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IP Studio Infrastructure intended for Modern Production and TV broadcasting Facilities

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Abstract

In the TV broadcasting, movie production and business the transportation of video between creators (programmers, studios) and distributors (broadcast and cable networks, cable and satellites companies) is still a mix of File Transfer Protocol (FTP), physical delivery, and expensive multicast satellite. Cloud-based file sync-and-share providers like Dropbox and box are playing an increasing role, but the industry's unique demands for speed and multicasting have fueled the growth of IP Video transport. This paper gives a solid grasp of the major elements of IP video technology, including content preparation, system architecture alternatives and network performance management.

Keywords: *SDI Technology, Broadcasting facilities, IP Technology, Gateways*

1. Introduction

IP video delivery is a viable and reliable method of transmission, although it suffers constraints in terms of bandwidth and multicasting. Video-specific solutions like those from Aspera, Signiant, and Brevity are recommended for many content companies because they plug into existing workflows, save time and money, and are easy to use[1]. Existing workflows that use tape systems are still prevalent in the industry so the transition to IP delivery will not happen overnight. IP Video transport needs to include better support for workflows, transcoding, storage, and live ingest and transport, the speed of traditional video production and broadcast television technology, however has not kept up with the accelerated network speeds and bandwidth [1], [2]. Although the speed of traditional broadcast technology lags behind that of IP technology, the need to manage an increasing amount of content continues in the broadcast word for example; multiple format, video-on-demand, OTT, etc. As the market jockeys to identify the best way to accommodate viewer tastes. Higher quality content (HD. 4K, and beyond) requires more horsepower to distribute through and between broadcast plants [3].

2. IP Trends in video production technology and TV broadcasting

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Internet Protocol (IP) is the principal communication protocol in the internet protocol suite for relaying datagrams across network boundaries. Its routing function enables internetworking, and essentially establishes the internet. IP has the main task of delivering packets form the source host to the destination host solely based on the IP addresses in the packet headers [4]. For this purpose, IP defines packets structures that encapsulate the data to be delivered. It also defines addressing methods that are used to label the datagram with source and destination information.

2.1. The use of IP Technology in production and TV broadcasting facilities

In the long term the current Serial Digital Interface (SDI) standards simply do not provide an affordable and sustainable solution. IP technology is the solution to remain efficient and satisfy demand. Broadcasters will need to choose the technology that has already demonstrated its ability to support the bandwidth that video production and broadcasting facilities require. The rate at which IP technology covers more and more content is simply impossible to ignore. Adopting IP technology in production and broadcasting facilities empowers and improve broadcasters with scalable flexibility and speed.

3. IP Video for broadcasting technology

For IP video for broadcast engineers, delivering video signals over IP networks is rapidly revolutionizing all aspects of the broadcast business, starting at the camera and reaching all the way to viewer's homes and mobile devices. Many new standards, including ATSC 3.0, 4K/UHD and beyond are being built to leverage the tremendous cost and scale advantages of IP technology [4], [5].

IP technology is adopting the two largest open standard in the word such as Ethernet and Internet Protocol, into an environment that has traditionally been based on SDI technology. It is about exploiting a rich ecosystem of third party products to build a content factory that is agile and competitive. IP technology for production and broadcasting is summarized into four main key points:

- ✓ **Gateways: S**imply, gateways are converters between signal types and signal transport protocols. Gateway products provide a solution for those looking to make an incremental transition [5]. Rather than require gateways for every SDI signal, providing them as options in both routers and modular products enables the change for signals, islands, studios, facilities or any other combination. In the real world of television operations moving to IP will be a gradual translation. So protecting operational method and installed equipment is essential because the cost of new equipment and changes in workflows may be avoided.

- ✓ **Software Defined Network (SDK) integrated control:** SDN capability into plant configuration and control systems protects asset. A properly configured SDN- based control surface can access either crossbars or packet switches through a comfortable, user-friendly and intuitive interface

- ✓ **IP product line support**: Without a complete ecosystem full IP integration is not possible. Applying the IP technology across the entire broadcast workflow facilitates a move to IP and allows latency and switching accuracy to be effectively managed to provide optimal video processing [6].

4. IP based for live video production technology

IP routers and switches are indeed very fast and offer low latency for large number of signals. However, vertically accurate switching is required, and the most cost-effective method to manage the simultaneous routing is required, and the most cost effective method to manage the simultaneous routing of hundreds of mutually related signals is not source flows or multicast [7]. Because achieving accurate switching is challenging when accounting for both flows and SDI simultaneously. Ideally, this should be achieved without gateways on every signal and without two core fabrics; one for IP and another one for SDI.

Camera, router, server, signal, signal processing, production switcher, and multi-viewer: This is the workflow chain that enables live production and is the engine that drives broadcast. Many plant operations do not require a vertically accurate switch, but for live production this requirement is an essential piece of the system design. So, this is a critical factor to consider when discussing a major technology change in one of the most critical workflow segments a broadcaster has to manage.

