THE BROADCAST BRIDGE

Connecting IT to Broadcast

IP - The Final Frontier

Essential Guide

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Introduction from Riedel

In this last article, we will present a case study of AMP VISUAL TV, a large studio and OB provider based in France that has chosen Riedel's MediorNet and Artist systems as the basis for its newest OB vans. Through their partnership with Riedel, AMP VISUAL TV has built a networked signal and communications backbone that will meet all of today's requirements for producing in 4K, while laying the foundations for an eventual transition to IP-based operations.

We hope that you have enjoyed and learned a few things from this Essential Guide to Broadcast IP Infrastructures. When we set out to create an IP guidebook for engineers, we intended to offer a reference that could be used again and again. Change is hard, but it is also inevitable. Hopefully, by reading this book, you have increased your understanding and are better equipped to handle some of the decisions you'll face as you continue on your IP journey.

Of course, we welcome your feedback about this guide and would enjoy hearing your stories about the challenges and victories you've experienced. We have much to learn from each other and collaboration will help us all get to the IP finish line faster and easier.

Please send any comments to marketing@riedel.net. You can also reach out to us through any of our social media channels, listed here: https://www.riedel.net/en/social-media-links/

And thanks for reading!

Riedel Communications

IP - The Final Frontier

By Tony Orme, Technology Editor at The Broadcast Bridge

Part 1 - Security

With any technology project, engineers run at break neck speed to achieve tight deadlines at ever decreasing costs. But security is a new aspect anybody migrating to IP must consider from the out-set. In Part 1, we investigate security, what it means, and most importantly, who is responsible for it.

All networks have vulnerabilities and even SDI systems can be attacked. The only difference is that we know when a hacker has broken into an SDI network as they have a pair of wire cutters in their hand!

With IP networks, you no longer need an armored vehicle to break into a broadcast facility. In a poorly designed network, cyber criminals can use internet technology to break into the facility from the comfort of their own armchairs.

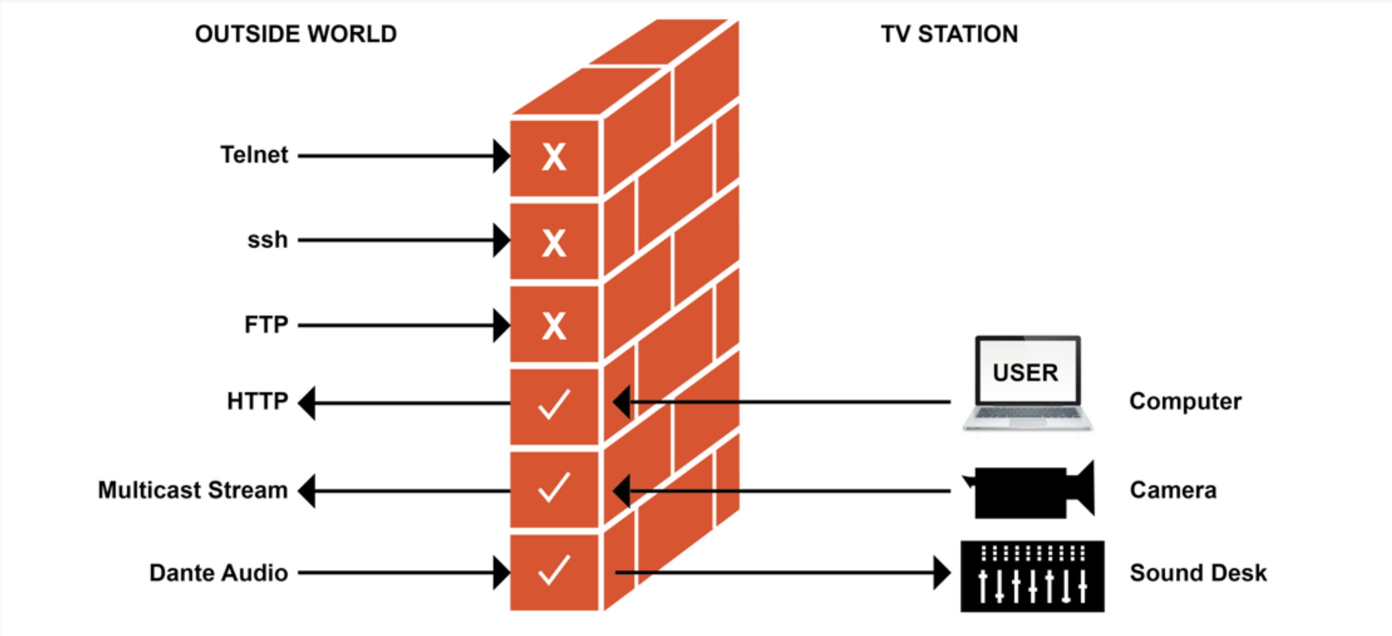


Diagram 1 – Firewalls are used to block hostile attacks from SSH and Telnet sources, but allow video and audio streams to continue.

To protect against cyber-attacks security must be considered, planned for, and implemented at the beginning and not as an afterthought when the video and audio is already streaming across your new network.

Educate Users

Although technology may appear to be the most influencing factor when building IP networks, users play a huge role in guaranteeing the effectiveness of secure networks. Vulnerability and penetration testing will go a long way to prove your network is secure, but to counter-act user vulnerabilities, we must think more carefully about security.

Firewalls and Intrusion Detection Systems (IDS) block attackers from gaining entry using brute force and random attack methods, and stop users from gaining access to malicious websites. But phishing emails can completely bypass these systems. They work at a human psychological level by manipulating people into performing actions or giving out information they wouldn't normally provide.

The purpose of phishing is for the attacker to gain sensitive information from employees and users to enable them to gain access to secure networks and infrastructures. Cyber criminals are masters of exploitation and know how and when to maximize their chances of success.

Phishing emails are sent when users are most vulnerable and stressed, such as late in the afternoon, on a Friday, or at the end of the month. They will spoof C-suite managers' email addresses assuming more junior staff will do as they are asked without question. And they also exploit real deadlines such as tax returns and end of month payments.

Although SPAM filters and virus checkers go a long way to stopping phishing emails from arriving in users' in-boxes, the filters are always playing catch-up. Attackers are constantly designing new methods of bypassing SPAM and virus filters and an attack must have happened and reported before it can be added to the filter library.

CEO's Drive Security Attitudes

The most efficient solution to phishing attacks is decisive action driven from the top of the company. CEO's must drive forward personal security measures such as encouraging the need to change passwords regularly, the use of two-factor authentication, and consistently taking security seriously.

When a new employee starts at a company, security training should be at the very beginning of on-boarding to enforce its importance, and not be an add-on or afterthought.

