BROADCAST
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Connecting IT to Broadcast

Multiviewers For Flexible Operations

Essential Guide

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ESSENTIAL GUIDES

Introduction

By Tony Orme, Editor at The Broadcast Bridge

IP and COTS infrastructure designs are giving us the opportunity to think about broadcast systems in an entirely different manner. Although broadcast engineers have been designing studio facilities to be flexible from the earliest days of television, the addition of IP and COTS takes this to a new level allowing us to continually reallocate infrastructure components to make the best use of expensive resource.

High-speed networks further abstract the processing equipment from the point of use giving even greater flexibility. We have the option of centralizing core infrastructure components, distributing them, or providing a combination of the two. In a true IP environment, we do not have to be concerned with SDI signal loss and cable length restrictions as we can keep our video, audio and metadata essence in IP through standards such as SMPTE's ST2110.

HPC (High Performance Computing) has championed the way for IP broadcast installations. This is yet another example of how broadcasting is benefiting from the gains in other industries allowing us to ride on the crest of the wave of their innovation. It would have been almost unheard of to pass live 4K video and audio through a computer server even five years ago, but the speed with which HPC has advanced for machine learning and finance has allowed us to use them without hardware modification.

Ethernet speeds now exceed the requirements of HD and 4K uncompressed video. More surprisingly, the equipment needed to make these networks operate are readily available from industry vendors. They are not available from consumer outlets, but they are available from multiple vendors who also provide high specification service level agreements intended to keep systems working in the most demanding of applications.

Once broadcasters move to IP, they start to see how flexible and scalable IP and COTS infrastructures really are. Flexible licensing gives even greater choice as this opens up a whole new plethora of opportunities through the pay-as-you-go model.

Studios are rarely used for one show. Sets, lighting, camera and sound configurations are regularly changed to make the best use of this incredibly expensive resource and the same demands for versatility is now finding its way into the rest of the broadcast infrastructure. We can no longer design a playout system for a fixed number of channels or a technical area to work with a limited number of shows. Instead, there is a massive demand to make all technical areas even more flexible.

Software licensing combined with COTS infrastructures delivers this level of flexibility. Software can be pre-installed on servers and enabled through license keys that can be procured for any length of time the vendor agrees to. These truly dynamic systems deliver the capability the modern broadcaster is looking for not only through the infrastructure design, but also through the combinations of OPEX and CAPEX options.