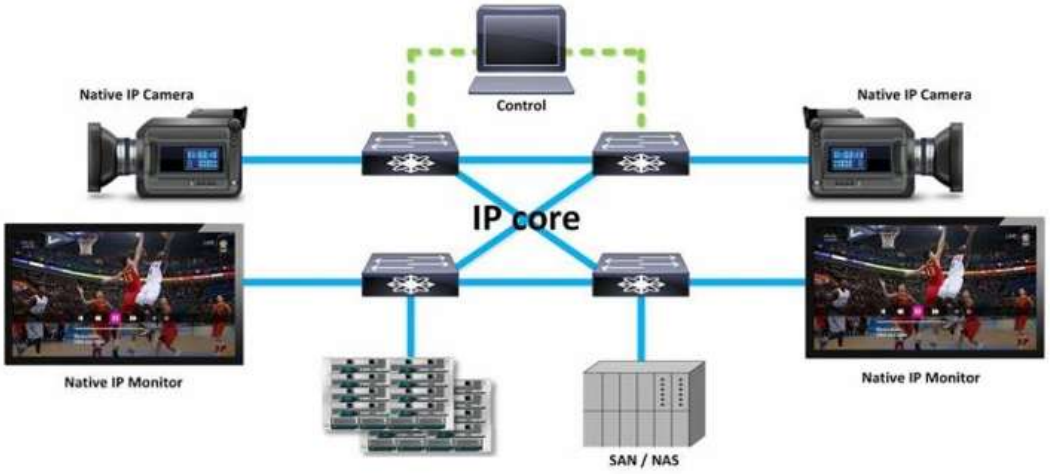

Figure 1.End-to-End IP environment [7]

For Modern production and TV broadcasting facilities the end–to-End IP environment provides multiple advantages including; efficient routing, link aggregation, multiple distribution and time synchronization. In this case once the signals that can be carried as high bit-rate IP traffic, for modernized production and TV broadcasting facilities can take advantage of wide range of existing, standardized IP mechanisms to optimize media transport.

As the new technology is advancing fast like; Ultra High definition (UHD) video (4K and 8K). To support these enormous demanding services with IP studio infrastructure for modern production and TV broadcasting facilities, it is one of a stopgap as looking for a better solution.

4.1 IP based modern production studio and TV broadcasting infrastructure

IP switch topologies use a leaf and spine connection scheme (also known as one-to-one connected mesh). This is required for non-blocking switch capability. Connecting many 10Gbps fibers in this scheme can be time consuming and physically challenging to manage. To overcome this issue there is a solution called an optical inter-connect or OIC. The OIC uses an optical shuffle to physically remap the 10 Gbps signals into a more logical structure in which multiple fibers go to the same physical location.

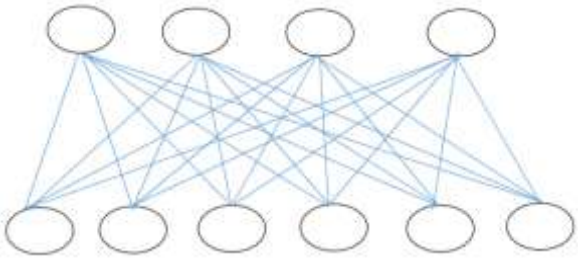

Figure 2. One-to-one connected mesh

Single fiber 10Gbps links form the structured interconnect at the demarcation point. In this case the advantages of OIC is that a signal tap can be generated at the shuffle. The optical tap provides non-invasive signal interrogation for debugging and troubleshooting the structured fiber interconnect [9].

5. Modern studio infrastructure model

Consequently, the use of Ethernet/IP technology is beginning to move the studio from a format/ hardware-centered approach toward a network/software-centered one. It is something that gets the job done simply and reliably, but also makes the studio ready to move into a future that will require more than video- and audio-signal processing. It means a unique link to convey multiple video and audio signals, control and programmed-associated data.

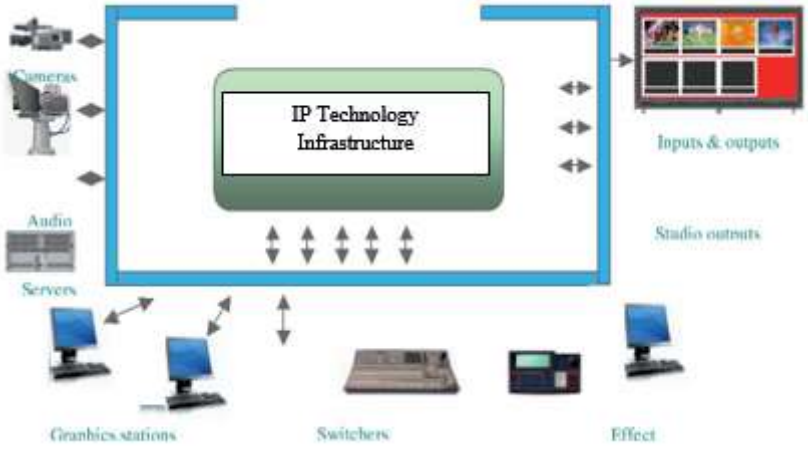

Figure 3. IP Technology Based studio infrastructure [8]

5.1 Advantages of modern studio infrastructure

For the Business case there are multiple advantages when considering IP technology for broadcast, but none is more compelling than agility. The operational advantages of IP technology simply offer better return on investment. For the technical case, broadcast television operations are the factories that drive the medium and IP technology improves employee productivity. Going forward, IP technology will change the production of the video. IP data transport provides away to move media from point to point and enables carriage of additional time-varying data related to the media itself [6].

6. Conclusion

As other advancements in television technology, the dawn of IP studio infrastructures will no doubt be

refined and expanded in the coming years. However, the benefits are real today and will serve systems well for the foreseeable future.

6. Acknowledgement

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