

Software IP Enabling Storytelling



Essential Guide

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Introduction

By Tony Orme, Editor at The Broadcast Bridge

Television is still a niche industry, but nonetheless, one of the most powerful storytelling mediums in existence. Whether reporting news events, delivering educational seminars, or product reviews, television still outperforms all other mediums in terms of its ability to communicate to mass audiences.

One of the major impacts of software infrastructure for broadcasters is its flexibility. But when we speak of flexibility it's often easy to get bogged down in the technical detail of virtualization, networks and monitoring. Flexibility in terms of ease of use is much more relevant for production teams.

Virtualized systems can now meet the demanding data throughput for video and audio, which in turn makes high quality broadcast systems available to a much broader group of production teams. Virtualization has also driven down the barrier to entry for technology making access in terms of cost lower now than it's ever been.

Keeping systems simple is key for anybody working in a broadcast environment and this is even more critical for production teams. Software provides the opportunity to remove the operational complexity and even abstract core components, so production teams do not need to be concerned with how to configure complex workflows. Instead, they can spin-up predefined configurations and adjust them accordingly.

Ease of software configuration moves the focus to empowering production teams to concentrate on the story they want to tell and not have to think too much about the technology they're using to do it. After all, when writing a script, how many producers think of the ASCII codes and keyboard serial interface to the operating system?

The same should be true of operational broadcast infrastructures. For production teams, the focus should be on the functionality and the problem the system solves, not necessarily how it does it.

This level of operational flexibility requires top-down thinking as opposed to the bottom-up analysis engineers and technologists often consider first. We shouldn't be thinking of how we can fit the production teams around the technology, but instead how the technology can best meet the needs of the users.

The top-down thinking approach is a variation of the agile methodology that is now prevalent in modern technology circles. Agile encapsulates the whole concept of change. In fact, agile thrives on change. And to meet the needs of change we must develop flexible systems that can adapt quickly.

The combination of facilitating change and making systems easy to use is manifested in the idea of flexibility. And with software we can deliver this flexibility and remove the deep technical operation to make broadcast systems easy to operate and access.

From an engineering and technologist's perspective, and to make the most of software-based infrastructures, we really need to know what's going on under the hood of the facility. Spinning up software apps and deleting them when finished may sound all well and good, but what does this really mean in terms of making a system work effectively? How does software improve flexibility and what does this mean for production teams?



Tony Orme.

Television is at a turning point in its evolution. We've moved from a system that is totally dependent on highly specialized and custom hardware making infrastructures static and rigid, to a system that is now based on COTS and flexible software to deliver dynamic and scalable systems. Not just for the engineers, but for the users too.

Although dynamic and scalable systems will make broadcast infrastructures more adaptable for the future, the real benefits are the operational flexibility and ease of use with which production teams can work allowing them to focus on making programs and telling their story.

Tony Orme
Editor, The Broadcast Bridge

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To truly understand the benefits of IP, software and cloud, it helps to take a higher-level view of the problem we're trying to solve, the challenges we face, and the people this new technology is helping.

Broadcasting has traditionally been a technology led business. The line speeds, frequencies and data transfer rates needed to make television work have been at the forefront of the hardware capabilities for a good eighty years. But more recently, advances in industries such as telecoms and finance has seen a massive progression in hardware capability, to the point where real time processing in software has not only become possible, but a necessity.

With every technology advance we have to look at the benefits the end viewer has gained. SDI helped improve the quality of pictures, HDR and WCG delivered vibrant and colorful images and surround sound greatly improved the immersive experience. The question is, what is software and COTS really doing for the viewer? What benefit do they gain? In other words, why are we moving to IP and software processing?