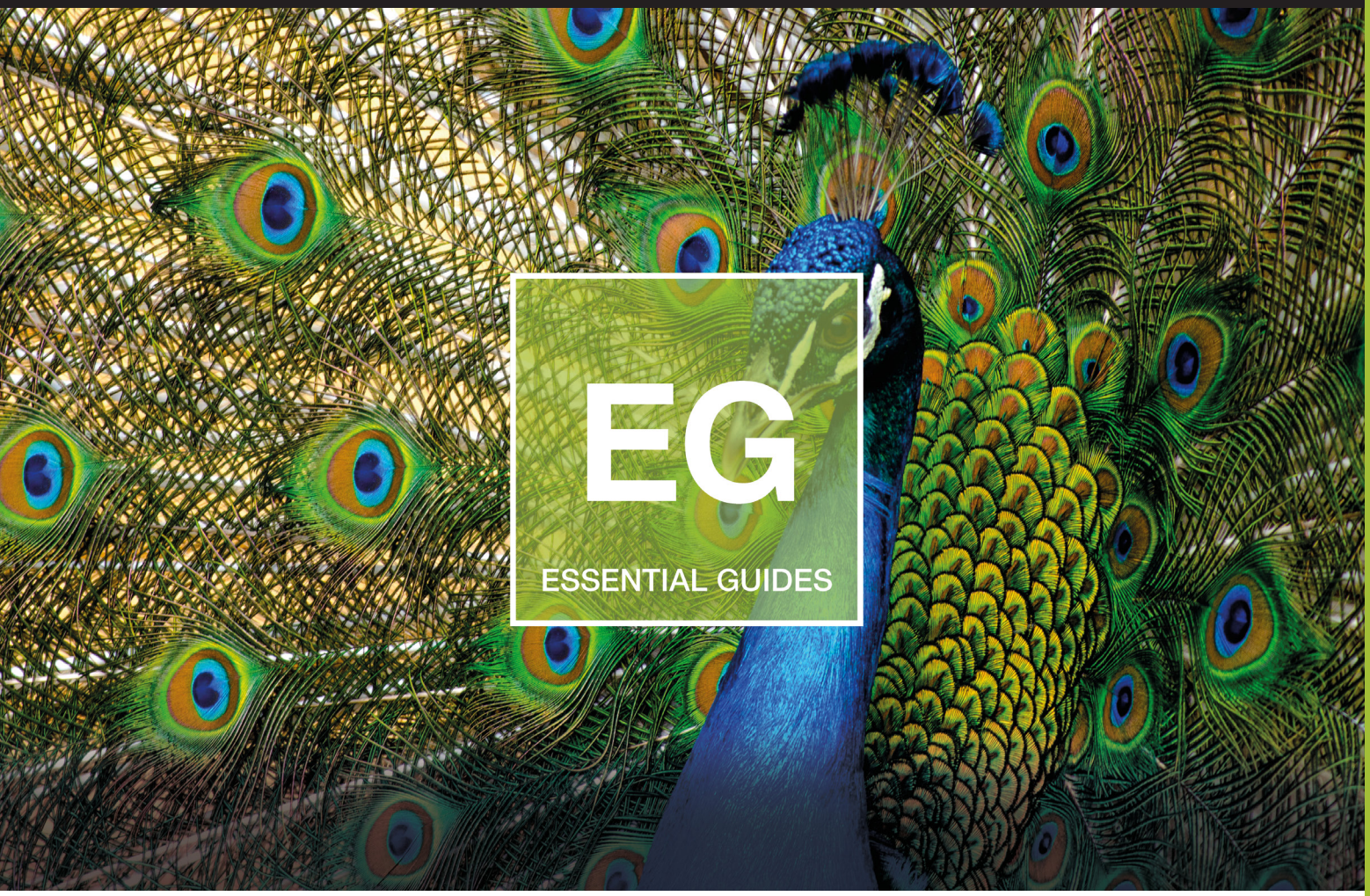
Tony Orme.

Public cloud systems are entirely OPEX, but broadcasters may want to keep some hardware of their own, in which case the combination of CAPEX and OPEX is available. There are many options for the broadcaster to choose from allowing them to best meet their own requirements.

IP and COTS is more than just about saving money, it's about leveraging the flexibility and scalability they delivery.

Tony Orme
Editor, The Broadcast Bridge

Multiviewers For Flexible Operations



By Tony Orme, Editor at The Broadcast Bridge

Adoption of IP has taught us that the benefits are more than distributing video and audio over a new transport stream, they also embrace completely new working practices that deliver flexibility and in addition make broadcast infrastructures future proof.

Broadcast stations have always had an element of flexibility about them. Studios are really just working spaces where we can control the temperature and humidity, acoustics and lighting. They were designed with flexibility in mind from the outset as scenery could be regularly changed, the number of cameras could vary and the method with which audio was recorded could be tuned to the production.

SDI Limitations

Flexibility is nothing new to broadcasting and most systems engineers would make a facility as future proof as possible to keep the studio as active as possible for as long as possible. Tie lines, routing matrices and wall boxes all demonstrate the commitment to flexibility from the beginning. However, the resilience of a traditional broadcast facility was limited due to the restrictive nature of SDI, AES and MADI.

With IP, we have a common transport stream allowing video, audio and metadata to be simultaneously transferred over IP networks. In all probability, the IP will transfer over Ethernet, but other options are available such as fiber. This opens up a whole new world of opportunities as each of the principle elementary streams, that is video, audio, and metadata can transfer over the same network and cable.

This has further led to the democratizing of processing hardware. Instead of requiring broadcast specific hardware solutions, we can now look to COTS systems based on high-speed servers, network infrastructures and storage systems to provide most, if not all of our video, audio and metadata processing and storage needs.

Advances in HPC (High Performance Computing) has demonstrated the speed with which data can be processed now exceeds broadcast requirements, especially for 4K/UHD systems. Infrastructure latencies are incredibly low and multi-processor servers are taking data processing speeds to new levels.

