance, generic IT hardware meeting broadcast specifications is abundant and affordable. Industry vendors have already begun to publicly showcase deliverable products that embrace the new standards. From camcorders and portable field editing gear through ingest and complete asset management systems, newly interoperable products will continue to emerge.

Finally—with all the stars aligned—broadcasters have the basic tools necessary to cost-effectively launch the next golden age of television.

Snell & Wilcox Solutions for Open Standards Broadcasting

As the broadcast industry migrates to IT technology, Snell & Wilcox is moving from its position as a pioneer in setting open standards to being a premier provider of the best technology for the new IT-based facility. The company already has a comprehensive range of digital infrastructure products for converting analog-to-digital; SD-to-HD; and baseband-to-file. As broadcasters enter the file-based world, their workflow will change. So will the products from Snell & Wilcox. Here are a few examples:



Ingest:

As a leader in ingest technology, Snell & Wilcox offers its advanced **Ingest Station** for high-end applications and **Comet**, an open standards ingest system that sets a new benchmark for features, cost and interoperability.

Ingest Station and Comet allow video facilities to turn programs and archives into files with standardized metadata annotations. These files can, in turn, work with many third party systems and devices, ranging from playout servers to full asset management systems. Comet features dual simultaneous encoding to MPEG2, MXF, AVI or M2V, including Sony IMX-compliant D10 format files.

Both Ingest Station and Comet take advantage of the SMPTE RP-210 metadata dictionary via an advanced template-based framework that allows facility managers to control every aspect of metadata annotation to ensure that in-house standards are followed and errors are virtually nonexistent.

Automated quality control:

In a file-based facility, quality control is a critical issue since it is difficult to evaluate a file without converting it back to baseband. To assure file integrity, Snell & Wilcox developed **Mosalina**, an automated single-pass quality measurement tool. Mosalina checks files for quality faster than real-time and “scores” them with a PAR (Picture Appraisal Rating).

This powerful QC feature reliably assesses quality during the ingest process without any need for post-processing. Most conventional systems measure the quality of MPEG2 using PSNR (Peak Signal-to-Noise Ratio), a dual-ended method that has the disadvantage of requiring a comparison of the compressed video with the original source material during a second pass.

Metadata translation:

It is critically important in an IT facility to track every aspect of a file's metadata, from the time it is created through all the changes that occur as it moves along the broadcast workflow. Asset management systems enable broadcasters to track the metadata associated with a large number of files. However, it is important to understand that most asset management systems offer only large file tracking services without a good understanding of how the media objects relate to each other. To address this issue, Snell & Wilcox designed **MetaShare**, a collaborative metadata server that is based on the AAF and MXF object models. MetaShare offers a rich representation of how different elements of media relate to each other in terms of origin (film, videotape, and live sources), versions and wrappers (different versions of bitrate, encoding, etc.) and compositional information (how different programs use media elements).

In addition to MXF and AAF, MetaShare also interfaces with a wide range of legacy metadata formats such as CMX, Sony and GVG EDLs, Avid Log Exchange (ALE), FLEx film transfer files, DPX and XML, a primary format for interchanging metadata with legacy systems.

File-based engine:

To help it and other companies create open standards products for the file-based world, Snell & Wilcox developed the **MediaX** high bandwidth PCI card. It runs on a generic stock Windows personal computer and keeps with the philosophy of using open standards to reduce hardware costs for broadcasters. For example, MediaX is the “engine” that powers Snell & Wilcox's Comet technology, a product that delivers a new level performance and functionality to broadcasters for a very reasonable price. Snell & Wilcox has also made the MediaX platform available to third-party providers who are using it to build a variety of future software applications, including acquisition/playout servers, MPEG encoders, multi-format transcoders, and digital transport products.

“Smart” Infrastructure:

Since a major segment of Snell & Wilcox's business involves infrastructure products for broadcast facilities of all sizes, the company also is very focused on continually adding new value to its **IQ Modular** line, the broadcast industry's leading component infrastructure system, and to its acclaimed **RollCall** control and monitoring systems.

mosalina

With more than 300 “smart building block” components, **IQ Modular** offers a comprehensive range of signal processing and interface products. It provides broadcasters with flexible “bridges” that interconnect analog and digital; standard and high definition and baseband and file-based infrastructures.

Snell & Wilcox sees these modules—controlled and monitored by its **RollCall** network—as real-world problem-solvers for broadcasters moving at any stage through the DTV transition. Today, such flexible intelligent infrastructure products are mainly used to interconnect and control “islands” of analog, digital, and high-definition equipment.

New modules are evolving that will add file-based, metadata-rich IT islands into the mix. They will have built-in capability to recognize metadata and to identify file movement throughout an existing SDI video infrastructure. The idea is to quickly adapt to change—whether it be in business models or technology—in a cost-effective, efficient way.

By employing a RollCall-controlled and monitored plant, broadcasters can choose a financial model that makes sense for them, whether it’s full-blown centralcasting of multiple stations over a wide area network or the simple use of a few modules in a single facility. By centralizing the control and monitoring of a broadcast infrastructure, stations can do more with less. That’s because RollCall software makes broadcasters more efficient.

A key feature of the RollCall system is the **RollMap** application—a unique technology that offers a global view of the entire infrastructure of a broadcast operation, whether contained in a single building or deployed around the globe. RollMap provides custom network views that enable operators to structure the representation of any equipment. Typically, views are shown as a physical representation of the network topology, but it also enables users to arrange hardware by channel, physical location or even create virtual networks and place products inside to create a virtual “channel in a box.”

This logical management structure makes locating and managing the correct equipment for operations far simpler than any system in the past has been able to offer.



Control & monitoring in a file-based environment:

SNMP (Simple Network Management Protocol) is the common way for IT-based products to be monitored and controlled in any installation. Unfortunately, SNMP by itself is not a panacea for the broadcast industry.

SNMP, by nature, is not real-time and it focuses on the machine status of equipment in a network. Broadcasters need real-time control of equipment and instant information about the integrity of the video signals in their plant—not just that the equipment is switched on and working.

Snell & Wilcox has introduced an extension to its RollCall control and monitoring system. Called **RollSNMP**, it increases the power of a RollCall network by enabling monitoring of SNMP status information from other vendors’ systems. RollSNMP has already been integrated successfully with products from Pinnacle, Cisco, Barco, Omneon and others as well as with IT products such as the Microsoft Windows 2000 and XP workstations and servers. Other devices can easily be integrated via straightforward XML configuration files.

RollSNMP allows operators to track failures in IT components such as machine state, operating systems, networks, storage, RAM, and cooling systems. It enables a smooth transition to tomorrow’s facility without compromising current standards of broadcast quality. RollSNMP makes intelligent decisions about when to use SNMP and when real-time control is needed via RollCall.

RollCall and its enhancements can be used cost-effectively by any size broadcast facility to control one to thousands of products. The system provides a dual redundant control network that takes full advantage of Internet protocols, but also can operate in real-time over its own, completely independent, coaxial network, giving engineers peace of mind that their facility control is not totally dependent on the reliability of an IT network.

As the broadcast industry embraces open standards and file-based technologies, Snell & Wilcox sees exciting days ahead. With standards development largely behind us, the next step is to begin the transition. We stand ready to make that transition work through creative research, well-designed products, and the sharing of essential knowledge to help our customers make the right decisions along the way.

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