Performing regular phish testing can help CEO's learn more about training for their staff. They send phishing attack emails to their own employees and track who responds and clicks on the links. Further training should be provided for those who do make the mistake of responding in order to help users achieve higher and better levels of personal security.

Help Users

A no-blame policy will help users quickly report mistakes such as inadvertently clicking on a phishing email. They know they can call IT and report it without reprisal or fear of losing their jobs.

Diagram 2 – Both these were taken from a web browser with the upper address bar showing the HTTPS lock icon and secure web site, and the lower address bar showing the unsecured HTTP only web site.

Spoof websites are another area of concern. Attackers are very good at counterfeiting a real website and making it look very convincing using man-in-the-middle attacks. They occur when a third party maliciously intercepts a connection between the browser and server and makes each think they are the other.

Anybody uploading media to servers should be aware of man-in-the-middle attacks as they can be easily used to intercept and obtain the media for illegal distribution, or even hold the owner ransom.

Secure Websites

HTTP (Hyper Text Transfer Protocol) is the process used to transfer data between servers and clients so that web-pages and streamed media can be viewed. Additionally, HTTPS (Hyper Text Transfer Protocol Secure) ensures the server the user is communicating with is the actual website they think it is and not a man-in-the-middle attack situation.

A secure verified website will have the “lock” icon next to the web address in the browser.

As well as certifying the origin of websites, HTTPS encrypts the data exchange between the server and website using TLS (Transport Layer Security). This ensures eavesdroppers cannot listen to the data exchange and use the information for criminal means.

Once a user enters the servers’ URL into the address bar, the HTTPS handshake is initiated and the server will respond by sending a certificate back to the browser.

Certificate Authorities, such as GoDaddy.com and GlobalSigh.com govern the publication and validity of certificates. Owners of HTTPS-enabled servers must apply to one of the CA’s for a certificate and will need to supply information such as the servers IP address, public key, and details of the company, like those provided to banks when opening an account.

Unique Digital Certificates

Once a certificate has been created, it is made tamper-proof by processing with a hash-function to give it a unique finger print. By issuing this certificate, the CA is validating the upload server as a bona fide computer associated with the owners’ business. Clients uploading their media can be confident and assured that they are dealing with the business they expect to be dealing with and not a third-party imposter, or man-in-the-middle attacker.

When a browser receives the encrypted certificate it looks for the public key to decrypt it from a list of trusted keys installed in the browser. Once the public key has been found, the certificate is decrypted to expose the servers own public key and other company information. Maintaining the validity of this list of trusted CA’s is paramount for security in internet commerce.

Encrypt Keys

The second important aspect of data exchange using HTTPS is encryption using secure keys. Public Key Infrastructure (PKI) is a system used to create, manage, store, and distribute digital certificates and public keys.

Asymmetric encryption uses a unique private-public key pair. If data is encrypted with the public key, only the private key can decrypt it. And if data is encrypted with the private key, only the public key can be used to decrypt it. The private key must remain private to the website, but the public key can be given to anybody. This is a very secure system, assuming the private key is not stolen from the server. But it is computationally intensive, and the webserver would grind to a halt if a film was uploaded to it.

The alternative is symmetric encryption that requires both the users’ browser and server to have the same key. It’s a computationally fast method of encryption and decryption but distributing the key on a public internet is very insecure and eaves droppers can easily pick it up and then gain access to your data.

To achieve the security of asymmetric encryption and the speed and flexibility of symmetric encryption, HTTPS uses both asymmetric and symmetric encryption.

To initiate the process, the user clicks on the web address, and the encrypted certificate is sent to the browser over an unencrypted link to validate the server and extract the web servers public key. Then the browsers symmetrical key is encrypted using the public key and sent to the server. The server decrypts the symmetric key using its private key and both the server and browser switch to symmetric encryption to exchange media files using this newly created symmetric key.

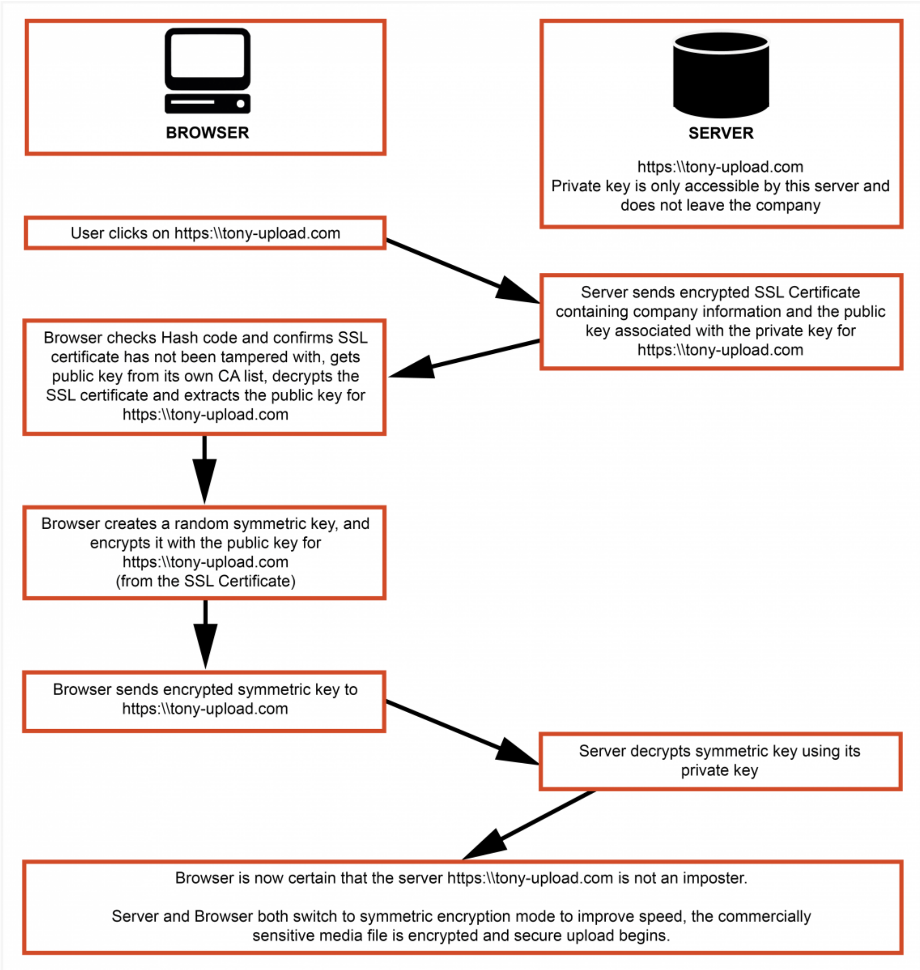


Diagram 3 – HTTPS certification guarantees validated servers and encrypted media files to stop man-in-the-middle attacks.

