Design of an All-Media Convergence Production and Broadcasting System Postprint

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Abstract

According to business development requirements, an all-media convergence production and broadcasting system shall be designed to integrate with the existing Tianchi cloud platform, leveraging the capabilities of the converged media platform to supplement and enhance metropolitan channel operations.

Full Text

Design of an All-Media Convergence Production and Broadcasting System

Abstract: Based on business development requirements, an all-media convergence production and broadcasting system was designed to integrate with the existing Tianchi Cloud platform, leveraging the capabilities of the converged media platform to supplement and improve the business operations of the Urban Channel.

Keywords: All-media; Convergence production and broadcasting; Convergence aggregation; Convergence production

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As the Urban Channel' s business develops, the existing production system can no longer meet operational requirements. The channel urgently needs to achieve integrated high-definition production and broadcasting to enhance program production capabilities. Simultaneously, to adapt to new program formats, the existing studio production system must be expanded to enable both live and

recorded broadcasting capabilities while fully integrating the system' s historical data and operational conventions.

1.1 Security and Stability

In this system design, security and stability are of paramount importance. The security of critical business data within the network and the overall network architecture must be guaranteed. Infrastructure components such as storage and databases, as well as the network architecture, should all feature secure and stable backup solutions to ensure the safety of news program production and broadcasting. Equipment selection prioritizes products with high standards, quality, and performance stability, along with excellent environmental performance and electromagnetic interference resistance.

1.2 Advancement

The system fully considers current advanced AV, IT, IP, and network technologies while accommodating future technological trends, employing advanced technologies to construct both business and management networks. While ensuring security, it maximizes the openness of information source ports and satisfies integrated high-definition and standard-definition news acquisition, editing, and broadcasting workflows, thereby achieving efficient, high-quality, high-caliber, and high-definition news production.

1.3 Efficiency

Timeliness is a distinctive characteristic of news, demanding high levels of material sharing, multi-channel information acquisition, and production efficiency. By thoroughly analyzing business models, optimizing system interaction workflows, and utilizing advanced network technologies, the system achieves the goal of improving production efficiency.

1.4 Compatibility

This system is designed according to the principle of "high-definition primary, standard-definition compatible," meeting the demands of large-scale high-definition program production and broadcasting while enabling non-linear editing stations to support mixed HD/SD editing capabilities.

1.5 Scalability

This design scheme fully considers scalability requirements, reserving capacity in core equipment and links to facilitate smooth transitions when expanding business scale in the future. Simultaneously, system software can be upgraded and improved as needed by our station while ensuring production and broadcasting safety.

2.1 System Architecture

The production and broadcasting system designed in this project expands upon the existing Urban Channel News Network to implement a high-definition integrated news production and broadcasting network serving Urban Channel operations. It includes modules for material upload/download, archive preservation, script editing, audio/video production, content review, studio broadcasting, and convergence production. Currently, our station has established the Tianchi Cloud converged media platform at the new site, achieving unified cloud support, convergence aggregation, convergence production, and convergence publishing capabilities. Following the station' s unified technical roadmap and to reduce construction costs while enriching business experiences, this designed production and broadcasting system integrates with the Tianchi Cloud platform via a 10-gigabit dedicated line to enable converged production capabilities.

2.2 Production and Broadcasting Workflow

News programs typically feature short production cycles, high timeliness, and strong workflow characteristics, with special requirements for security and stability. The network system in this solution can construct application systems suitable for various needs based on practical application characteristics, scale, and workflow, meeting the production and broadcasting requirements of various news information programs including political news, sports news, and financial news. The typical production and broadcasting workflow includes: topic selection, material acquisition, program upload, script writing, review, program editing and production, final review, broadcasting, and internet publishing.

2.3 System Functions

The script module uniformly plans the acquisition, editing, and broadcasting workflow for news programs according to their business characteristics. The designed script management system can effectively handle workflow relationships among news scripts, news materials, edited news programs, and broadcast rundowns, significantly improving news program production and broadcasting efficiency. The broadcast rundown integrates with studio broadcasting system scheduling and control. The script system achieves seamless connection with news production and studio systems through embedded software access, enabling unified management and application of script and program information.

The fine-editing workstation serves as the primary production site for program editing and production, featuring both video processing and general audio processing capabilities. The review workstation conducts review of final edited programs and can also review various text elements including rundowns, lyrics, subtitles, titles, and leads. Programs passing review can be automatically imported into the studio for broadcasting according to strategy, while rejected programs can be re-edited at the fine-editing workstation based on review comments. The dubbing workstation handles program dubbing tasks, featuring

direct audio marking, preview, and frame-by-frame editing capabilities. After dubbing completion, the dubbed materials can be directly placed on the timeline for editing and saved to the archive upon completion. It supports multi-track audio editing and clipping, multi-channel audio input/output, frame-accurate audio adjustment, and independent dubbing material management modules.

Program synthesis software is responsible for backend program generation, featuring intelligent grid synthesis capabilities, supporting EDL-based synthesis and synthesis of programs into specified formats. It includes cluster rendering, intelligent segmentation, and EDL synthesis functions, and supports EDL combination of synthesized segments with non-generated segments.

