WHITE PAPER

The spring of IP technology transition for broadcast television production

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We all know that Ethernet and IP underpin the Internet and form one of the most disruptive technologies in the history of mankind. Insatiable consumer demand for content continues to fuel the development of ever faster networks like hydrogen fusion fuels the sun. As it stands today, the bandwidth required for data networking equals - and in many cases exceeds - the bandwidth requirements for full bandwidth, real time video.

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It can be argued that SMPTE SDI signals are antiquated, inflexible and difficult to repurpose and hence a bottleneck. It can equally be argued that for live video production, the aggregate bandwidth required to move those signals far exceeds that which can, at the present, be affordably managed with Ethernet and IP. However, assuming that Moore's Law holds up in the broadcast world, Ethernet and IP, or variants thereof on the horizon, should remove that bottleneck. It's coming, and soon, but certainly not next month.

In the meantime, the answer to designing a facility that can successfully implement a packet video (i.e., IP) approach lies in fully understanding the technology and, most importantly, the workflow and ultimate purpose of the facility.

Another essential consideration for most businesses is capital equipment preservation. Video production facilities traditionally have long life times. To extend the lifetime of original investments, new facilities invariably incorporate legacy equipment, or more accurately, new facilities tend to be installed on top of an existing infrastructure. When making a phased transition to IP, decisions about how best to merge SDI with IP, particularly for production applications, a thorough understanding of the technology behind IP is essential, not least because there are differing standards and models based on what the end user of each facility wants to achieve.

Assuming that everyone has done their homework and fully understands not only what IP can do in general but what it can do in highly specific terms for their application, you're ready for the hard part - the transition.

The technology transition

Future projections only make sense when referenced to the present. There are of course already many processes and products in the video ecosystem that exploit packet video technology. (To avoid confusion between networks and protocols, packet video will now be used rather than IP. Packet video is the ticket to the IP onramp.)

Video distribution to the home is packet based. Internet video is also packet based. The only processes that have not been options for packet based technology are those that require very high bandwidth, very low latency, very low differential delay or a combination of these… until now.

That's because there are now demonstrably effective options for successfully implementing packet video technology in bandwidth-intensive applications, each of which can be taken in turn, or as a whole, to enable a facility to make the packet video transition, and again, for emphasis, this is a transition, not an overnight sensation. You only have to bite off, and digest, what you can chew.