Fast Encryption for Media Files

Media and large files are now exchanged using the fast-symmetrical encryption method. To further improve security, a time limit on symmetrical keys is enforced and new keys are created to reduce the risk of them being copied and hacked. Each time a user accesses the HTTPS server, a new HTTPS session is negotiated, and a new symmetric key created. Timeout's periodically action the browser to re-negotiate the HTTPS protocol with the server to force the creation of new symmetric keys.

Technology can only go part of the way to ensure that networks and web access are secure. People are always the weakest link in any security system and it's the responsibility of every user to make sure they understand security and implement the measures needed. It's of the upmost importance that the CEO drives personal security measures hard, provides regular user training, and enforces regular phishing attack testing of employees.

Part 2 - Solutions

Many broadcasters are seeing the benefits of IP and progressing ever closer to migration. But making IP systems work and achieving the COTS benefits CEO's demand involves more than just understanding the technology. In Part 2, we look at the migration from the perspective of the engineers who are making IP work, where they can find the best and most reliable information, and how to make IP workflows operate with optimal performance.

Migrating to IP requires an entirely different mindset to the traditional broadcast engineering approach. Although television technology has been developing over the past eighty years, its only recently that it has moved from being a cottage industry to approaching full maturity.

Broadcast engineers are renowned for finding innovative solutions to complex problems. Especially when new technologies emerge such as the introduction of SDI, HD, and MPEG. Hand crafted boxes of electronics, cables, and even software were used to interface new and old systems together, especially where manufacturers didn't have an off-the-shelf solution.

Complex Workflows Emerged

Although this approach solved a specific problem and kept the station on air, with the passage of time the modification was forgotten, resulting in overly complex workflows and esoteric systems. A lack of formal change procedures and documentation updates compounded the complexities. But, at the time, the broadcast engineers were under a great deal of pressure to keep the stations broadcasting in the face of emerging and cutting-edge technology.

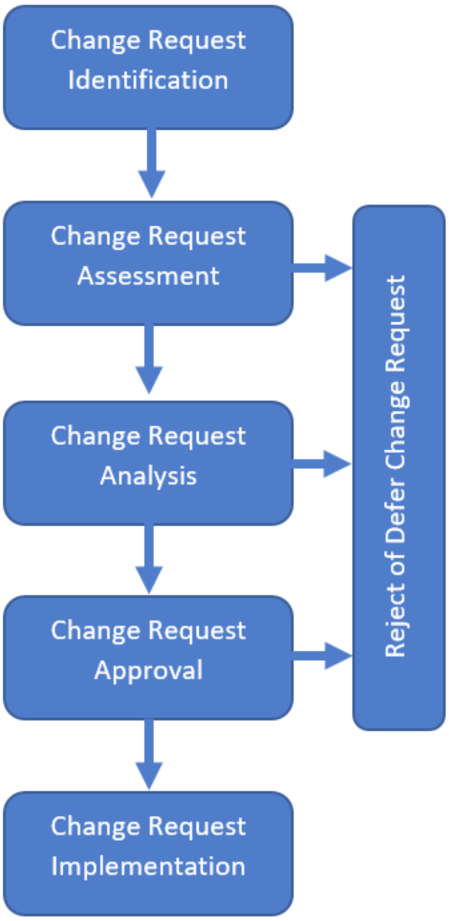


Diagram 1 – ITIL is made of many processes such as this change control request. ITIL forms a fundamental part of an IT engineer's role in keeping networks and infrastructures working reliably and efficiently.

ITIL (Information Technology Infrastructure Library) is the process IT departments use when operating and maintaining data center facilities. It is a series of procedural systems, such as change management and incident management, that help IT managers run their facility with the maximum efficiency possible.

Such processes provide a deep audit trail for changes made to the infrastructure to allow engineers to track change and provide roll-back if something goes wrong. The impact on users is assessed and nobody is permitted to make the change until the authorized manager has signed off. This also prevents unauthorized changes and helps maintain high levels of security.

Ticketing systems help enforce the audit process. If a user wants a change to their system or has detected a problem with their service, then they will call the IT help-desk and raise a ticket number. Apart from being a vehicle to track the fix, managers use help-desk ticket data to quickly identify patterns with emerging issues and allocate appropriate resource to keep the system working reliably.

Processes Maintain Order

Generations of broadcast engineers have just fixed problems when they occur and learned very early on in their careers not to jeopardize a live transmission or advert. Multi-channel playout services have introduced formal change processes and broadcast engineers are beginning to see ITIL type processes more and more in television.

IT engineers have had less opportunity to fix computers and network switches at the component level due to the dense integration of high pin-count semiconductors. The maturity of the IT industry means there are no, or few, serviceable parts. Software configuration was originally only available through command line entry, often requiring a detailed knowledge and understanding of complex attributes and strings of esoteric characters to support them.

Up to about fifteen years ago, it was common for a service manual to be shipped with broadcast equipment such as video tape recorders, cameras, and sound consoles. Most broadcast facilities had maintenance departments and in part this was due to the analogue nature of broadcast electronics and their propensity to drift. Embedded software gave little opportunity for modifications to be made to parameters within the code.

Different Ways of Thinking

Consequently, broadcast and IT engineers have evolved with different thought processes and disciplines. They had to focus on the divergent aspects of hardware and software to make their respective systems work reliably and efficiently.

Developments in telecommunications systems such as 5G are demonstrating that the transfer of high capacity data rates with low latency is possible. In the space of just a few years, IT has moved from backroom office applications to full blown broadcast quality real-time signal processing. High speed hardware is becoming more and more difficult to design and build, and the demands on the scarce skillsets needed to achieve reliable design is increasing as servers play greater roles in our lives.

All this demonstrates that the knowledge, understanding, and thought processes of broadcast and IT engineers can at times, be worlds apart. This is not because of any group being better than the other but is instead due to the different business environments that both broadcast and IT have worked in.

Mutual Respect

For broadcast facilities to continue to prosper, both disciplines must gain a deep understanding of not just the detail of the technology of their counterparts, but also gain an appreciation of the way each group thinks and works.

Building relationships with trusted integrators and manufacturers is often key to bridging the gap and facilitate cohesive and harmonious working between broadcast and IT engineers. There is much information throughout the internet on how IT and broadcasting work but it's often difficult to evaluate the accuracy of the data being presented. Again, partnering with a trusted vendor and respected publisher can be of paramount importance.

The key criteria to developing new skillsets is to keep an open and flexible mind. Adaptability is probably the most critical personal characteristic any person can possess. And as we progress through IP migration, this is truer now for broadcast and IT engineers than it ever has been. But this is an attitude that must be championed and driven by the CEO, and then all the way down through the management chain.

