Exploring Integrated Media Broadcasting Applications for Traditional Channels: Technical Implementation of Nanjing Broadcasting Group' s Intelligent Media Two-Way Integrated Broadcasting Platform (Postprint)

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Abstract

To accelerate its media convergence transformation and development, Nanjing Radio and Television Group has actively pursued innovative exploration into new forms of video production and distribution, establishing an all-platform, dual-screen (large and small) intelligent media convergence broadcasting platform that targets not only mobile terminals but also large-screen outlets including channel terminals, smart TV terminals, IPTV terminals, and outdoor large-screen terminals. This paper primarily introduces the platform' s project background, system architecture, technical innovations, and key features.

Full Text

Preamble

Title: Exploration of Traditional Channel Media Convergence Broadcasting Applications—Technical Implementation of Nanjing Broadcasting Group' s Intelligent Media Dual-Screen Integration Platform

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Abstract: To accelerate media convergence transformation and development, Nanjing Broadcasting Television Group has actively explored innovative forms of video production and distribution, building an intelligent media dual-screen integration platform that serves not only mobile terminals but also large-screen outlets including broadcast channels, smart TVs, IPTV, and outdoor displays.

This paper primarily introduces the project' s background, system architecture, technical innovations, and key features.

Keywords: dual-screen integration; media convergence; 5G; MCN; technical implementation

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The intelligent media dual-screen integration platform enables synchronous reverse integration of mobile content into traditional broadcast channels. Through the deployment of a streaming matrix, it incorporates remote 5G city slow-live signals, mobile live streams, and user interaction data into the convergence platform, achieving low-cost time slot filling. This transforms the traditional shoot-record-broadcast model by integrating event live streaming, MCN broadcasts, slow-live streams, streaming matrix network feeds, and bullet-screen interactions, creating a novel 5-in dual-screen integration experience (online, on-site, on-air, with users, with commerce). "Live Nanjing" leverages the large screen' s spatial advantages to display multiple signals simultaneously, providing audiences with more useful information at once.

1. Application Modes

The platform currently operates in two primary modes:

1.1 City Live Mode

In early 2020, against the backdrop of deepening media convergence reform and concurrent with adjustments to traditional professional TV channels, Nanjing Broadcasting Group sought to achieve better channel resource integration by synchronously presenting MCN live content on television channels, thereby realizing two-way integration between online and TV broadcasting. The initial design established the dual-screen integration system as an MCN signal dispatch center that would process signals from MCN live rooms and push them to the group' s new media broadcast control center for television transmission, while simultaneously distributing signals to the group' s mobile client, media convergence news command center, and integrated production studios to achieve multi-channel aggregation and distribution of MCN products. As the project evolved, the system underwent continuous upgrades and iterations, incorporating slow-live streaming, user mobile live streaming, and event broadcasting

functions, resulting in richer signal sources and more comprehensive platform capabilities.

City live mode also employs a "news live + scenic slow-live + real-time audience interaction" approach to enhance news broadcast stickiness. [Figure 1: see original paper] illustrates the city slow-live mode, while [Figure 2: see original paper] shows the news live mode.

1.2 MCN Live Mode

See [Figure 3: see original paper] for the MCN live mode diagram.

2. System Architecture

The "Nanjing Broadcasting Group Intelligent Media Dual-Screen Integration Platform" comprises a streaming media signal aggregation system, switcher, integration broadcast system, aggregation and audit system, material management system, network system, and broadcast channels. Current signal sources include two MCN live room signals, nearly 20 city landmark slow-live signals from locations such as Nanjing's Confucius Temple, Toutuoling, Beige Pavilion, and Gulou Square, and two matrix signals from the media convergence broadcast control center. The system also supports simultaneous access to multiple mobile field signals. [Figure 4: see original paper] shows the project system diagram, [Figure 5: see original paper] the actual implementation, and [Figure 6: see original paper] the workstation layout.

2.1 Streaming Media Signal Aggregation System

This system consists of a streaming matrix and front-end signal sources, accessing both self-built landmark camera signals across the city from "Live Nanjing" and various urban camera signals provided by Nanjing Big Data Bureau. The self-built system has deployed nearly 20 HD cameras at city landmarks via 5G and fiber optic connections, with plans to exceed 100 points this year.