The studio broadcasting module comprises primary and backup broadcasting servers, primary and backup broadcasting workstations, and primary and backup full-function video servers. The high-definition broadcasting server supports four broadcasting channels with dual-node mutual backup, capable of providing cross hot-backup between primary and backup channels and supporting functions such as broadcasting while migrating. It employs a dedicated media file system to ensure uninterrupted broadcasting and no data loss even when two or more hard disks fail. The full-function video server utilizes a specialized file system with high-security data protection capabilities, integrating multiple functions including acquisition, editing, broadcasting, storage, and migration into a single HD video server. It provides program re-acquisition, mark editing, emergency broadcasting, and other functions, enabling studio live signal recording, studio signal re-acquisition, highlight reel production, and studio large-screen broadcasting. In primary-backup mode, media files are only migrated to the primary server, which automatically synchronizes materials to the backup server. All channels within the server operate in parallel and independently, featuring real-time video processing capabilities and supporting functions such as recording while broadcasting, recording while editing, and local playlist broadcasting.

The broadcasting control workstation controls the HD broadcasting server to enable flexible program regulation and operation. It supports local mode and primary-backup cross-control mode, automatically preparing the next program according to the rundown for sequential broadcasting. It supports rich button and control information, broadcasting adjustment functions, and cooperates with broadcast control for rundown broadcasting. During broadcasting, it can preview upcoming programs, modify in/out points, adjust broadcast duration, and provide countdown alarm functions. It supports seamless back-to-back broadcasting of two rundowns. Using MOS and FTP protocols for external communication, it meets studio business process requirements and can handle various mechanisms including external migration, internal migration, internal mutual migration, internal deletion, repeated program migration, and program migration failure.

Studio Migration Service employs a background cluster migration mode with unified scheduling to effectively ensure broadcasting safety and enable push

delivery of finished programs to various studios. It supports virtual machine deployment on the station' s existing IaaS platform. Embedded with broadcasting server file system plugins, it can migrate files via API interfaces into the broadcasting server' s local AMFS file system in the server' s dedicated data format.

The network management module is an important component of news business system management, responsible for internal network scheduling and management. It uniformly manages user information, permissions, and password data, and supports column version management. For editorial convenience, it employs a clear tree structure and prevents errors through coding uniqueness verification.

Data inheritance is a key consideration as this project is designed as an upgrade and expansion system for uninterrupted program production. To ensure safe production and broadcasting of important live programs, the system upgrade will achieve rapid and smooth switching with complete historical data inheritance. The transition is safe and swift, allowing tight integration with the original system without requiring modifications to business stations. All core data is fully inherited, including current system material files, timeline project files, script information, subtitle template information, cataloging data, user information, and user operation habit information. It features convenient non-linear editing parameter management capabilities, supporting customized editing strategies by column and space allocation by user.

2.4 Converged Production and Broadcasting Capability Design

As an extended subsystem of the new Tianchi Cloud platform, this system is required to leverage its own integrated production and broadcasting capabilities while utilizing the platform' s advanced architecture and support capabilities to enhance overall business efficiency, creating converged media production and broadcasting capabilities across aggregation, production, and publishing stages.

2.4.1 Converged Aggregation The new Tianchi Cloud platform uses the converged media content library as its core resource pool, aggregating diverse resources and providing multi-format retrieval services. The newly designed system can share aggregated resources from various sources through the Tianchi Cloud platform, not only directly retrieving and utilizing the platform' s vast resources to support television production but also feeding content back to the platform' s content library for other users' convenience. Non-linear editing software can directly call Tianchi Cloud platform content library resources onto the timeline for editing. The system enables two-way automated interaction: scripts and materials from the Tianchi Cloud platform can be automatically assigned as topics within this system for use as scripts and materials; finished programs and scripts within this system can also be automatically pushed to the Tianchi Cloud platform according to its specifications after review for internet publishing and station-wide sharing.

The system can access resources from the following sources:

(1) Signal Recording: Acquisition and recording of signals from CCTV, various satellite channels, and Jilin local channels.

(2) Cloud Clue Service: Enables internet content aggregation, including news clue sources from mainstream websites, forums, Weibo, and other channels, providing capabilities for targeted screening and selection of news clues.

(3) PGC (Professional Generated Content) Return: Journalists can remotely upload images, videos, and other materials into the archive through a mobile APP.

(4) Affiliate Return: Materials returned through professional return tools.

(5) In-house System Integration: Enables integration with the station' s HD news network, Public News Channel news network, and production network systems to achieve content···

2.4.2 Converged Production This system construction requires the implementation of two-way converged production capabilities: On one hand, it must support content production through lightweight editing tools accessed via the Tianchi Cloud platform portal; on the other hand, it must enable professional production tools within the Urban Channel News Network to directly use Tianchi Cloud platform materials on the timeline for editing, with finished programs automatically aggregated back to the Tianchi Cloud platform. Integration with the Tianchi Cloud platform enables common editorial functions including online script writing, video simple editing, H5 editing, and WeChat and Weibo editing.

2.4.3 Converged Publishing This system design requires that content completed through production can be pushed to the Urban Channel News Network for refined processing and studio broadcasting, or directly pushed to new media platforms for internet publishing.

The new media publishing channels that can be implemented are as follows:

Internet Publishing: Enables simple and fast publishing operations through a unified page on the convergence platform; simultaneously, to achieve manageable and controllable external distribution, a review process for external publishing content has been added, ensuring complete usage logging.

New Media Center: Materials edited in the Tianchi Cloud content library are connected to the New Media Center through standard interfaces, using either "material file + XML" or "material file" formats for delivery to various New Media Center systems···

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