Deep Monitoring

Troubleshooting in IP requires both IT and broadcast engineers to develop new methods of working and thinking. TCP (Transmission Control Protocol) is an efficient, reliable, and proven method of distributing data around IP networks, especially for office applications. But we do not use it to distribute ST2022-6 or ST2110 signals as the latency TCP creates is generally unacceptable for television. Instead we use UDP (User Datagram Protocol) – a fire-and-forget transport method.

Because of its durability, TCP can mask underlying network issues that may not be easily detected by office users. Most people surfing the internet, operating their finance software, or using word processing, wouldn't notice lost packets of data and so wouldn't report a problem to IT. But dropped packets can cause critical quality of service issues for video and audio distribution.

Switches and routers support various monitoring solutions to report dropped packets or deterioration in signal quality. But facilities use a multitude of vendor products to provide greater resilience and reliability. A high-level monitoring system such as Paessler's PRTG provides a helicopter-view of the entire facility. PRTG constantly polls switches, routers, and servers to acquire critical data reporting and provide alarm and monitoring information as required. However, standard IT diagnostics do not understand legacy tools for broadcast such as ember+, therefore, broadcast devices now need to support diagnostic output interfaces such as SNMP, sFlow, etc, to provide complete monitoring systems.

Recording Ethernet traffic to gain information around seemingly random events is a critical tool. But knowing what and when to record is even more important as a 100Gb/s Ethernet link will soon fill a dedicated storage device.

Monitoring data on a network using an analytics tool such as Wireshark is often unacceptable when diagnosing real-time issues. Wireshark generally runs on a server or laptop, which in turn may well be using an off-the-shelf NIC (Network Interface card). The NIC is the device that interfaces the Ethernet with the CPU and, due to the buffering employed, will destroy any time critical information.

NIC's are available to maintain the timing relationship but care must be taken when choosing them to be sure they provide accurate time referencing.

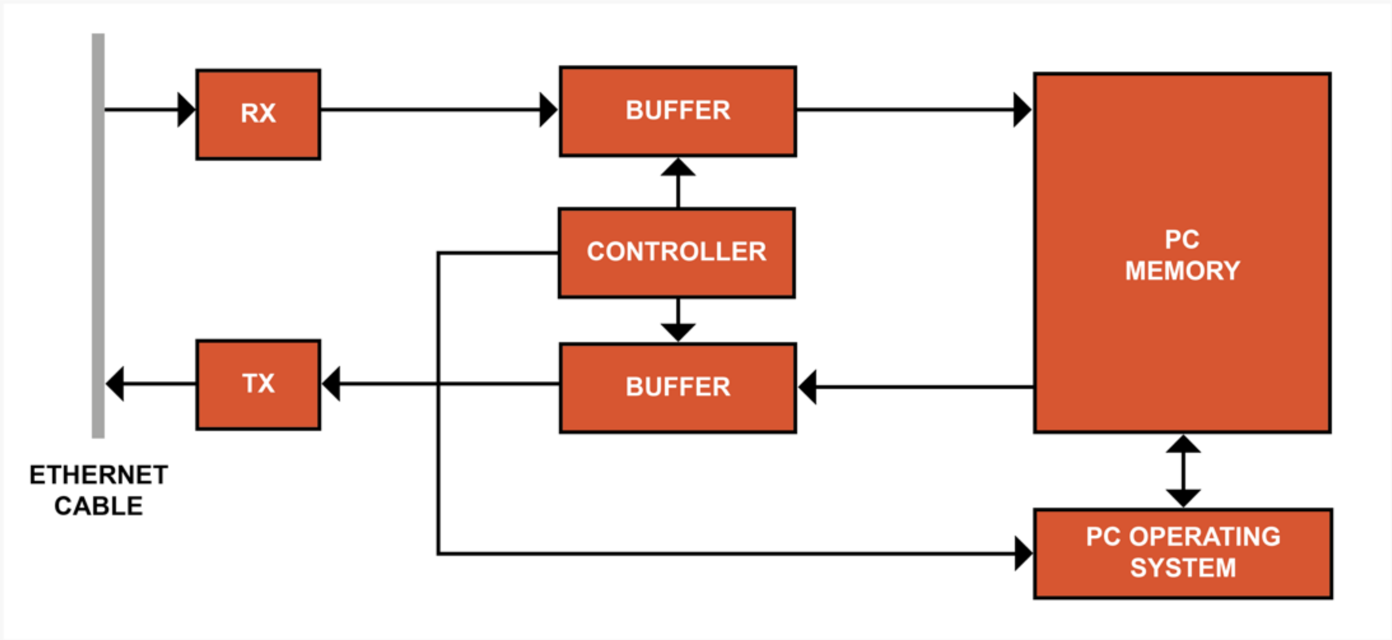


Diagram 2 – Care should be taken when using off-the-shelf NIC's as they do not always respect and maintain accurate timing positioning of packets on an Ethernet connection due to their internal packet buffering.

Beware of Switch Monitoring

Routers and switches provide facilities for network administrators to route and transfer specific data packets to a specified port on the switch, thus providing a convenient method of monitoring packets. But care must be taken when using these facilities as critical timing information could be compromised as the switch extracts the packets for analysis and transfers them through the fabric to the monitoring port.

Few IT engineers working in broadcasting will have experienced PTP (Precision Time Protocol) and gained the understanding needed to make it work. Broadcast engineers fully understand the need for accurate timing but may not have the knowledge required to design a PTP-aware network. Again, this is an area where broadcast and IT engineers need to collaborate and even pull in the help of a manufacturer or integrator who has deep knowledge and experience in this field.

Migration is continuing to progress at an unprecedented rate and few would have predicted such fast integration. All disciplines within the broadcast and IT arenas are playing catchup and not only need to understand their respective technologies, but also have a deep appreciation for each other's working practices. Trusted manufacturers, consultants, service providers, and publishers can go a long way to make IP migration reliable and as easy as it can possibly be.

Part 3 - All Together Now

As we migrate to IP, broadcasters are thinking about how they will interface their SDI, MADI, and AES systems together. Many see the benefit of IP and one day all devices will be IP-enabled. But until that time arrives, we need to understand how to interface new and old together. In Part 3, we investigate real applications on how to connect existing and new technologies.

Riedel's MediorNet real-time network uses dynamic bandwidth allocation to maximize fiber usage in their proprietary networks. MicroN can provide a gateway to IP networks to deliver the best of both worlds.

Few broadcasters have the benefit of implementing IP in a greenfield site and will instead be slowly and cautiously migrating IP into their existing infrastructures to meet their business demands. Upgrading from analogue to SDI had its challenges but could be quickly and easily achieved. And moving from SD to HD SDI was relatively straight forward.