Ingress And Egress Capacity

Although many broadcasters are currently focusing on on-prem datacenter designs, public cloud systems are now starting to appear. The biggest challenge for cloud is the ingress and egress capacities and associated costs, however, with OTT gaining more prominence and the progress made with remote operation, the need to move vast amounts of data between on-prem and off-prem datacenters is vastly diminishing.

Essentially, IP allows us to take flexibility, scalability and resilience to new levels. Combined with these infrastructures, the advent of SMPTE's ST2110 has the potential to deliver unprecedented opportunities. ST2110 effectively abstracts away the underlying transport stream layer from the video, audio and metadata essence. This is the first time in the history of television this method has been available to broadcasters for real-time operations.

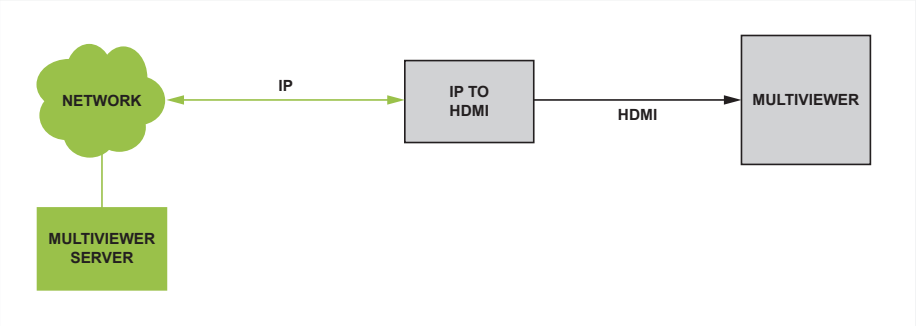


Figure 1 – IP infrastructures allow us to physically separate the multiviewer application and server away from the display device. Here, the IP to HDMI converter is close to the Multiviewer but the server can be some distance away, potentially in a separate building or even the cloud.

Although SDI, AES and MADI have served the broadcast industry well over the past thirty years and will continue to provide solutions for some applications, it is a relatively static method of operation and leaves little scope for flexibility, resilience and scalability. In part, this is by design as all three were designed to be highly reliable at the expense of being flexible from the start. The embedded clocks, CRCs and limited supported formats were more geared to reliability than flexibility.

IP Flexibility

IP from the outset, was designed to be a flexible packet switched mechanism. Although the protocol is hardware and transport stream agnostic, many broadcasters use Ethernet as the underlying transport stream. Ethernet in itself has developed massively in recent years and bandwidths of 40Gb and 100Gb are now available.

Multiviewers now present unparalleled flexibility. Studios, control rooms and viewing suites all use multiviewers. Flat panel display devices further expand their capability due to their shallow depth and versatility. There's no need to have SDI as the HDMI 2.0 specifications now support 4:4:4 color subsampling. Even though the color signals are only 8bits per channel, this probably isn't good enough for grading but is more than adequate for confidence and quality monitoring.

IP to HDMI converters are readily available at relatively low cost so a ST2110 stream can easily be converted to HDMI for the flat panel display. Many other versions of IP to HDMI converters are available for ST2022, compressed video and audio allowing IP to be taken right to the back of the display.

The true power of the flexibility of multiviewers appears when we consider the COTs solutions available. In the past, if you wanted to reconfigure or expand your SDI multiviewer then you would probably have to buy additional cards or even buy a new frame if you exhausted its capacity. All this is both expensive, time consuming and very inflexible, especially by today's standards.

Very High Shelf

Admittedly, the COTS servers needed to process multiple streams of ST2110 or ST2022 video and the associated audio are very high-end and stretch the technical abilities of these devices. They are off-the-shelf in terms of being readily available from industry suppliers, it's just that the shelf is very high, that is, the equipment is designed for high availability industrial applications and the costs reflect that.

Having such massive amounts of processing power and data throughput available on-prem or off-prem gives us outstanding flexibility. Not only can we run different applications on the servers, but we also have the choice of which software we run on which server due to software licensing.

Also, the individual software applications can be easily configured either through the Ethernet interface or pre-stored files. As the servers do not have any vendor specific hardware, such as SDI input and output cards, the video, audio and metadata can be easily processed on any server with sufficient resource.

