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Using IP to Solve the Multiformat (HD, 4K & HFR) Truck Challenge

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WHITE PAPER

Broadcasters and content creators are scrambling to implement systems that produce live content with the newest technological advances beyond HD, including 1080p60 and 4K UHD. In addition, particularly in live sport programming, producers are employing more high frame rate (HFR) sources, which focus on the action and highlight the drama of live events. The ability to draw the audience into the emotion of a moment in sports, such as with a frown from a player or coach, has increased demand for these HFR capture and replay devices.

As the transition time between new formats continues to shorten, the task of keeping a production facility up-to-date has become increasingly difficult. Never before have so many new potential signal types created such difficulty in managing signal paths, maintaining configuration of user interfaces and control systems and creating the new infrastructures required to handle them.

With this accelerated rate of change, outside broadcasting (OB) truck providers aren't always able to reach a full return on investment if they only choose one production format. Today, operators are looking for a way to be agile enough to accommodate multiple formats with one facility (or truck). The industry needs an approach that protects investments by using technologies that enable flexibility and scalability.

Standards-Based IP

Using standards-based IP interconnects and an accompanying distributed architecture is a technological solution to a very real business problem — the ability to react to the changing requirements of the production marketplace. A distributed architecture similar to the core/aggregation/edge approach pioneered in the IT data center world allows for straightforward expansion and augmentation of broadcast facilities. This type of implementation meets the needs of today and tomorrow using well tested and proven methodologies.

Today's 10 GigE IP technology provides the bandwidth required for a broadcast interconnect and allows for a common physical interconnect to provide transport for a varied array of data stream types. Previous technologies have attempted to accomplish this in a serial topology (SDTI), but IP offers a much more extensible solution for meeting the needs of the future. The IT industry demonstrated the superior potential for migrations and augmentations as the Ethernet market progressed from 10 to 100 Mb to 1 Gb to 10 Gb. By using a standard encapsulation such as RFC 4175, the medium and the stream can be decoupled and either simultaneously or separately transitioned to the next capability.

Standards-based IP makes this approach valuable beyond 10 Gb. The economies of the individual interfaces continue to improve, and certainly 10 GigE is not the end of the road. Common IT approaches to aggregation allow for easy interconnection of zones with varying physical network speeds and incremental improvement and upgrade as required. As the industry moves towards 2160p120 or 8K UHD, the same recommended system design can continue to scale as higher speed interfaces become available to the market.

The broadcast industry can help itself by quickly adopting a common standard to use as a long-term, IP-based replacement for the long-standing video interface, SDI.

ROI / Flexibility

Any implementation developed today should provide the flexibility for all contributors in the production chain — including acquisition (cameras), graphics, replay operations, switching and effects, audio, processing and transmission — to easily join streams, combine components of streams and provide those produced streams back into the system with efficiency. In addition, the signal format should not be tied to a physical wire.

In today's production market, particularly in OB trucks, the potential for building a system that allows for easy reconfiguration and deployment for HD/3G/4K UHD or HFR sources is attractive. Being able to pull a truck up to an event and know that the infrastructure is capable of supporting any production format through software configuration, without moving any interconnects, could mean the difference between maximizing the utilization of a mobile asset and losing out on revenue due to time required to reconfigure from event to event.

Customers do not want dedicated wiring based on the type of traffic. In addition, some devices that provide, produce or manipulate live video streams in a production environment no longer rely on a dedicated "video" interface but instead use only standard 10 GigE. Many anticipate their future IP infrastructures can and should accommodate a mixture of traffic via Quality of Service (QoS).

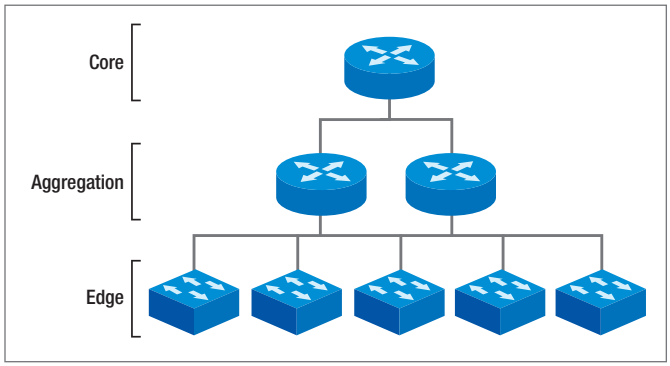

Figure 1. Distributed architecture.

By utilizing standard methods of encapsulation — such as RFC 4175 for RTP — and allowing for multiple raster formats, frame rates and more to be carried in the same way, the concept of one wire for all signals can be achieved. The promise of using a single physical interface type for 4K UHD, or for HFR HD/3G content is well at hand. Utilizing standard methods of transport that allow for easy separation of video, audio, and metadata essence means that all potential users of these streams can be assured their needs are met.

Distributed Architecture

Data centers pioneered the distributed IP architecture model, creating a topology where groups of processing devices or servers are managed through a top-of-rack switch. Switches are then aggregated to provide system-wide access across the enterprise.

