Overview of the Comprehensive High-Definition Upgrade and Network Transformation at Xunyang County Radio and Television Station (Postprint)

Authors: Liu Qingzhi

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

Abstract

This article summarizes the basic principles, overall planning, construction methods, and safety management that should be followed in the process of constructing the broadcast capability enhancement project at Xunyang Radio and Television Station. Proceeding from practical realities and taking the digitalization, networking, and high-definition of acquisition-editing-broadcasting, as well as media convergence development, as its core, the project comprehensively enhances broadcast capability construction and achieves high-definition and network integration upgrade and transformation.

Full Text

A Comprehensive Review of Full HD Construction and Network Upgrade for Xunyang County Radio and Television Station

Abstract: This paper summarizes the fundamental principles, overall planning, implementation methods, and security management practices that Xunyang County Radio and Television Station followed during its production and broadcasting capacity enhancement project. Grounded in practical realities and centered on digitization, networking, high-definition transformation, and media convergence development of production and broadcasting processes, the station comprehensively upgraded its production and broadcasting capabilities to achieve integrated HD and network infrastructure modernization.

Keywords: Production and broadcasting system; mutual backup; 10 Gigabit network; whole-station network; media asset management; network security

4.2 Construction of HD and Ultra-HD Editing Workstations

The U-EDIT broadcast-grade non-linear editing system integrates advanced contemporary technologies, offering powerful functionality, stable performance, and excellent compatibility. For this upgrade project, the Zhongguang Shangyang series non-linear editing systems were selected. The existing U-EDIT100UHD and U-EDIT1000 HD digital non-linear editing systems were upgraded, and five new sets of ultra-HD digital non-linear editing systems were deployed—the Shangyang UHD U-EDIT700UHD and U-EDIT3000UHD—along with an HD virtual studio system. Through 10 Gigabit switches, these components form an interconnected HD and 4K editing workstation network capable of HDMI 4K/HD/SD signal input and output. The U-EDIT non-linear editing software features a new open interactive architecture, with optimized workflows that fully satisfy applications from SD to HD while providing future expansion potential. With broadcast-quality video and audio processing technology, advanced design concepts, a powerful 3D subtitle animation creation system, and practical audio processing modules, the system enables flexible operation and unlimited creative possibilities for peak content creation.

4.3 Construction of a Safe and Stable HD/SD Synchronized Broadcasting System

The HD transformation of the hard disk broadcasting and transmission systems marks the final milestone in the station' s full HD upgrade. However, since many viewers still use SD TV set-top boxes and some programs remain in SD format, a transition period is necessary before complete HD broadcasting can be implemented. To ensure normal program reception during this transition, the station deployed a dual mutual-backup broadcasting and transmission system comprising two Shangyang iChannel M6 broadcasting systems, PBI DMM-210 four-in-one HD encoders, Shangyang SY-1005-A-HD digital switchers, Huawei modems, Shangyang MV5 multi-viewers, and TVZ3100II time calibrators.

As the core equipment of the broadcasting system, hard disk broadcasting systems were selected based on technical performance, functional characteristics, and security stability. The iChannel system is an HD/SD digital broadcasting solution for small and medium-sized TV stations, featuring an integrated broadcast control workstation and video server. Its core advantages include highly stable broadcast servers, high-performance RedBridge video/audio and Cutelink series boards supporting ultra-HD 4K HDMI and 3G/HD/SD/SDI signal outputs, software-based encoders for simple upgrades and strong scalability, embedded functions such as clocks, station logos, and subtitles, and distributed storage structure for material file management with secondary storage support. The system allows flexible deployment of program upload and playlist editing workstations according to the station' s production and scheduling requirements.

The system features the following key characteristics:

4.3.1 HD/SD Mixed Broadcasting During HD transformation, TV stations face the challenge of coexisting SD and HD materials. The iChannel broadcast server enables flexible aspect ratio conversion for source materials with diverse formats, aspect ratios, and resolutions, adapting to channel broadcast requirements automatically to minimize program preparation costs. The system supports mixed use of HD and SD materials with adaptive up/down conversion and customizable aspect ratio transformation methods. With built-in HD/SD compatible boards, users can seamlessly upgrade from SD to HD broadcasting without replacing the broadcast server.

4.3.2 Complete System Redundancy The backup system monitors the primary server status in real time and can automatically control the switcher to transition to the backup signal when problems occur, ensuring broadcast signal safety during server failures. The database server, as a critical backend support service, supports primary-backup database mirroring. When the primary database fails, all device nodes in the system immediately connect to the backup database source to ensure normal business operations. When the primary database recovers, the broadcasting system can automatically reconnect to the primary database source. To avoid single-point failures, the broadcast switcher, which serves as a crucial signal hub, can also be deployed as a primary-backup switcher system.

4.3.3 Automatic Material Classification and Ingestion The iChannel software can designate any file directory on the network for monitoring. When materials are copied to the designated directory, they are automatically recognized and imported into the broadcasting system. Imported materials are not limited by non-linear editing brand, facilitating seamless interconnectivity.