De-centralization Benefits

This further leads to enhance the concept of distributed processing. We no longer have to store all our hardware in one specific room or datacenter as it can be easily situated in other rooms, buildings, cities or even countries. The processing power stays where the data flow is most concentrated to keep network connections optimized and as low as possible.

Sports events vary enormously in their technical requirements. For example, a football match may need cameras and sound from one location and a hockey match from another. Routing the camera sources to the multiviewer, configuring the position on the display and then adding captions can be logistically very difficult.

Traditionally, we would have used SDI routing matrices to provide the correct sources to the multiviewer and this in itself would have been a difficult and challenging task. Fraught with the potential for error, changing multiviewer configurations was never that easy.

Multicasting Gains

Media IP systems, especially those using ST2110, will use IP multicasting to distribute video and audio. This is the IP equivalent of the video and audio distribution amplifiers and allows single directional flows with a one-to-many mapping when distributing video and audio through a network. This work is massively to our advantage as the receiving device (in this case the multiviewer) actively requests the multicast stream from the network switch it's connected to.

The combined automation of signal routing and display configuration can be easily managed allowing an entire configuration, including its sources, to be adapted within a matter of minutes. This automation takes the concept of flexibility to new levels as a studio can be configured for different events with incredible speed.

Again, it's important to remember that the multiviewer is now abstracted away from the hardware as it is a software application. It's fair to say the software will be highly tuned to make the best use of the servers' hardware resources, but it does not rely on custom circuits such as SDI cards to make it work. The video, audio and metadata are going in and out of the server via the Ethernet connection. It's only when the data arrives at the display is it converted to HDMI for viewing.

IP Distance Flexibility

This leads to another interesting concept and that is that the multiviewer no longer has to be physically close to the flat panel display. In SDI infrastructures, the multiviewer, being a custom hardware device, was limited to its proximity to the display. SDI cable has a maximum distance with which it can reliably transfer a signal thus restricting the distance to the displays. We could use distribution amplifiers or fiber converters to increase the effective length of transmission, but this is messy, increases complexity and introduces unnecessary points of failure.

IP is transport stream agnostic and so we can transfer it over many different types of standard IT infrastructure. The HDMI connection does have a physical limitation for distance, but the IP converters can be easily mounted on the rear of the flat panel displays and the Ethernet run to it either as twisted pair CAT6/7/8 or fiber.

