On the Application of 4K Technology in Television Practice (Postprint)

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

Abstract

With the continuous innovation and development of digital broadcasting and television technology, digital television has completed the transition from standard definition to 4K technology. For next-generation 4K technology televisions to achieve playback-practice integration, they must rely on the Internet to optimize and improve the playback-practice system. This paper analyzes and studies the design and implementation of playback-practice integration for 4K technology televisions.

Full Text

Preamble

Title: On the Application of 4K Technology in Television Practice

Abstract: With the continuous innovation and development of digital broadcasting technology, digital television has completed the transition from standard definition to 4K technology. For the new generation of 4K television to achieve integrated broadcast practice, it must rely on the Internet to optimize and improve the broadcast practice system. This paper discusses the design and implementation of 4K television broadcast practice integration.

Keywords: 4K technology television; live integration; system structure

Classification: TN948.13

Document Code: A

Article ID: 1671-0134(2018)11-069-02

DOI: 10.19483/j.cnki.11-4653/n.2018.11.016

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The emergence of 4K technology has brought higher quality audio-visual experiences to audiences and has garnered widespread attention in the television industry. Currently, countries worldwide are dedicated to constructing and perfecting the basic standard system for 4K television technology, while simultaneously intensifying research and development efforts. Integrated broadcast practice for 4K television has become a particularly popular research direction.

1. Application Characteristics of 4K Technology in Television Practice

The primary information transmission medium is optical fiber, which offers strong anti-interference capabilities and large information capacity during transmission. However, this technology requires fiber optic cabling and is constrained by geographical environments. The application of 4K technology effectively addresses these issues, and its high flexibility and efficiency have made it favored by television stations.

2. Research on Application Methods of 4K Technology in Television Practice

Research on the application methods of 4K technology in television practice can be summarized into three main aspects: providing superior audio-visual experiences, substantially enhanced clarity, and improved technical indicators. The specific research content can be summarized as follows.

1.1 4K Technology Television Provides Superior Audio-Visual Experiences

Compared with traditional analog television, 4K technology television has achieved breakthrough improvements in color richness, detail perfection, and clarity, delivering dual visual and auditory experiences to audiences. Furthermore, viewers can adjust the aspect ratio and screen width of 4K television according to their preferences.

1.2 Substantial Enhancement in Clarity

To date, China has essentially established and perfected standards for cable television digital transmission and satellite television digital transmission, but has not yet formulated unified standards for terrestrial television digital transmission.

1.3 Improvement in Technical Indicators

In traditional television production, display quality and information capacity of television signals are typically determined by technical parameters such as field frequency, scanning method, aspect ratio, and line frequency. In contrast,

4K technology television employs a technical format where multiple standards coexist, allowing the selection of appropriate standards based on actual requirements in different scenarios. Compared with standard-definition television, the advantage of 4K technology television lies in its high bit rate; storage of large data volumes and high bit rate signals are prerequisites for implementing 4K technology television.

Satellite transmission technology primarily processes video and audio content collected at news gathering sites through satellite acquisition systems, transmits it to satellites synchronized with the information, and then relays it to television stations via satellite. This technology requires high costs and involves complex operations.

Research on the application methods of 4K technology in television practice can be summarized into four aspects: the structural composition of 4K technology television live integration network systems, security analysis of 4K technology television broadcast practice integration network systems, interconnection technology for 4K technology television broadcast practice integration network systems, and networked workflow analysis of 4K technology television broadcast practice integration network systems. The specific research content can be summarized as follows.

2.1 Structural Composition of 4K Technology Television Live Integration Network System

Generally, the 4K technology television broadcast practice integration network system comprises four components: the basic network system, business support system, main business system, and other business systems. Among these, the basic network system and business support system constitute the fundamental architecture of the 4K technology television broadcast practice integration network system and serve as the foundation for establishing frontline business systems. The business support system defines various specifications and standards for business operations while providing support for interconnection among various business subsystems, enabling coordination among different business and management processes in the 4K technology television live integration network system. Simultaneously, both the basic network system and business support system are indispensable components in the system's core data exchange process. The former functions by providing data exchange channels for the construction between business systems, while the latter manages and schedules the entire data exchange process between business systems. Figure 1 [Figure 1: see original paper] illustrates the specific architecture of the 4K technology television broadcast practice integration network system.