Using a similar model for OB trucks — particularly trucks with multiformat requirements — can provide many of the same benefits, including: scalability, options for redundancy and ease of migration, or addition of future services or capabilities. Furthermore, in many cases, by leveraging the pace of development of commercial-off-the-shelf (COTS) IP switching for the core and aggregation layers of a distributed broadcast IP fabric, broadcast-centric devices can concentrate innovation at the edge to address our industry's specific I/O and processing requirements.

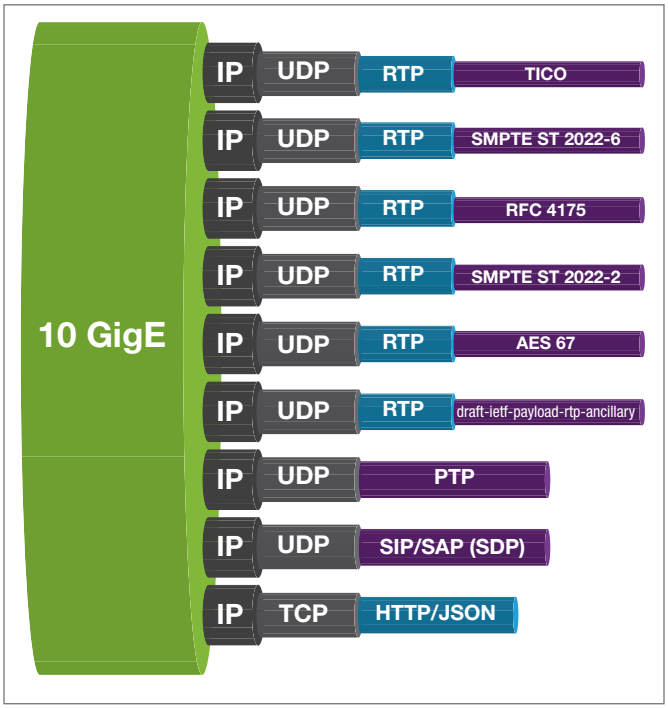

Figure 2. Flexible standards-based transport.

In the past, some have been reticent to use common IT interfaces for real-time video interconnects and/or transmission. The use of IT and IP technologies is widespread across many industries which require as high or higher reliability than the broadcast industry. Technologies such as virtual router redundancy protocol (VRRP), virtual routing and forwarding (VRF), and intelligent resilient framework (IRF) provide highly reliable systems, as well as highly sophisticated system architectures resulting from years of development. These technologies also can be leveraged in the broadcast market once IP is adopted as a core technology.

A Cautionary Tale

Until the mid-1800s, locomotives were a novelty item, impractical in the face of the low-cost alternative of waterway travel and shipping by packet boat. Initially, trains were used for short-distance passenger travel and were a luxury experience. The carriages tended to be open with plenty of standing room, and people put on their finery for the unprecedented experience.

The building of the actual rail line was often something that happened long before an engine and train were obtained. By 1860, seven different track gauges were in common use in the United States. In 1862, Congress specified the rail gauge for the transcontinental railroad, but it took almost 30 years for that standard to be fully adopted. With the standardization of the rails, locomotives became a major force in transportation of people and goods of all classes and became pivotal in the westward expansion of the United States.

In Erie's Railroad War, miles of track were destroyed, bridges were burned, one man was shot and several more were beaten. Ringleaders were sent to prison and fines and penalties were imposed as the citizens of Erie, PA fought to protect their lucrative business of transferring goods and people who were forced to stop in Erie by the change in railroad gauge.

No one wants to be remembered as the last holdout to the promise of moving into an interoperable, IP-connected video environment. The migration to IP as a replacement for SDI has started across the broadcast industry. The notion of requiring conversion across competing solutions is a speed bump in the way of progress for the industry at large. The consequences for delays in the development of a clear standard are not as dire as they were during the birth of the US railroad, but they certainly threaten the industry's ability to stay competitive with the growing number of options available for consumers.

Conclusion

IP-based connectivity, when combined with extensible protocols, allows for fast implementation of new signal types without changing the transmission mechanism. With continuous innovation from broadcast manufacturers, additional functionality such as low latency, programmable processing and vertically accurate switching can be added to the scalability, flexibility and fault tolerance afforded by this new IP core. By embracing open standards, the industry can be assured of a common, ubiquitous set of protocols for broadcast and media companies to transition from SDI to IP. When combined with a distributed architecture, production facilities are easily extended to meet the fast-changing requirements of today's broadcast production market.

In addition to benefits in the market overall, the ability for a single system (or truck) to accommodate multiple production types, with practically no downtime beyond a software configuration change, would provide broadcasters with two big advantages — enhanced revenue-generating capabilities from taking on additional jobs and reduced operational costs from not having to change over a system.

The demand to deploy a multiformat, flexible OB truck is upon us. A standards-based IP interconnected infrastructure utilizing a distributed architecture can pave the way to meeting that requirement and allowing for those formats to come as the industry continues to progress.