Coaxial cable for both migrations differed in their characteristics but they required the same broadcast engineering skillset to make it work. Although processing equipment, such as distribution amplifiers and vision switchers, operated completely differently between analogue, SD and HD, the interfaces and underlying cabling structures were very similar

Natural Analogue to Digital Migration

The basic video-audio coax and twisted pair cabling infrastructures have stood the test of time and serviced the broadcast industry well since the 1930's. As each video technology emerged, the quality and characteristics of the cable had to be improved to address the higher frequencies needed. But essentially, the cable looked the same and could easily be installed into existing infrastructures without too much inconvenience.

Although Ethernet networks have their history in coaxial cabling, twisted pair infrastructures such as CAT-5 have dominated the landscape since the 1990's. Simple to use and easy to install, CAT-5 could achieve data rates of 100Mbit/sec.

CAT-5 Provides IT Connectivity

Various improvements to CAT-5 occurred over the years culminating with CAT-8 to achieve 25Gbits/sec and 40Gbits/sec. But as fiber costs came down and even higher data rates were needed, fiber infrastructures started to dominate IT infrastructures.

From a cabling perspective, any type of signal can be distributed over fiber or CAT-5. This is different from an Ethernet network operating over fiber or CAT-5 as the distributed signal must comply with the specification of the underlying Ethernet protocol.

We can easily install singlemode fiber backbones with their virtually unlimited bandwidth capabilities and finally future-proof our infrastructures since fiber is agnostic when it comes to the signals it can carry.

Use IT Infrastructure

During IP migration, broadcasters can take advantage of fiber infrastructures and connect high speed devices together using proprietary protocols. Broadcasters still benefit from the COTS infrastructures since the technicians installing the cabling for IT can easily install the same cabling for broadcasters.

When IP connectivity becomes available for such equipment, patching the fiber into an Ethernet switch is an easy process thus making the broadcast equipment ready for connectivity to the Ethernet network when the vendors make the interfaces available.

Two dominant media IP standards have emerged; ST2022-6 and ST2110. Both distribute over IP and can deliver lightweight compressed and uncompressed media.

ST2110 Efficiency

ST2110 is more efficient than ST2022 as it removes the unnecessary overhead of line, field, and framing information, and has delivered the most significant change to broadcasting since the 1930's as it abstracts away the media essence from the underlying transport stream. And for the first time in the history of television, we can process video, audio, and metadata all independently of each other while still maintaining frame-accurate synchronization.

The key to making ST2110 work over an IP network is providing an accurate timing reference. PTP (IEEE1588:2004), usually locked to an external source such as GPS, provides the sub-microsecond accuracy needed for reliable distribution of media across an IP network.

Timing Timing Timing

During migration, a hybrid network of IP-Ethernet and SDI-Video-Audio will soon develop and maintaining accurate timing between the two is critical.

SDI, AES, and MADI networks also require a single source of timing reference. Sync Pulse Generators (SPG) have been the traditional origin of black-and-burst for video and word-sync for digital audio. As well as ensuring that adequate bandwidths are available on the IP network links, a timing relationship between the PTP grand master and SPG must be established.

If we consider a studio that has SDI cameras and IP video playout servers, both must be frame synchronized to achieve seamless switching between the camera and playout server video output.

When a PTP slave, such as a video playout server, synchronizes to a PTP grand master, the value of the counters representing the number of nanosecond tic-events that have occurred since the epoch are adjusted to make them the same as the grandmaster PTP clock.

The video servers internal media clock is running at 90KHz for video processing and 48kHz for audio processing and this is used to gap each IP packet to maintain compatibility with ST2110-10 and keep the 40 millisecond frame rate. The 90KHz clock is derived from PTP by counting the number of nanoseconds.

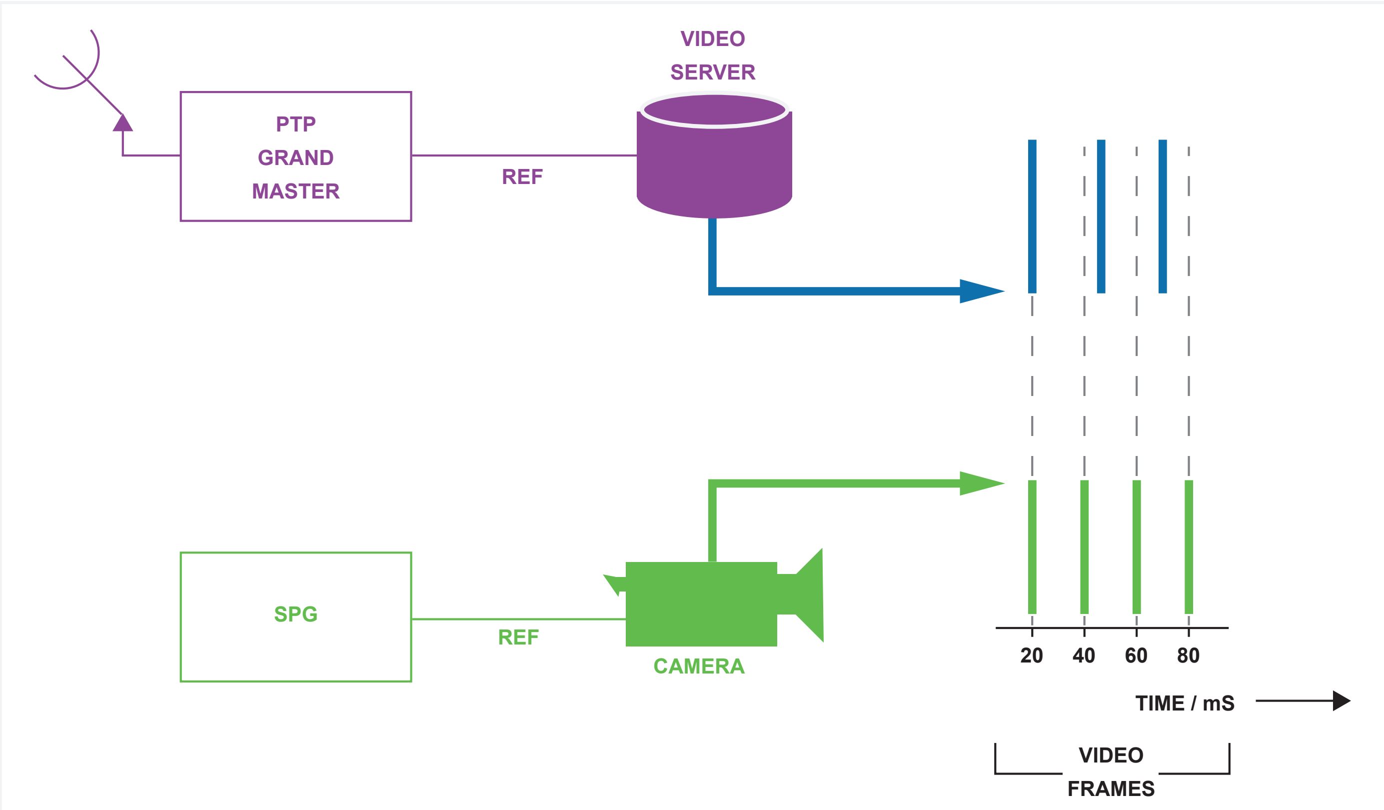


Diagram 1 – When integrating ST2110 and SDI, the PTP Grand Master and SPG should be locked to guarantee frame accurate switching. In this case, the SPG field counter is running slightly faster than the video servers field counter and the video fields do not align. This will cause video disturbance when switching between the two.