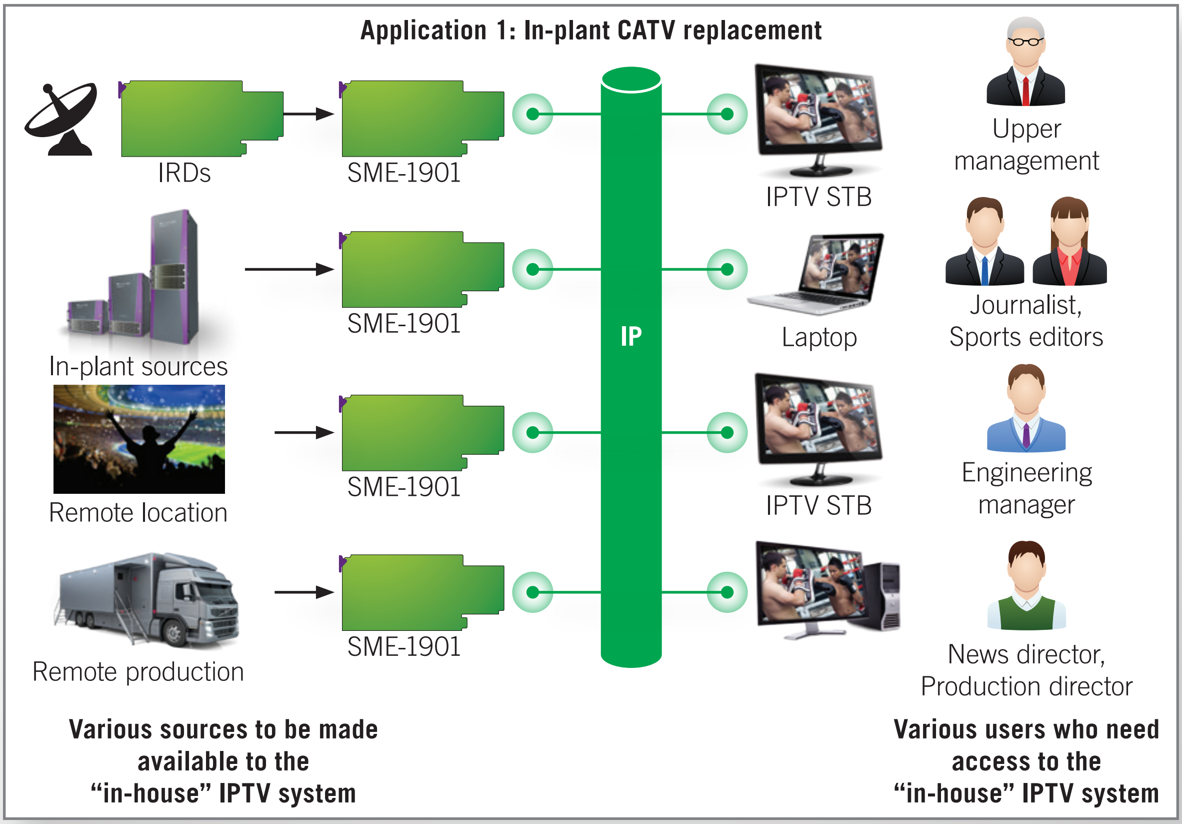
Let's start with…

Ingest and input monitoring

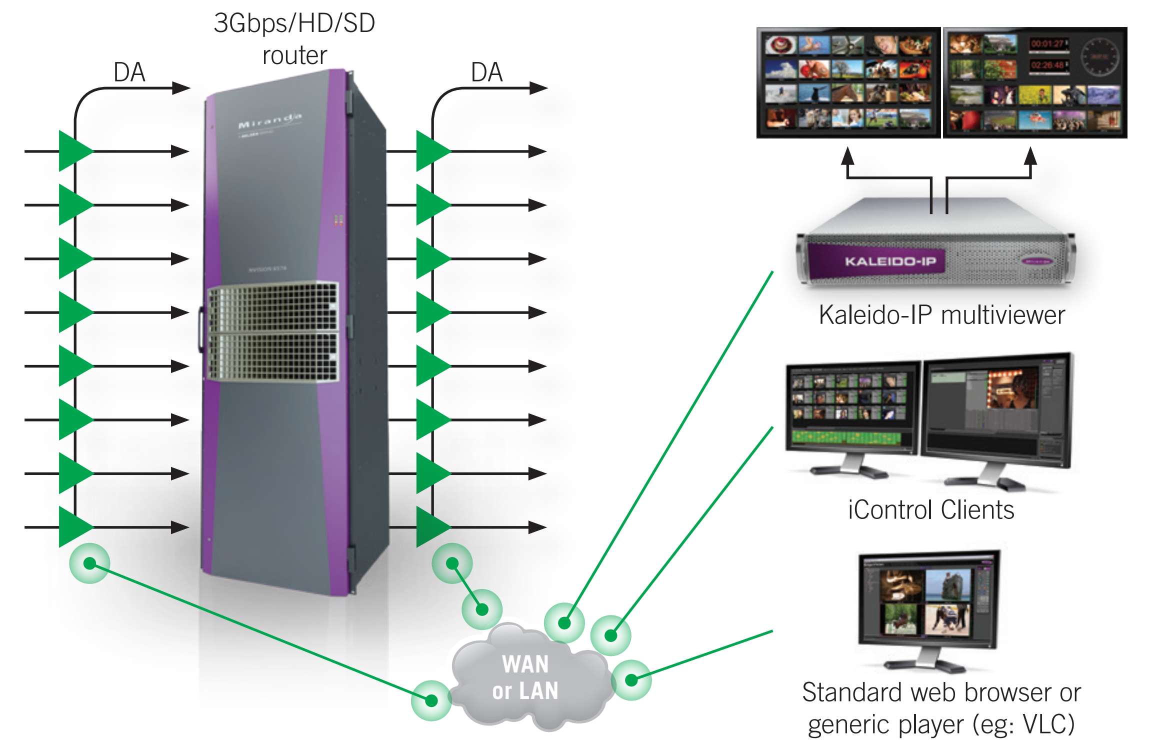
Often at ingest, signals are buffered, replicated and distributed. For example, a 1:6 DA will generate an output bandwidth of 24 Gbps with 1080p 60 signals. In such cases, six separate cables feed full bandwidth video to their dedicated users. Frequently, one DA output feeds an in-house RF television network for on-screen monitoring. Using one coaxial cable, any signal in the network can be viewed anywhere a receiver is installed, which saves what would be massive costs for additional coax.