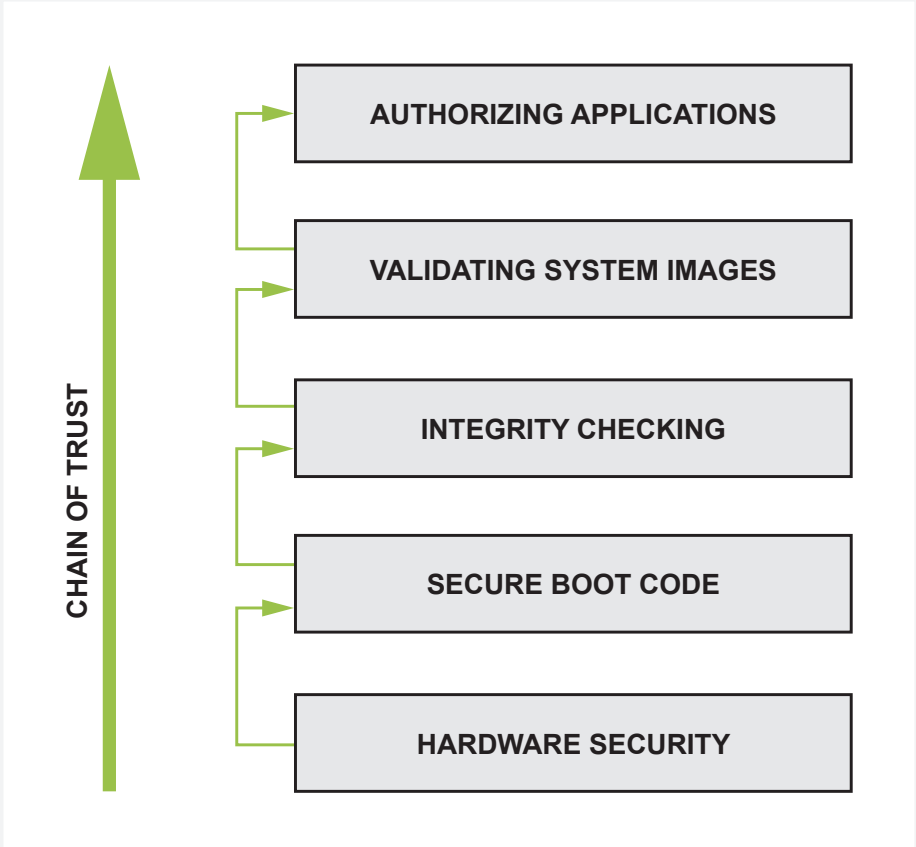


Figure 2 – security should be built into an infrastructure at the beginning of a design and not be an after-thought at the end. Here, the servers "chain of trust" starts at the base of the server with the hardware security as each component must not only be compatible with the server hardware but also have verified provenance, the "secure boot code" confirms the hardware layer is verified and then "integrity checking" verifies the firmware installed on components such as the disc drives and video cards, "validating system images" verifies the kernels and drivers have not been tampered with and "authorized applications" confirms the applications running on the server are from trusted parties.

Abstracting the multiviewer application in this way further presents us with more opportunities to decentralize our infrastructure or completely move the processing off site to the cloud, especially when we consider the flexibility software licensing offers.

Although software licensing is well established in IT used in other industries, it has only recently gained attention within broadcasting. The ability to distribute code safely and securely with flexible usage benefits both the vendor and broadcaster massively. A license is a unique code that can be locked to a specific release of code to allow vendors to enable specific functions within an application for a specified length of time.

OPEX Functionality

This is further enforcing the idea of the OPEX model. Instead of thinking about buying products that provide a specific service, we should now be thinking in terms of a group of functional requirements that meet the needs of a production.

OPEX is incredibly popular as it allows business owners to scale their infrastructure costs at a rate proportional to their sales as upfront costs are greatly minimized. This can be further improved if the broadcaster opts for a full cloud model. But even if they don't and they do opt for a combined CAPEX/OPEX model, then the amount of hardware, such as servers and network devices, will also be greatly minimized as they will only need to be procured as the business expands.

Service Level Agreements are a well-established model and will give broadcasters even more flexibility for support. Many IT vendors have been providing this model for years and can offer many different services from same day repair to guaranteed delivery of new components within a few days. This reduces the need for a broadcaster to hold spares and reduces all the associated costs that go with it.

Licensing Resilience

Software licensing and functional thinking now opens up a whole new world of flexibility. Instead of buying multiviewers for a studio control room to meet peak demand, the broadcaster may find that they only need two multiviewers for 80% of the time. The licenses for the additional two multiviewers can be purchased as required. As the software license is effectively a file, it can be downloaded from the vendors website so there are no shipping costs or delays.

In this scenario, the broadcaster may have opted to build a server farm where the servers can be allocated to functions as required, such as a multiviewer. The software can be pre-installed and then just enabled by the software license. This is the ultimate in flexibility as the software is not even tied to a specific server and can be run from any of the servers in the server pool.

Cyber security is gaining more interest, especially as broadcasters move more to IP. Modern IT COTS servers have security built into them at a hardware level and to truly take advantage of the protection they provide then they must be kept up to date with software and firmware patches. This is another reason to buy SLAs, and while security at this level is also provided by cloud operators in the end security is always the responsibility of the broadcaster.

Greater Scope

Software applications provide more scope for security than we've ever had with traditional broadcast equipment. We can provide much more granular access to the functionality of the code. For example, with the multiviewer only an engineer can change the configuration, but a studio camera operator can change the mnemonic for each part of the display.

Another consequence of software licensing and the flexibility it offers is that we are making the systems future proof. Even taking Moore's law into consideration, the processing power available to us will only increase over the years. More industry's outside of broadcasting are driving the need to improve the resources available and it is this innovation that we ride on and improve how we design, build and operate broadcast infrastructures.

Multiviewer flexibility has improved immeasurably in recent years. Not only has the product's feature-set improved but the combination of software licensing and COTS infrastructures has helped deliver unparalleled flexibility.