4.3.4 Seamless Cross-Network Interconnection with Peripheral Systems Based on the whole-station network interconnectivity design concept, the system enables one-click resource interaction across networks with core peripheral systems such as non-linear editing and media asset management. After broadcasting, materials can be returned to the media asset system for management. This enhances operational experience while ensuring efficient, stable, and secure data transmission.

4.3.5 Automatic Broadcast Recovery Traditional broadcast operators are responsible not only for broadcast control but also for post-failure recovery operations. The system implements automatic broadcast recovery through technologies such as power-on auto-start and synchronized playback.

4.3.6 Intelligent Material Technical Review Strategy for Security Material security is a critical prerequisite for broadcast safety. The system ensures codec information compliance through legality detection during material

ingest. During import, the software automatically performs material legality detection according to preset system parameters, automatically transcoding non-compliant or improperly formatted materials before import, thereby guaranteeing broadcast security from the source.

This efficient and stable broadcasting system effectively satisfies the high-quality, safe, and synchronized broadcasting needs of the station' s two HD/SD channels.

4.4 Construction of a Scientific and Standardized Material Management Storage System

In the information age, media competition is exceptionally intense, and content requires effective management. Only through robust content asset management can media organizations stand out in competition. The Media Asset Management (MAM) system is a content management platform developed for digital TV, mobile TV, and multimedia content distribution services. It provides comprehensive management of digitized storage, cataloging, retrieval, and equipment assets for various video materials, audio materials, text, images, and other media assets. The station selected the Tehong TH-MAM media asset management system with disk arrays for material management and storage. A new 128T APT 016E5-G10 network storage system was added, featuring a fully modular, cable-free design and embedded ZFS file system to ensure stable operation and high data security. Additionally, an existing 64T array was upgraded and integrated to form a 192T storage system jointly responsible for audio-visual material storage and management. The system performs automatic daily backups of database content, enabling database recovery in case of data loss, system reinstallation, or initial system trials, ensuring long-term storage and standardized management of the station' s video assets. The storage system can also be upgraded and expanded according to development needs. The purpose of establishing the media asset system is to create a comprehensive system that preserves and manages these valuable materials for maximum utilization, creating both economic and social benefits.

4.5 Construction of an Efficient 10 Gigabit Whole-Station Network System

After implementing HD acquisition, editing, and broadcasting, data transmission volumes increased significantly, rendering Gigabit network speeds insufficient for development needs. In this construction project, the station planned ahead and redesigned the infrastructure, with the media asset storage management system as the core. Dual-mode dual-port 10 Gigabit fiber network cards were installed on equipment in the news department, feature department, new media department, advertising department, studio, non-linear editing systems, broadcasting systems, and program review systems, along with deployment of 10 Gigabit 24-core fiber optic cable lines. Three Huawei 10 Gigabit switches with 48 10Gbps/s SFP fiber interfaces (30 optical modules each) were used to establish a whole-station 10 Gigabit network platform connecting departmen-

tal acquisition systems, editing systems, program upload and broadcasting systems, program review systems, virtual studio production systems, and media asset storage management systems. This network optimizes production processes across all stages including material acquisition, program production, program review, data storage, content distribution, and program broadcasting. It enables the most effective resource integration and most refined process management through interconnectivity, information sharing, and resource sharing, achieving digitization, networking, and workflow integration from program production to broadcasting and storage. The network satisfies whole-station interconnectivity requirements, facilitates resource sharing between new media (mobile TV) and traditional media, enables converged media content products, and achieves a substantive leap in integrated convergence.

4.6 Construction of a Secure and Reliable Network Protection System

Network security protection system construction is critical for TV stations. To prevent unpredictable illegal access to internal network resources or potentially destructive intrusions, the station implemented multiple security measures. First, the iGate6 file gateway was deployed to isolate the external network from the internal network, creating a secure channel for data interaction between the office external network and the internal production and broadcasting network. The iGate6 file gateway effectively safeguards data transmission between different network segments through security measures including whitelist file format filtering, format detection, logical isolation, traffic management, behavior management, firewall protection, and log auditing. Second, internal management was strengthened by strictly prohibiting the use of mobile USB drives on internal network devices and deploying a dedicated management server for internal network virus protection. These measures effectively ensure the security of the entire network and stable operation of equipment.

With the rapid development of radio and television technology, audience demands for picture quality continue to increase. To meet the requirements of the times, county-level TV stations should seize opportunities, actively seek support, enhance production and broadcasting capacity, fully achieve HD, digital, and network transformation, and realize the functions of one-time acquisition, multi-format production, and multi-platform distribution. This lays a solid foundation for county-level converged media center construction and effectively enhances the communication capacity, guidance, influence, and credibility of grassroots stations [1].

References: [1] Wang Haifeng. Discussion on HD Upgrade of County-level Radio and Television Station Production and Broadcasting Networks [J]. Electronic Production, 2017(09).

(Author affiliation: Xunyang County Radio and Television Station, Ankang City, Shaanxi Province)