The implementation of packet video improves the ingest process even more, much more. For example, the source signal is compressed to only 5 Mbps, wrapped in an IP header and then fed into an Ethernet network as a multicast signal. That means that one hundred signals only need half of a 1 Gbps Ethernet network. Wherever the Ether-network is accessible, any device with the right software and network support can receive and view the video signal via desktop, laptop, tablet or smart phone. Metadata can even be included as its own stream, or as a part of each program stream, and can include advanced signal measurement data in addition to source specific details including point of origin, format, resolution and revision history.

The following simple block diagrams use the industry-leading Miranda SME-1901 module to show how such a function can be implemented today.



Application 2: SME-1901 – Core router monitoring



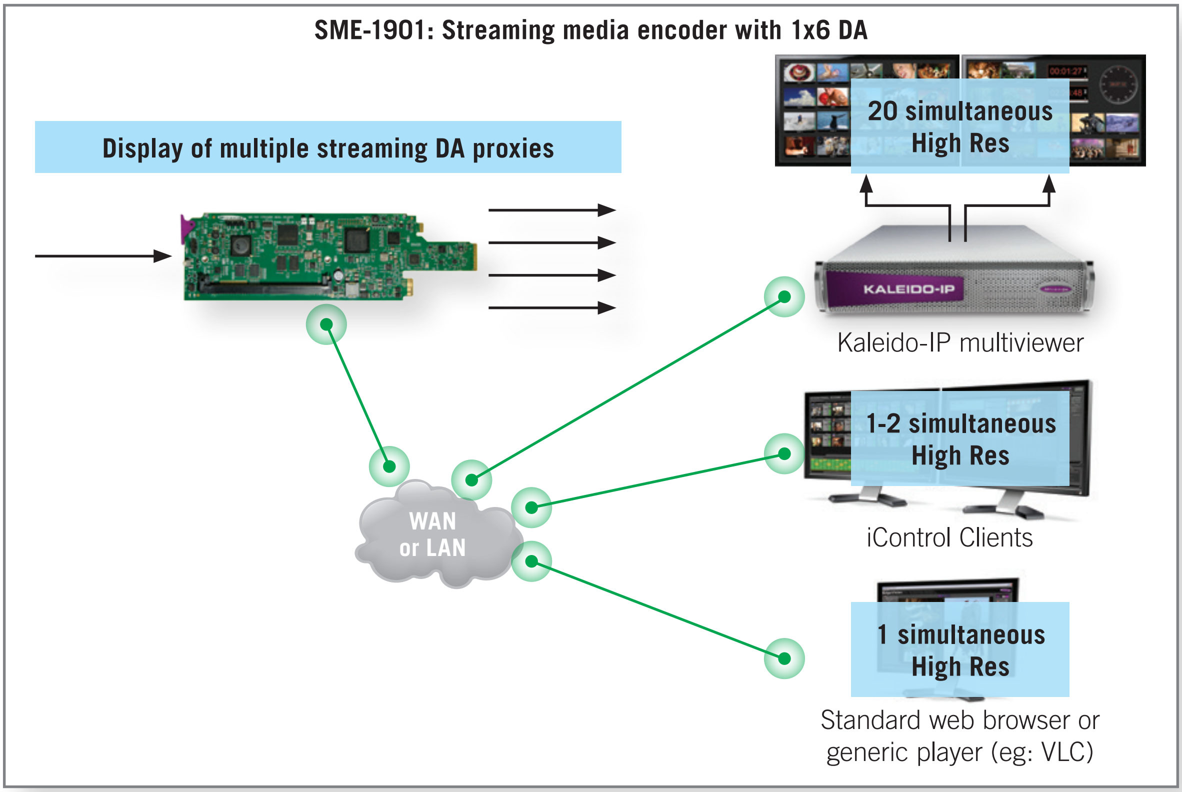
Remote monitoring

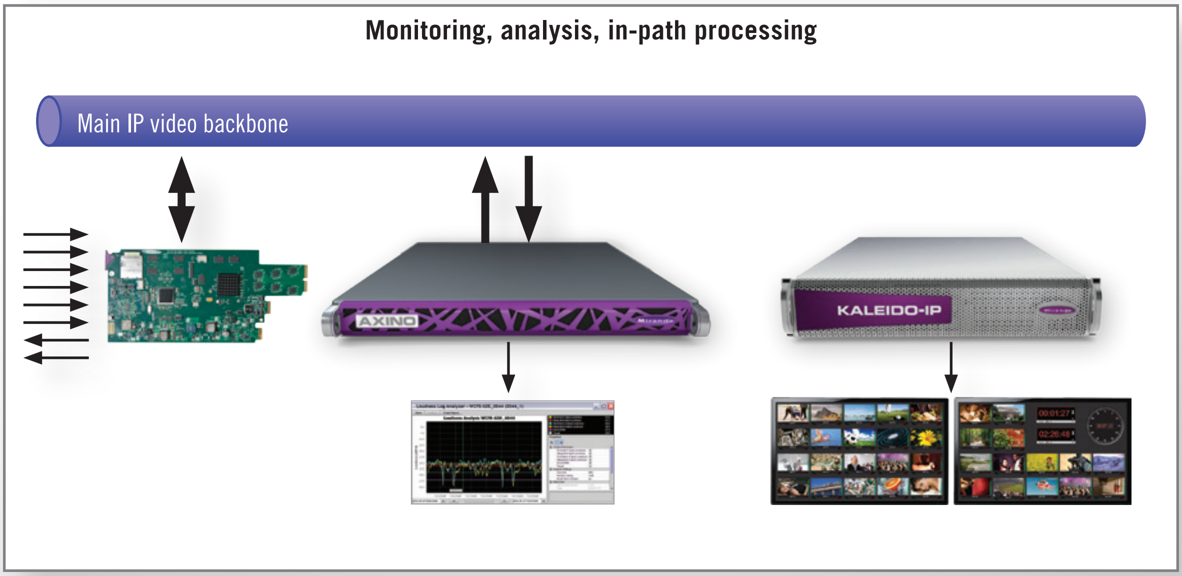
As I've already referenced, television distribution is packet based, whether it's distributed over the air or within a glass or copper cable. IP packets, MPEG2-TS packets or MPEG2-TS over IP encapsulation are predominant wherever digital TV is broadcast. Cable and phone company networks are likes trees. The homes they feed are the leaves, attached to neighborhood vaults ("limbs"), which in turn connect via thicker branches to a video home office which then trunks back to a head end, which ultimately serves to distribute the original content: the acorn. Ideally, video monitoring can occur anywhere on the treecosystem. Most of the tree is unmanned, i.e., it only requires an occasional gardener.

Conceptually, based on physical room and power, a remote monitoring device can be installed starting with a set-top box that includes functionality that extends back up the limbs to the trunk. This device selects any video stream in the system, which can be augmented with analytic data and sent back up the network for automatic or manual review. In one example, monitoring is visual with multiple signals and their corresponding metadata displayed on a multiviewer. The difference is that such a multiviewer is optimized to display compressed packet video, which must be tuned or selected from the stream. The compressed video is then decoded, scaled and keyed into the mosaic. The metadata, including diagnostic information, may also be keyed into the mosaic prior to display on the target monitor.

Controlling audio loudness is equally important and legally required throughout most of the world. Packet video technology enables a single network segment to carry hundreds of audio channels to a single processing engine for compliance analysis and conformance. Signal level status and event logging can all be provided in a very low bandwidth back channel in the same network segment, or perhaps a separate network used for SNMP-based management.

The following simple block diagrams show how such systems can be deployed today using Kaleido-IP, EdgeVision and Axino products, which surround packet video networking with Miranda's industry leading monitoring and probing technology.