Frame Lock Video

The PLL oscillator in the SDI camera locks to the clock frequency of the SDI signal from the SPG. For SD this is 270MHz and for HD progressive is 2.97GHz. The camera will then derive its frame, line, and pixel signals from this input. To achieve a 25Hz frame rate in SD, the camera's digital electronics will use counters to just divide 270,000,000 by 10,800,000 to get 25.

In the case of SDI, all equipment connected to the SPG will be phase and frequency locked, resulting in an exact number of frames per second.

However, if the video servers slave nanosecond counter and the camera's local PLL are not exactly time synchronous, and the playout server is running fast relative to the camera, then there will be more video frames from the playout server than the camera. When switching between them on a vision switcher, frames will be dropped or duplicated resulting in a significant problems.

Buffers Add Latency

To overcome this, either buffers and frame synchronizers must be used, thus adding to latency, complexity and cost, or more efficient solutions can be used. Some PTP Grandmasters have black and burst SPG's built into them and products such as Riedel's Mediornet have the ability to synchronize black-and-burst to PTP. This is a true hybrid solution that covers the transition from SDI to IP.

A PTP Grandmaster is used to synchronize the IP-compatible equipment. Mediornet synchronizes to the PTP Grandmaster through the MicroN interface and all connected Mediornet frames through the fiber infrastructure to provide a timing frame for SDI equipment.

This provides the best of all both worlds as the IP and SDI equipment are frame synchronous.

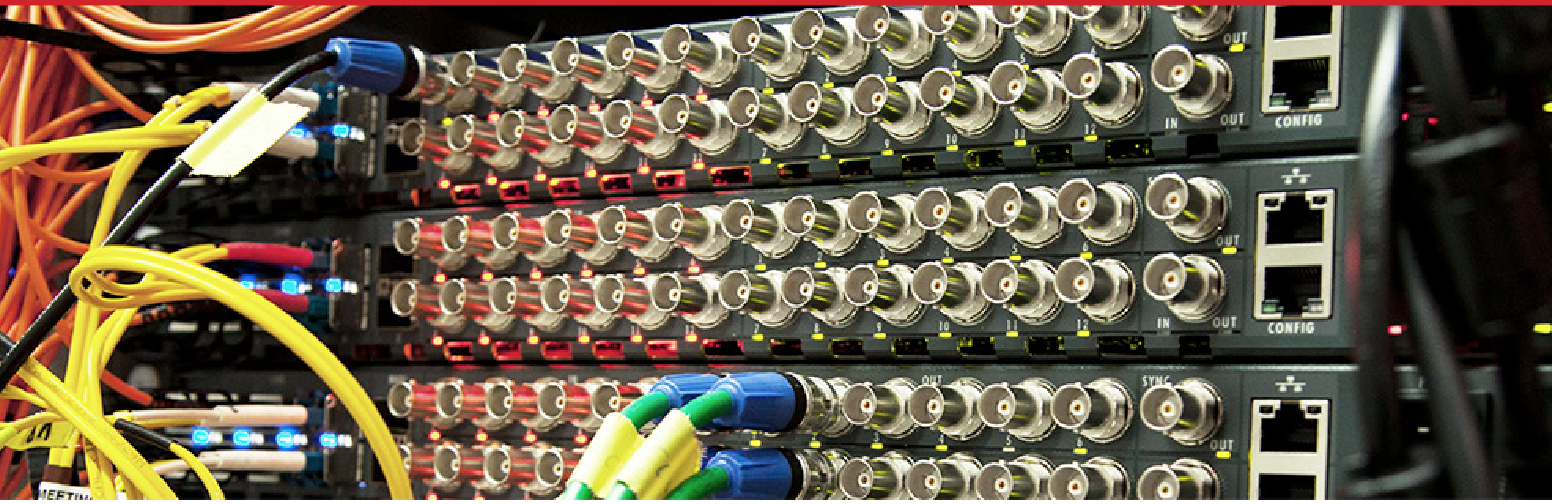
Timing First

We are just at the infancy of migrating to IP and to truly take advantage of the benefits of COTS, broadcasters should consider moving to ST2110. Although we can use existing fiber cabling infrastructures to migrate cautiously, to be ready to move, broadcasters should consider their timing designs before any equipment is procured.

Timing has always been at the core of any design. It is the first consideration as each frame of video must arrive synchronous to the vision switcher, and each sample of audio must arrive synchronous to the sound console. PTP and IP is no different, especially as we migrate from SDI, AES, and MADI, and timing must be considered and understood at the outset.

Taking The Hybrid Approach On The Road To IP

By Michael Grotticelli



Looking to take advantage of distribution and cost benefits, many broadcasters have expressed an interest in migrating to full IP infrastructures. However, if you've got a full complement of baseband equipment and workflows that your team is familiar with, it might not be practical to attempt a complete overhaul in a facility.

There are basically three different ways to tackle the migration to IP infrastructures.

The first would be a greenfield approach where a facility purchases and installs everything they need to make the jump to IP in one swift motion. This is the most disruptive of strategies since, with the technology being where it is, it involves a steep learning curve for staff. Akin to ripping off the band-aid, facilities on this track are taking a certain amount of risk but, with proper planning and guidance, can be successful. These early adopters then quickly begin reaping the benefits of IP.

