

Proposal for IP-Based Transformation of Broadcast Studios in an All-Media Environment (Post-print)

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Date: 2023-10-08T00:00:00+00:00

Abstract

In the all-media environment, the collision between traditional media and new media has induced varying degrees of transformation in the media industry during the new era. As a representative of traditional media, television—confronted with the impact and challenges posed by new media—must inevitably pursue IP-based studio transformation. The extensive application of big data technology and cloud computing technology can assist television media in breaking free from conventional frameworks, thereby fostering a favorable development space for its sustainable growth. This paper analyzes IP-based studio transformation within the all-media environment and proposes reasonable measures grounded in practical realities.

Full Text

Conceptualizing IP-based Transformation of Studios in the All-Media Environment

Abstract: In today's all-media environment, the collision between traditional and new media has precipitated varying degrees of transformation across the media industry. As the representative of traditional media, television must inevitably pursue IP-based studio transformation to address the impact and challenges posed by new media. Through extensive application of big data and cloud computing technologies, television media can break free from previous constraints and create favorable conditions for sustainable development. This paper analyzes IP-based studio transformation in the all-media environment and proposes practical measures grounded in actual conditions.

Keywords: All-media environment; IP-based transformation; studio

CLC Number: TN948.12

Document Code: A

Article ID: 1671-0134(2018)08-070-02

DOI: 10.19483/j.cnki.11-4653/n.2018.08.025

With the rapid development of Internet technology, converged media has become the mainstream trend in broadcast television development. In particular, the application of big data technology and cloud computing platforms assists television stations in establishing core platforms that lay the foundation for future development. In the all-media environment, IP-based transformation facilitates deep integration between broadcast television technology and Internet technology, enhances studio informatization levels, and promotes sustainable development of broadcast media. Strengthening research on conceptualizing IP-based studio transformation in the all-media environment and proposing reasonable measures for practice can provide support for subsequent related work.

1. Conceptual Framework for Studio IP-based Transformation

Facing the impact and challenges from new media, broadcast television has undergone varying degrees of transformation and change. Especially with the widespread application of Internet and mobile network technologies, utilizing these technologies for television program production, broadcasting, and services can effectively deliver higher-quality media services to users and enhance competitive advantages. In accordance with all-media development requirements, operations should be supported by advanced technologies, particularly in studio system IP-based transformation. On SDN networks, unified scheduling and management of data flows can be achieved, making program production more flexible and facilitating subsequent studio equipment maintenance and management. SD signals are carried and transmitted from 1.5G to 12G, with currently widely adopted Ethernet rates at 10GbE. Single-link network signals cannot carry 12G-SDI signals.

4. System Composition of Studio IP-based Transformation

For 4K ultra-high-definition signal transmission using SDI interfaces, there are three primary implementation methods: First, the conventional approach splits 4 sub-images into four 3Gbps data streams, generating four corresponding 3G-SDI signals, though this transmission method is relatively complex. Second, compressing 12G data into a single 3G-SDI signal for transmission via high-definition video cables, which requires substantial data compression workload. Third, using a 12G-SDI interface to transmit uncompressed original video, though 12G-SDI transmission rates are extremely high. While transmitting 4K signals via video cables is feasible, it complicates studio system architecture.

In summary, IP-based transformation of studios in the all-media environment offers greater advantages compared to traditional SDI signal transmission. With

advanced technical support for high-quality signal transmission, the goal of converged media can be achieved, thereby enhancing the competitive advantage of broadcast television media and pursuing sustainable development in the all-media environment. IP-based architecture for signal transmission can effectively resolve these issues, offering more prominent advantages over traditional SDI technology with its format-agnostic characteristics. SDI has evolved from 270M to 1.5G and 3G, with transmission methods and formats continuously upgrading and optimizing. Through IP-based transformation, signals are encapsulated and transmitted in IP packet form, making signal formats and system expansion more flexible, facilitating connection to production system public platforms, enabling efficient signal sharing and transmission, and achieving unified monitoring of access devices. Therefore, IP-based transformation has gradually gained widespread acceptance in 4K ultra-high-definition television infrastructure, using fiber interfaces to replace BNC interfaces and IP switches to replace SDI baseband matrices. To effectively address these challenges, extensive equipment installation with IP interfaces establishes 4K ultra-high-definition video systems on IP-based infrastructure.

In the development of studio system IP-based transformation, recording equipment is gradually becoming tapeless and file-based. With the popularization of high-definition television programs, studios primarily adopt P2 recorders and hard disk recorders. Hard disk recorders offer diverse recording formats that can effectively resolve incompatibility issues between recording equipment formats and post-production formats. Regarding hard disk recorders, on PC platforms, built-in network interfaces compatible with TCP/IP network transmission protocols streamline material transmission processes and substantially improve work efficiency and quality. P2 recorders feature convenient operation, simplicity, and low recording error rates, and are widely used in studio program recording due to their unique advantages.

Based on the SMPTE standard system, SDI signals are transmitted in IP networks through RTP packets. After encapsulation, audio and video formats can be widely applied in broadcast television to meet the needs of real-time content exchange networks, including wide area networks and local area networks. SMPTE standards redefine network timing synchronization mechanisms, replicating Gen Lock functionality in IP networks to achieve synchronous transmission and synchronization locking. In SD systems, accessing synchronization signals enables synchronous transmission and picture switching, whereas IP system architecture can achieve synchronization signal transmission without dedicated cables. Switcher system equipment supports IP input and output, enabling simultaneous transmission and processing of SDI and IP signals. The IP-based architecture reform of television studio systems primarily employs universal IP switches, connecting IP interfaces with switches to form unified protocols.

Studio IP-based transformation is an inevitable choice, offering the advantage of abundant network bandwidth. As systems transition from high-definition to ultra-high-definition, data volume increases eightfold.

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Source: ChinaXiv — Machine translation. Verify with original.