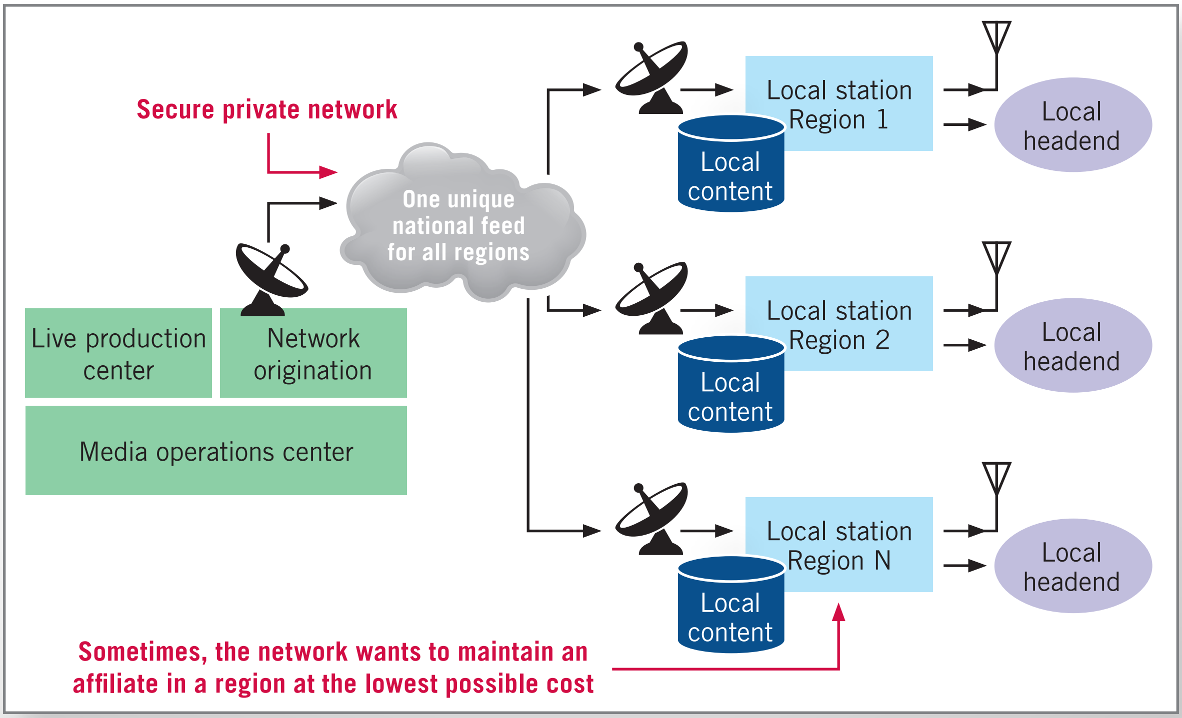
Remote playout

Classically, satellites were used to relay video program material from a network production facility to O&Os and affiliates ahead of playout. This programming was received, recorded to tape and queued for playback. Network advertising was already burned in and local advertising slots were indicated with time code data and color bar video inserts. Local stations simply played back the program and cut in local programming and advertising at the correct point in time. Many companies believe that sub-dividing their access areas into smaller geographic regions could provide a more cost effective operational model, particularly with the increase in Over-The-Top (OTT) video and the desire to monetize it through hyper-local advertising. Other companies see consolidation of multiple channels into smaller, more power-efficient facilities as a better approach.

For either application, packet video technology provides excellent performance. Modestly compressed video, 50 to 100 Mbps for example, can be sent non-real time over secure data networks to local video storage locations. Tens of hours of programming can fit on a solid state drive, which is smaller and uses remarkably less power than most tablet computers. Programming and advertising are stored locally.

Well-optimized code can traverse the Internet rather quickly. Delays under 100 ms are not uncommon, even for sites thousands of miles apart. Asset management, traffic and last-minute scheduling can all be done through the cloud. All the playout engine needs is a good decoder and video keyer, both of which are very affordable and exist as FPGA (field programmable gate delay) or microprocessor-based functions.

The Miranda Cloud Solution can perform exactly this task, and more. A couple examples are shown below to tie it all together.



Conclusion

Although the transition to IP for the uninitiated can be daunting, as illustrated on the previous page, Miranda is already positioned to lead the way with a mature “root and branch” approach that is already well-established, hardy and poised for the broadcast industry IP growth spurt that is sure to happen as soon as the next broadcast spring arrives.

About Miranda

Miranda Technologies a Belden Brand, develops, manufactures and markets high performance hardware and software for the television broadcast industry. Its solutions are purchased by content creators, broadcasters, specialty channels and television service providers to enable and enhance the transition to a complex multi-channel digital and HD broadcast environment. This equipment allows customers to generate additional revenue while reducing costs through more efficient distribution and management of content as well as the automation of previously manual processes. Miranda employs approximately 700 people at its Montreal headquarters and in its facilities located in Reading (UK), Grass Valley (California, USA), Paris (France), Tokyo (Japan), Zaltbommel (Netherlands), Dubai (United Arab Emirates), Beijing (China) and Hong Kong. In July 2012, Miranda Technologies was acquired by St. Louis-based Belden Inc., a worldwide leader in cable, connectivity and networking solutions. For more information, please visit www.miranda.com.