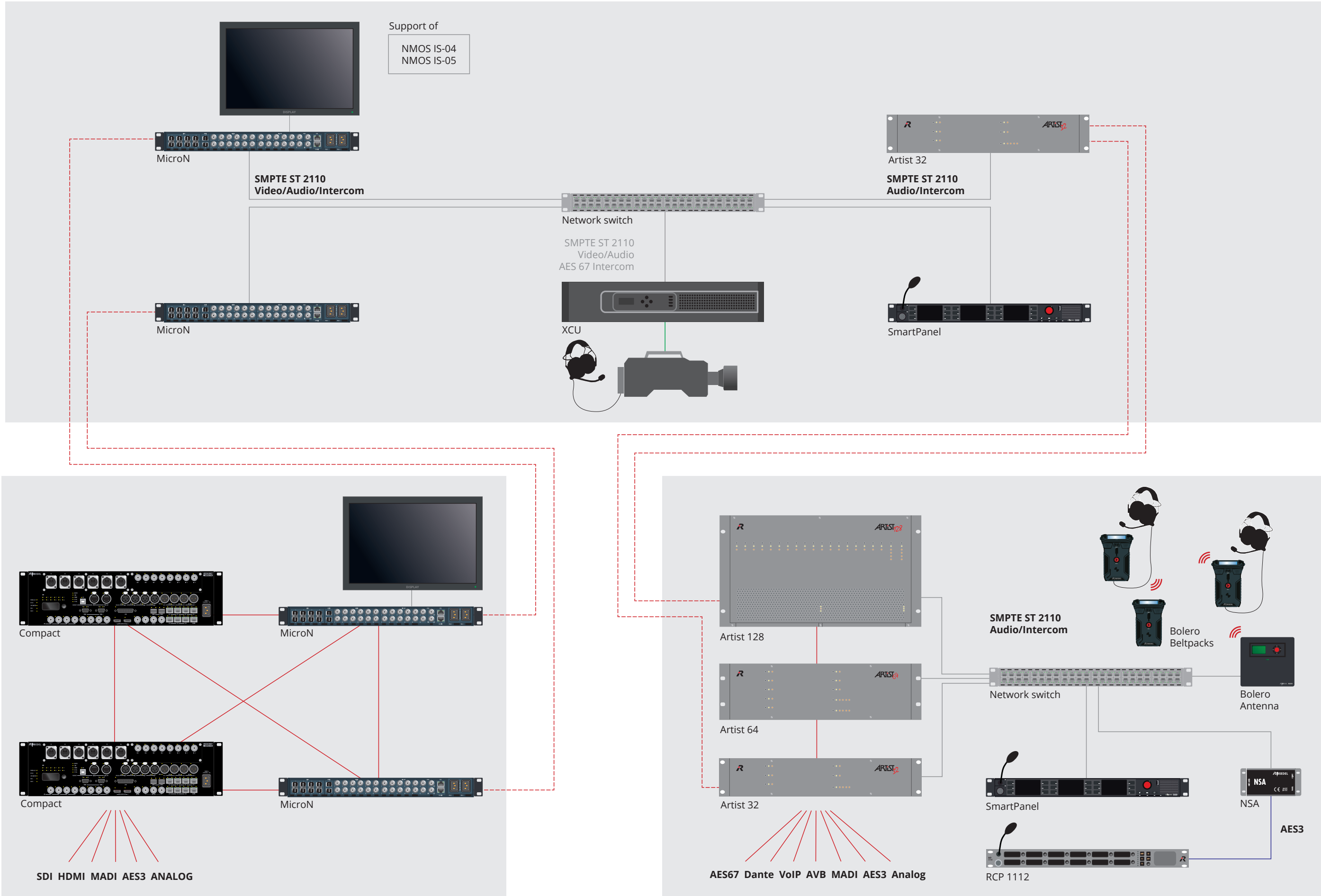
Another tactic is to wade into IP waters by working first with audio streams, which tend to be smaller than video streams and thus easier to move around. In this way, staff can become familiar with IP packet switching and the network topologies that are required to make IP infrastructures successful. Once comfortable, and with some successes under their belts, they can apply their experiences towards the video side of their operations.

Finally, a "Hybrid" approach would use SDI and IP equipment side-by-side while deploying IP Gateways or transcoding systems to port SDI signals to IP or receive signals from the IP realm. Signal distribution systems like the Riedel MediorNet platform can be that middle ground between the baseband and IP worlds.

MicroN is a software-defined, 80G media distribution network device for Riedel's MediorNet real-time media transport, processing, and routing system. It serves as a high-density signal interface with a variety of audio, video, and data inputs and outputs. But, since MicroN is software-defined, apps allow it to take on different roles such as a standalone signal processor, point-to-point transport, a multiviewer, or an IP Gateway. Within a MediorNet network, users can deploy a MicroN with the IP app on the edge of the network to acquire or deliver signals in the SMPTE ST 2110 video-over-IP format.

In a Hybrid workflow scenario, a MicroN with the IP app serves as a gateway to bring SDI signals into the IP realm. A 1RU MicroN unit includes support for one 10Gb optical SMPTE ST 2110 input and output, four bi-directional local baseband 3G-SDI inputs and four 3G-SDI outputs that can be dedicated to monitoring. IP stream monitoring is critical because when you start to move to video over IP, the timing becomes more important as the files become larger. However the underlying principals of how to move content across a network are the same. Therefore, deploying a product like MediorNet MicroN in the baseband realm helps establish this Hybrid workflow that can be leveraged to support multiple parts of a live or studio production.

IP interoperability



MediorNet network **Intercom network**

Using the Hybrid approach, production teams can continue to use their existing baseband SDI equipment to leverage their significant SDI investment, and simultaneously add on the MediorNet MicroN appliance to their MediorNet system to get the most value out of the video-centric IT network. In an ideal hybrid world, you use the cameras and switchers as you already have, outputting baseband signals, then ingest them into an IP gateway product like MicroN IP for conversion to IP for distribution around the on-site production as well as for signal contribution back to the main broadcast center.

With the hybrid approach, the IP learning curve becomes much more gentle, allowing engineers to acquire the new skills that they will need at their own pace. Also, MediorNet provides the exact same experience for dealing with baseband signals and IP streams in terms of the user interface, removing another important pain-point on the road to our all-IP future.

So, there is no need to abandon baseband just yet! In these ways, production teams can cost-effectively leverage the benefits of IP in today's SDI-dominated world.

Riedel - Case Study

The Sponsors Perspective

AMP VISUAL TV

MediorNet Moves The Game On In Europe

Introduction

AMP VISUAL TV, one of Europe's largest providers of OB vehicles for remote video productions, has adopted Riedel's MediorNet real-time signal network and Artist digital matrix intercom for its Millenium Signature 12 and new Millenium 6 OB vans. MediorNet and Artist combine to provide a comprehensive signal transport and communications backbone for these groundbreaking vehicles, both of which greatly expand AMP VISUAL TV's 4K and HDR production capabilities.