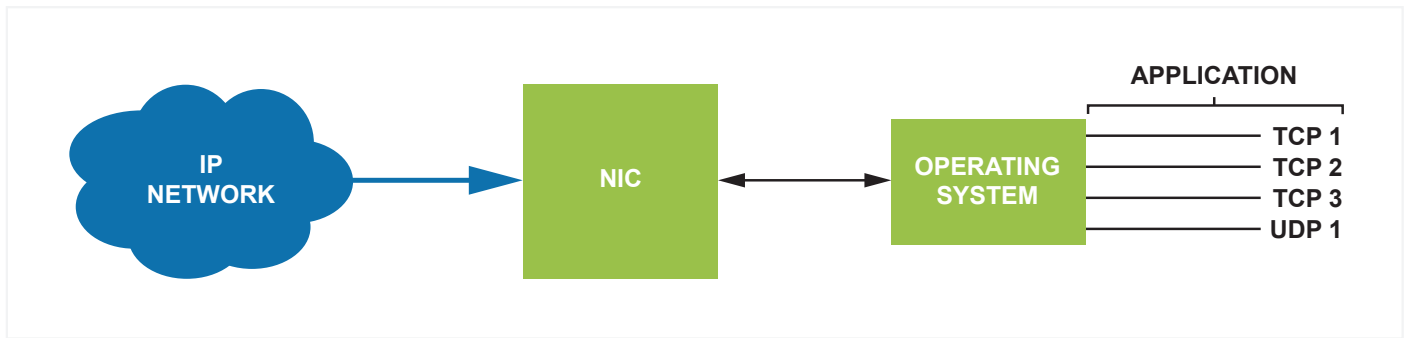


Fig 1 – Multiple applications negotiate through the operating system to gain access to the NIC (Network Interface Controller). The operating acts as an arbiter and scheduler to maintain order within the server and keep the IP data packets coherent and error free for the higher-level applications. This results in an abstraction of the lower-level hardware control away from the higher-level service applications.

Lengthy Hardware Development

Hardware development cycles can easily take six months for relatively straight forward designs and years for complex high speed signal processing. Analogue video gave technology a run for its money requiring custom designs not seen in any other industry. Every device from cameras to monitors and video recorders required specialist design taking years to perfect. Digital improved development times slightly but even here progress could be painfully slow. The bottleneck was clearly the hardware design.

Television is a relatively small industry compared to the multi trillion-dollar telecommunications business, or finance industry, or medical sector. If finance would have needed to record 270Mbit's per second back in the 1980s then D1 video recorders would have been much different. These industries have attracted massive R&D investment to meet the growing demands of their clients and users. The great news for broadcasters is that we can ride on the back of this innovation and use the IP infrastructures and components these industries have provided to our advantage.

Optimizing Systems

Software designs often provide solutions in much shorter timescales than is achievable with hardware. But we must not forget that many of the broadcast products designed over the past thirty years have had software at the heart of their application. Custom hardware often led to custom operating systems to run the code tuned to the hardware and operating system. As embedded versions of Windows and Linux became available, vendors had the opportunity to write more generic code.

One of the disadvantages of the custom style of development is that the code is difficult to design and even more difficult to maintain. A deep understanding of the underlying hardware is necessary to fine tune the application to achieve the best results with the limitations of the available hardware. This further limits hardware design as not only do development engineers have to go through massive architectural changes, but the operating systems have to be adjusted and application code further tweaked.

In the ideal system we want to abstract the software away from the hardware to avoid having to rewrite large parts of the application code or go through new learning cycles for the application software engineers.

Benefitting From Industry

COTS servers and modern operating systems are facilitating this method of working. Although the hardware is designed and built by many different vendors, generic interfaces are provided to allow the operating system to communicate with the input/output devices. For example, Microsoft Windows provides the WDF (Windows Driver Framework). This encapsulates a software interface to the NDIS (Network Driver Interface Specification), which in turn communicates with the low-level registers and memory within the media access layer of the NIC (network interface card).

Through the WDF developers have a generic interface and comprehensive library that allows them to send and receive IP traffic. Although the transfer of IP packets may sound relatively easy, and at a packet level it is, the devil is always in the detail.

A NIC in itself generally doesn't have provision for protocols such as UDP, TCP and RTP. Instead, the operating system is expected to provide this.

Leveraging Operating Systems

Protocols vary in complexity. UDP is relatively straight forward as it wraps the data and provides improved header information such as port numbers to facilitate application sub-addressing within a server. However, if multiple software services sending and receiving UDP datagrams within a server all need access to the NIC then there must be some form of scheduling, direction and arbitration. Otherwise, the UDP datagrams will get mixed up, the services will not receive the correct data, and chaos will soon ensue. Achieving reliable delivery of datagrams from the NIC to the correct service, and vice versa are the responsibility of the operating system.

These challenges are further compounded when we consider TCP as the protocol is designed to solve two problems: guarantee delivery and congestion control. Not only must the operating system now guarantee the IP packets reach the correct software services running within the server, but it must also provide a higher level of control that assures the IP packets are delivered to the software service in order, and with 100% validity. Furthermore, the TCP operating system function must comply with the fair-use policies of the internet to make sure packet flooding doesn't take place and congestion limits are observed, all while trying to optimize data throughput.

In just this one function alone we can see that the operating system is providing a multitude of complex independent services that must work reliably and efficiently to guarantee the best IP connectivity and data transfer possible. Even the most dedicated vendors would find this an almost impossible task to achieve if they had to write the operating system from the ground up. Luckily, Microsoft Windows and Linux operating systems, to name just a few, have done all this difficult work for us.