The Sponsors Perspective

SRG-SSR And Rohde & Schwarz Push Back Frontiers Of Virtualized Multiviewers At Revolutionary News And Sports Production Centre

Rohde and Schwarz has evolved a heritage in the broadcast and media industry stretching over 70 years. Throughout this period, the company has developed a reputation as one of the leading developers of hardware-based technology solutions worldwide. However, recent years have seen Rohde & Schwarz placing far more emphasis on its software development skills.

Rohde & Schwarz's media monitoring and multiviewer platform, PRISMON, is an excellent example of a product that exploits the advantages of both its hardware and software basis and enables one technology platform to span both monitoring and multiviewing solutions.

Last year saw the company introduce its first virtualized product in the form of PRISMON.cloud which enables remote signal monitoring around the world. This quantum progression in Rohde & Schwarz's software development skillset enables it to offer customers a far wider reach of monitoring facilities in both a production centre environment and also further down the distribution chain, right up to the viewer's chosen device.

The benefits of such a flexible and future proofed software technology to a station's technical or operational director is simply huge.

One question frequently asked to Rohde & Schwarz by customers is whether it is possible to handle SMPTE 2110 data streams within a virtualized environment. The answer is yes, R&S already has such applications up and running across Europe.

Schweizer Radio und Fernsehen (SRF) is the Swiss public broadcasting company, created in 2011 through the merger of radio broadcaster, Schweizer Radio DRS, and television broadcaster, Schweizer Fernsehen. Immediately, this new business unit of Swiss national broadcaster, SSG SSR, became the largest electronic media house in German-speaking Switzerland. Since the beginning of 2020 also the former subsidiary tpc was in-sourced. Almost 3,000 employees work for SRF in four main studios in Zürich, Bern and Basel.

SRF Operations is responsible for all production systems and technologies throughout television, radio and multimedia operations at SRF. A revolutionary News and Sports Centre for SRF is the most ambitious project that SRF and SSG SSR have embarked on for decades. The facility — located in the Leutschenbach district of Zürich - is being built specifically to leverage an IP workflow for significantly streamlined and simplified operational processes. Its cornerstones are digital first and mobile first with a tight focus on video and audio quality. The project sees a change away from program-oriented organisation to a story and content-oriented focus. Within the new structure, journalists will be organized as expert teams and not on program structures.

A key strategic goal of the new building is to have a higher efficiency and flexibility in all directions. But it also means a big technical change. Through re-inventing workflows, SRF will bring together many production islands that grew over years into one big new technical concept.

File based and live workflows are growing together, national and regional operating teams work as one integrated unit. There exists just one audio / video / metadata backbone throughout the complete production process from ingest to playout based on full implementation of the SMPTE ST 2110 uncompressed IP standard in HD and ready for UHD.

SSG SSR and SRF's goal is for their workflow to become format agnostic, future proof and efficient. This brings a big change for the employees. There are new organisations, new working hours, new tools and systems, and new workflows.

The Multiviewer Challenge

From day one, tpc / SRF set out with the ambition of creating a new and radically different production solution. Included in this approach was its multiviewer system needs: from the earliest stages, SRF sought a fully virtualized multiviewer architecture. "With a completely virtualized platform we get the flexibility that we always wanted from a multiviewer system," explains Andreas Lattmann, Chief Technology Officer, Planning & Projects at SRF. "Hardware agnostic, integrated in the network and capable to display whatever and wherever needed."

Within SRF's new facility, there exists a master switching room, central ingest, many studios and galleries with different multiviewer needs, as well as a new playout and postproduction system. "Within this environment, the demands for multiviewing are very high and mission critical," explains Lattmann.

"Everybody in the building has different needs to see what's going on and where.

"With the inherent flexibility of a virtualized multiviewer system we can support the operational teams as well as the journalists by showing them the specific sources and destinations that are required for their work and nothing less or more. Dynamic setups and the sheer number of signals that can be handled by PRISMON helps us in supporting the efficiency of everyone."

A Software/IP-based System Solution

Within the news and sports production centre, there is still hardware required, but not special-built-for-purpose. Instead SRF is using standard COTS servers to render the multiviewer signal and the servers are directly integrated within its ST 2110 backbone. With this implementation, SRF achieves the full flexibility that an IP environment enables.