The MediorNet network delivers several core benefits to MS12 and Millenium 6 including integrated components that work together seamlessly, flexible and modular system design, and an innovative approach to signal distribution and routing. At a base level, this offers greater efficiency through simpler configurations, an enormous reduction in cabling, and the ability to create flexible interiors in the vans. Even more, with similar Riedel systems installed in both MS12 and Millenium 6, as well as in their fly packs and IXI DSNG vans, members of the production team can easily shift from one van to the other and interconnect those fly packs and DSNG vans as production requirements demand.

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The Client

As a specialist in live television coverage, AMP VISUAL TV provides services that cover all aspects of the production process for live programs and those produced under live conditions. The company operates one of the Europe's most extensive fleets of OB vans for on-location events and has nearly 40 studios at its disposal in and around Paris, France.

With more than 500 employees and 30 years of experience in television production, AMP VISUAL TV has always undertaken to guide its clients through the technological developments that drive and shape broadcasting. Today, the AMP VISUAL TV crew offers expertise in every aspect of production and a commitment to results that exceed client expectations.

The core of AMP VISUAL TV's mobile OB fleet is its Millenium family of extendible semi-trailers, anchored by the state-of-the-art Millenium Signature 12 (MS12) HD/4K-capable OB van. With the ability to support productions of up to 40 cameras, MS12 features a modular design and a mobile partitioning system. This enables it to be transformed into a two-in-one OB truck capable of conducting joint operations with two independent production areas, two audio mixers, two vision rooms, and up to 42 modular workspaces. MS12 was launched in 2016, just in time for coverage of the 24 Hours of Le Mans. Other recent projects include Euro 2016 football in UHD, Europe League matches and final, the 2016 U.S. presidential elections, and the 2018 winter games in South Korea.

The Challenge
For its new Millenium 6 OB van, AMP VISUAL TV envisioned a 100 percent flexible and reliable networked signal infrastructure that could remain future-proof, especially as broadcasters continue to explore fully IP-based operations. Millenium 6 would be an all-new 4K HDR OB van boasting an unprecedented combination of technology, aesthetics, and ergonomic features designed to give production teams maximum power in minimum space. Designed to handle most major productions, Millenium 6 also would feature a modular design and a mobile partitioning system adapted from MS12 to enable flexible workspaces.

The Solution
To meet these requirements, AMP VISUAL TV partnered with Riedel Communications once again to design and deploy a communications and signal transport backbone based on Riedel's Artist digital matrix intercoms and MediorNet real-time media network. MediorNet meets AMP VISUAL TV's requirements by delivering the performance customers demand and the flexibility they need to address the challenges of broadcasting in 4K, both now and in the future.

Millenium 6 features a robust and decentralized MediorNet signal network that can support up to 26 wired and wireless cameras, a multiviewer monitor wall, and Riedel's Artist (wired) and Bolero (wireless) intercom systems when fully implemented with a fly pack. Millenium 6 is equipped with four MetroN core routers, 24 MicroN high-density signal interfaces, and two MediorNet Compact Pro stage boxes. In addition, a Riedel Artist intercom matrix rides on the MediorNet network, together with assorted control panels, commentary panels, and Performer digital partyline beltpacks.

MediorNet's decentralized router concept is quite unique and represents a complete departure from the traditional monolithic routers found on many of today's OB vans. Typically, a van is designed around its router because the router takes up a significant amount of space and places large demands on power and cooling. Every signal in the van must pass through the router so cables run from the router to every I/O device on the van. This can amount to a lot of cable.

The MediorNet approach puts the four MetroN core routers at the "center" of the van with MicroN devices placed wherever signals are required, connected to the MetroN with singlemode optical fibers. This approach significantly reduces cabling, simplifies the overall configuration, distributes risk by eliminating the router as a single point of failure, and opens up the interior of the van for the creation of flexible workspaces. With no large router, cooling requirements are reduced and less cable means more room in cable trays and, theoretically, less overall weight.

One advantage of centralized routers is that they are completely non-blocking, which means that every signal is available at every location in the van. While this approach is very convenient, it can be a very inefficient use of available bandwidth. MediorNet cannot efficiently create a 100 percent non-blocking signal backbone, but a little bit of planning makes this a non-issue.

Never, in practice, will every position need access to every signal. By determining a maximum signal count for each location, designers can implement a system that will handle 99 percent of the situations that Millenium 6 is likely to encounter. Should it ever become necessary to accommodate that last 1 percent, operators can use the MediorWorks software interface to quickly make the appropriate changes.

François Valadoux, Chief Technology Officer at AMP VISUAL TV, said: "At first, the blocking aspect of MediorNet was a concern. But after talking with our engineers and thinking about what we wanted to accomplish with Millenium 6, we determined that we are getting everything we want without compromise and that not having every signal at every position has not been a problem."

Each MediorNet Compact and MicroN feature on-board signal-processing capabilities including frame synchronization, embedding/de-embedding, and delays. The MediorNet Compact units provide a complete array of audio, video, and data I/O while the MicroNs include 12 SD/HD/3G-SDI I/O, two MADI optical digital audio ports, a Gigabit Ethernet port, two sync reference I/Os, and eight 10Gb MediorNet high-speed links.

The MediorNet MicroNs are software-enabled hardware that can perform different duties through the use of Apps. Currently, five different Apps are available including standard, point-to-point, MultiViewer, IP gateway, and a new Processing App for color correction and UDX conversion. License switching allows clients to change Apps easily.

The Result

Working seamlessly with the MediorNet MetroN core router, which provides the heart of the network architecture, the MicroN devices give AMP VISUAL TV a high degree of flexibility in addressing the current and future demands of video production. MediorNet Compact Pro frames serve as stage boxes and provide AMP VISUAL TV with additional signal interfaces for the field. Signals includes analog audio inputs and outputs (including mic pre-amps), Ethernet tunnels for various uses, MADI for multichannel audio, and HDMI video signals – all seamlessly integrated into the MediorNet signal fabric.

In addition, the MicroN devices support Millenium's modular approach with the ability to be strategically placed close to signal sources and destinations, making it easy for AMP VISUAL TV to tailor signal routing to the demands of individual productions, whether large or small, while reducing cabling and system complexity. Fewer cables mean less weight, more space in cable trays, and reduced aircon requirements. Without the need to build around a large centralized router, AMP VISUAL TV is enjoying much greater workspace flexibility.

Another efficiency created by decentralizing the router and placing I/O where it's needed is full redundancy of all video and audio signals for commentary, intercom, and signal distribution, critical elements of any live production.

Finally, the modularity of the MetroN interfaces, which allow Millenium 6 to link easily to the MS12 HD/4K van or to a shared fly pack for producing shows of all sizes, has been a huge convenience. Rather than over-investing in gear, AMP VISUAL TV is able to tailor the infrastructure to production requirements. MediorNet resources can be allocated to several productions at once or assembled together to support a single large event.

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