Demanding Security

We should also consider the thorny issue of security. It's almost impossible to have any network connected device completely isolated from the internet. Whether executing software updates or exchanging files, the modern world requires us to access the internet. But as soon as we connect to the world wide web, we put ourselves at risk.

Operating systems are adept at dealing with security. There are enough engineers and security experts working at keeping the principal operating systems safe for us to be assured that they are as safe as can be. That said, maintaining secure infrastructures is a company-wide responsibility acting over many tiers, but operating systems provide a key part in stopping bad people from accessing our data.

As just demonstrated, COTS servers and operating systems go a long way to providing reliable and secure infrastructures to work with. Developers do not have to worry whether a TCP stream has been reliably received or sent, or whether the correct services in the server are receiving the correct data. This is further enhanced when we start focusing more on the bigger picture of television.

The Bigger Picture

Television is still quite niche, but nonetheless, one of the most powerful storytelling mediums in existence. Whether reporting news events, delivering educational seminars, or product reviews, television still outperforms all other mediums in terms of its ability to communicate to mass audiences.

Working with COTS servers and operating systems has an often-unseen advantage. That is, the systems and interfaces are generally well known and understood by a large percentage of users. For example, most users know how to open files on a Windows PC or launch programs on MAC OSX, some can even fight their way around a Linux desktop. The operating system, and the applications that run on them, abstract away the difficult low-level services we rely on, such as the NIC and TCP interfaces.

Broadcast television works to rigid, well-defined models of operation. Cameras connect to production switchers, which in turn require graphics engines, keyers and DVEs, and that's before we start considering the complexity of sound. Most engineers and technologists will be well versed at building and maintaining these systems.

Excelling At Creativity

Creative people, whether engineers, technologists or production professionals excel when solving problems. For the technologists this could be building a remote facility to overcome lockdown restrictions, and for a producer it could be sharing a complex story in a simplified manner with their community, or wider public. The point is, people excel at creativity, no matter what their discipline, whereas computers are generally poor at creativity but do excel at repetitive tasks.

As computer processing capability and speeds continue to increase, then so will the number of applications available for real-time video and audio. But there is more to achieve than just replacing traditional broadcast workflows with software applications running on COTS servers. Another level of abstraction is available that will greatly enhance television as a creative and information sharing outlet. But we have to think differently about our technology.

The analogy is similar to a drill. When we need to install a shelf, we don't necessarily want to buy a drill, what we do want is a device to make a hole in my wall for the shelf mountings. It's just that the drill is the best device we have found (so far) to make a hole in a wall.

Focus On The Story

In a similar way, a producer or program maker wants to tell their story, they don't necessarily want to buy a production switcher, graphics creator, keyer, video and audio recorder, etc. Instead, they want a solution to solve their problem. That is, how to make a television program. It's just that all these devices (and many more) have been traditionally used to make television programs.

Software is a generic abstract term for describing a solution to a problem. For example, accounts software helps me file my tax returns, video keying software helps me superimpose names of the presenters, so the viewer knows who they are, and what they do.

If we think of software in terms of abstracting away devices from the functionality of the problem we're trying to solve, then we can think about workflows in an entirely different and more productive manner. This is nothing new for broadcasters as we wouldn't expect the person operating the production switcher to have an in depth understanding of the video multiplication going on within a linear keyer, but they do understand the function of the linear keyer and the problem it solves.

Reaching Existing Limits

It's just that with traditional hardware-based designs, we've hit a natural limit of what we can achieve in terms of workflows with the tools we have. We do have very well-defined processes and it's quite justified to argue that these processes have stood the test of time and are established for a reason. The only problem with this is that it doesn't take into consideration the demands of the viewers, whose requirements and needs have definitely changed. And the viewers demands in turn influence the program makers, the content they provide and the working practices they want to adopt.

Thinking in software terms, by definition, empowers us to abstract the workflow another level so that we can look at what we're trying to achieve and not become obsessed with the tools we currently have at our disposal.

Empowering Story Telling

If we can allow ourselves to transcend the baggage of established process then the opportunities open to broadcasters, producers, story tellers, engineers and technologists are endless. For example, in software, it's entirely possible to build a three-camera studio with production switcher, keyers, DVEs, video server players and a sound console. But the program maker doesn't necessarily want this, what they do want is a method of recording a one-plus-one interview with name straps and a short package to be played in from a video server.