The project required extensive planning, which saw SRF / tpc and Rohde & Schwarz working together closely. "Based on many tests and a proof of concept, we figured out that the crucial issues, such as picture quality, latency and functionality are fulfilled within a virtualized system such as PRISMON," explains Lattmann.

The two companies continue to work together on the deployment of PRISMON Multiviewers, aiming to exploit all of the advantages the new virtualized system offers. “Due to the fact that the product is still quite leading edge, there are enhancements and developments being integrated within PRISMON as an ongoing process. There are new functionalities and releases that enhance the use of the system,” Andreas Lattmann explains.

This is one of the primary benefits of a software based, virtualizable platform, such that it can be updated as and when the deployment requires, features are developed or as new standards become available.

Third Party Integration Based On ST 2110

Within the new centre, PRISMON Multiviewer is integrated alongside technology from Nevion. SRF is using Nevion’s VideoIPath as the orchestration solution for its realtime network. It is the system that enables signal management, bandwidth management, redundancy, address handling and much more. ST 2110-based, VideoIPath is the brain of the complete IP System and also for the multiviewing.

Andreas Lattmann, Chief Technology Officer, Planning & Projects at SRF.

“ST 2110 is the future standard for live audio/video and ancillary data handling in a professional environment. It is an open standard and helps us in migrating to a full COTS-based, IT product-based infrastructure and fulfilling all of our realtime needs such as being predictable, stable, synchronised, scalable, format agnostic and future proof,” Lattmann states. “With this once in a lifetime chance to build a completely new infrastructure with a greenfield approach, it is important to build this with state of the art concepts. So, we committed very early to this standard, became member of SMPTE including its standards group, AIMS and AMWA. Based on these decisions we needed partners that supported the same standards: Rohde & Schwarz is doing this with its PRISMON Multiviewer.”

So, how does IP-based operation enhance workflow efficiency within the new centre? Thanks to SRF’s end-to-end approach as opposed to its previous island-based approach, all signals are available throughout the production infrastructure. With an overall monitoring system, SRF has enhanced the reaction time if there are any failures in the system. With the PRISMON Multiviewer system SRF can ensure that the signals are available in the expected quality at whatever point in the process.

The Results

Now that the PRISMON Multiviewer system is installed and tested, Andreas Lattmann is able to assess the results of the project. “We are happy with the installation of the (PRISMON) application on COTS servers with the support of Rohde & Schwarz technicians,” he explained. “All open points are well addressed and professionally managed by Rohde & Schwarz.

“Since the application is installed on COTS Servers and a VM platform, we are able to expand or shrink the system’s dimensions based on our needs, quickly and easily. A central License-Management Facility allows us to adapt the system to any workplace that needs specific features. The measurement function within PRISMON Multiviewer helps us in a reduction of expensive measurement equipment for many workplaces.

“It is very helpful that PRISMON is based on standardised interfaces. This makes our goal (and perhaps that of any broadcaster) of integrating a best-of-breed solution based on third party control systems easy,” Andreas Lattmann concludes.

Today, PRISMON is a product that empowers customers through ultimate application flexibility – both on-premise and within virtualized environments. This challenge requires the skillsets of two different types of people – hardware engineers and software developers. Rohde & Schwarz has built its reputation over many decades on our hardware engineering capabilities. But also, PRISMON is a software-based product that is over 10 years in development. During this time, the company has developed excellent software development skillsets and these are valuable when it addresses the needs of virtualized workflows.

With all these skillsets, Rohde & Schwarz can advise customers: both advice and support throughout the signal processing chain and also on how the virtualized infrastructure is being set up. In order to maximise both latency and data throughput and stability, it can optimise the data processing throughput in a virtualized framework.

The question is how does a broadcaster tame that asynchronous IT/IP world in ways that enable viewers to consume AV content in manner they are familiar and happy with? The closer you can get to the performance that a traditional hardware-based system provides, the happier the customer is. It requires specialist knowledge and skillsets, but the big challenge is to customize a virtualized environment to the specific needs of that user – this is where the strength of the relationship between the customer and the technology partner is so important.

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