The basic network system platform's functions in the 4K technology television broadcast practice integration network system are primarily divided into two parts: data transmission and information communication. It can provide stable and efficient routing support and network access for different business subsys-

tems based on their actual requirements. The business support system platform serves as the interconnection and management hub for the 4K technology television broadcast practice integration network system, defining and implementing system information and interface protocols. The main business system can be subdivided into multiple systems including news, non-news programs, advertising, and media resource management. Other business systems refer to support systems for business operations outside the main business scope.

2.2 Security Analysis of 4K Technology Television Broadcast Practice Integration Network System

Security and stability are the fundamental guarantees for the performance of 4K technology television broadcast practice integration network systems. To ensure system security and stability, several approaches can be adopted: First, construct a database system that combines centralized and distributed architectures with local and remote backups, ensuring normal database operation through multi-level storage and periodic management to provide robust security for the 4K technology television broadcast practice integration network system. Second, build a scientific operation platform based on dual-host technology, enabling timely host switching in case of failures to ensure uninterrupted business operations. Third, upgrade and transform critical system modules to add redundancy functions, promoting full performance of storage and switching equipment. Finally, introduce load balancing technology into the basic network to expand link transmission bandwidth and improve transmission reliability. Simultaneously, adopt link backup by reserving redundant links in the network to provide buffer capacity when failures occur.

2.3 Interconnection Technology for 4K Technology Television Broadcast Practice Integration Network System

During the operation of 4K technology television broadcast practice integration network systems, system interconnectivity primarily includes two aspects: first, data exchange among various subsystems within the system; second, interaction between the broadcast practice integration system and other technical systems. [3] To ensure the stability of these two types of connectivity, combined with the specific requirements of 4K technology television, the following interfaces can be established: interfaces between the 4K technology television broadcast practice integration network system and video/audio systems; interfaces among various business subsystems within the broadcast practice integration network system; interfaces between the broadcast practice integration network system and office systems; interfaces between the broadcast practice integration network system and extended business systems; interfaces between the broadcast practice integration network system and external station systems.

2.4 Networked Workflow of 4K Technology Television Broadcast Practice Integration Network System

Typically, the networked workflow of 4K technology television broadcast practice integration network systems can be divided into four chronological parts: planning and shooting, program production, program preparation for broadcast, and broadcasting. The entire process requires support from data management, and the scope of media asset management is extensive. Program preparation for broadcast and data management are integral components, among which planning and shooting serves as the starting point of the entire networked workflow and holds significant importance.

During program production, substantial amounts of material are required, typically sourced from field shooting, ingesting, and acquisition. Additionally, before program broadcasting, strict review must be conducted, with comprehensive inspection of broadcast materials according to the broadcast playlist to ensure quality. During the broadcasting phase, the sequence of the program playlist must be strictly followed.

Through analysis of 4K network advantages, thorough investigation and understanding of relevant equipment in the market has been conducted. During equipment selection, choices should be made based on market equipment types and the actual needs of television stations. The television station adopted a horizontal evaluation method and systematic assessment for the selection and development of 4K backpacks. After continuous screening, testing, and validation, the LiveU 4K interview-specific backpack produced in Israel was ultimately selected. This backpack features exceptional anti-interference capabilities, effectively coping with harsh environments and ensuring video signal transmission quality is not affected by environmental conditions.

With the continuous development of science and technology in China, mobile Internet technology has matured and been widely applied across various fields, particularly in radio and television. Based on network transmission, the application of 4K technology has significantly improved video transmission quality and efficiency compared to previous video transmission effects. This article primarily discusses the application of 4K network-based video transmission in television stations, combined with case analysis, hoping that through 4K technology application, video transmission effects will become more secure and reliable. In summary, in the era of 4K technology television, integrated broadcast practice has become mainstream. To achieve this goal, it is necessary to integrate various aspects of television production and broadcasting, construct a broadcast practice integration network system, and establish unified management platforms and rational production methods, thereby promoting the sustainable development of 4K technology television.

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Note: Figure translations are in progress. See original paper for figures.