Software automation allows us to provide this level of abstraction and configuration without the production team needing to get bogged down in the detail of how the individual components connect and relate to each other. In essence, this is top-down provision instead of bottom-up thinking. This further allows the program makers to focus on their creativity and achieve better story telling results appealing to wider audiences.

The tools are already available to facilitate new methods of operation that maintain the highest levels of flexibility with the minimum level of resource. This further simplifies the operation for program makers leaving them to get on with delivering content and allowing engineers and technologists to solve the next new and interesting challenge.

The Sponsors Perspective

How Does Flexible Access Change The Way Vizrt Serves Customers?

By Steve Wind-Mozley, CMO, Vizrt.

Flexible Access is our way of responding to customer needs we see in the market. At a high level, it is about putting our customer experience first and foremost. In these uncertain times, our customers need to produce more stories, better.



We have five newly defined Vizrt Solution Suites which streamline how our customers can meet their content production needs. Flexible Access lowers the barriers of entry to our product portfolio and provides more surety around return on investment.

There are three reasons why Flexible Access benefits our customers. The first is it is friction-free. With much lower upfront costs that can be serviced by OpEx budgets rather than scarce CapEx ones, and by sharing more of the investment risk with us, customer procurement requirements can be met more readily.

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The second is around dynamic flexibility. We're offering our customers the elasticity to scale up and down as their business demands. Dynamic flexibility allows our customers to choose how, when, and where to deploy our solutions. Because they are increasingly software-defined, the choice between on-premises, in a data center, or in the cloud becomes a business decision rather than a purely technical one.

And the third one is our Customer Covenant – our pledge to our customers to build meaningful partnerships that create value. Customers no longer need to make all their investment upfront in the hope of being able to generate a sufficient return in the future. The recurring billing mechanism that Flexible Access provides means that they can shorten the time between the investment outlay and the revenue inflow, all underwritten by us.



We believe that content is a vector of value in all the markets we serve. All our customers derive value in some way, shape, or form by producing content. More importantly, the ones that thrive produce content at the right time in the right manner, so it is relevant for their audience. Our task as providers of technology is to make it simpler.

Given the rapidly changing environment that our customers operate in, we think that the traditional model of a customer investing up front and then working to secure a return over many years can be problematic. Our customers tell us they require the capability to adapt as their world changes, and that is what we seek to provide.

Our customers are made up of a strata of persona types. CEOs want to grow the business. CFOs look for a strong return on investment. CMOs care about brand consistency and audience engagement. The journalist wants to tell great stories, with good volume. The tech director needs to run the show and have it look as good as possible. Our Solution Suites gather our tried and tested Vizrt products into workflow groups, making it easier for all stakeholders to access and connect with the value they can deliver. And of course they all can exploit the inherent flexibility in this new way of working.

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Software is the way that we deliver this flexibility. If I'd been in a hardware-centric environment when COVID hit, then I could never have removed 50 people from my gallery and sent them home and still be productive. But in a software driven one, I could virtualize my studio with Vizrt software, utilizing NDI and have my people create remotely.

Running through Flexible Access and the Vizrt Solution Suites is our Customer Success ethos, designed to deliver a market-leading customer experience from procurement, deployment, skills transfer and training, through to in-life value creation, support, development, and maintenance.

Customers will be able to adapt and scale their Vizrt Solutions Suites as their needs change, providing them with the confidence to drive their business forward, and of course, with support and maintenance built in, our customers will always have access to the latest version of our software.

What Are The 5 Solution Suites That Make Up Flexible Access?

- **Vizrt Production Control.** For when customers want to run live productions, be they remote or local, in an efficient manner.
- **Vizrt Extended Reality (XR).** For when customers want to employ augmented, virtual reality, analysis, or video wall elements to bring stories to life, be that via telestration, virtual sets, across video walls, or other immersive graphical elements.
- **Vizrt Newsroom.** For when customers (journalists and content producers) want to produce large volumes of high-quality visual stories efficiently.
- **Vizrt MediaWorkflow.** For when customers want to leverage their content assets and monetize these across all their audience touchpoints.
- **Vizrt Channel Branding.** For when customers want a strong, consistent visual identity to drive viewership and value through channel branding and cross-promotion.

We believe that over time, customers will gain more value using these Solution Suites. We've taken our training, professional services, support teams and our solution architects, and put them together to create a unified Customer Success team. Their job is to think about how customers can become more successful by using a Vizrt workflow. That is a constant, always-on conversation dedicated to improving customer outcomes.

Flexible Access is the natural step that we are taking to align ourselves with our customers' success to help our customers deliver more stories, better told.

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