2.2 Switcher

The core comprises two 4K switchers in mutual backup configuration, supporting 40 channels of 12G-SDI input and 24 channels of 12G-SDI output with format conversion for all inputs, enabling scheduling of various aggregated signal sources and seamless switching between live streaming program sources.

2.3 Integration Broadcast System

Employing multiple integrated broadcast workstations with full redundancy consideration, the system ensures resource sharing and long-duration interoperability, guaranteeing network pull-stream, push-stream, production, and switching capabilities. It can load primary packaging subtitle information for program content packaging and supports virtual systems and modeling for virtual scenery

and virtual anchor programs. Additionally, an independent three-dimensional interactive information packaging system handles real-time loading of titles, bullet screens, corner logos, 3D transitions, crawls, multi-windows, and channel previews.

2.4 Internet Aggregation and Audit System

The system simultaneously supports large and small screen interaction across multiple platform programs and different public accounts/Apps, enabling display of text, emoticons, images, and short videos. It interfaces with WeChat public platform backends and App backends to obtain corresponding data. The system supports a three-level audit mechanism, whitelist/blacklist functionality, sensitive word filtering, and dangerous content library processing.

2.5 Material Management System

Equipped with large-capacity storage for rapid import and preservation of video files, the system plays materials through video players while supporting video list scheduling to ensure local material DDR playback with network sharing and interoperability.

2.6 Network System

The network employs optical-electrical conversion and gigabit switches to form a local area network, connecting over 30 network cameras to the production system. Direct network pull-streaming ensures latency within one second, with audio input through camera lines. Picture and audio from different rooms can be synchronously switched and selected, supporting remote PTZ control for convenient composition adjustment. [Figure 7: see original paper] shows the dual-screen integration platform network system diagram.

2.7 Broadcast Channel

The final program signal is output to the broadcast machine room via a keyer switcher overlaying graphic packaging machine sources, combined with slow-live signals and other network signals to provide broadcast signals for channels and outdoor displays. The integration broadcast system' s IP push-stream signals are available for "NiuKa Video" and other network platforms for live streaming, enabling multi-directional interaction among multiple MCN live points and different anchors through dual-screen linkage. The large-screen broadcast end facilitates bullet-screen message interaction, topic discussion, product purchase, and activity participation through QR code scanning, HTML5, Apps, public accounts, mini-programs, and other interactive methods to increase program diversity.

3. Technical Innovations and Features

The "Nanjing Broadcasting Group Intelligent Media Dual-Screen Integration Platform" incorporates numerous technical innovations:

Mobile new media business and production can feed back to traditional TV large-screen terminals through the intelligent media dual-screen integration platform, enabling synchronous service of small-screen new media content production to HD channels and 4K outdoor large-screen production, achieving better dual-screen terminal integration and utilization of broadcasting new media content.

The platform aggregates real-time internet big data, interactive bullet screens, and real-time packaging signals through multi-window, multi-dimensional convergence presentation, broadcasting over 7$×$16 hours of uninterrupted multi-backup HD program integration in different forms, locations, times, and platforms across TV channels and various network platforms.

The three major technical platforms—the citywide 5G slow-live video platform, broadcast-grade city live broadcast dual-screen integration middle platform, and streaming media video data intelligent detection system—operate synergistically in a 4D+ dual-screen integration form (4D: four dimensions including citywide multi-point slow-live and network broadcasting, online short videos, audience bullet-screen graphic interaction, web-side interactive posters and applications; plus cloud platform).

The SRT cloud video aggregation system enables convergence of multiple mobile sources using the latest SRT protocol and audio blanking technology, achieving multi-point, multi-camera, multi-directional interactive live streaming including video, audio, communication, TALLY, and return video signals.

The platform implements intelligent processing of interactive data (text, images, short videos) to enable real-time bullet-screen audit, automatic alarming, information filtering, and real-time updates for TV live channels. The application of interactive user databases and bullet-screen databases enables cloud storage of bullet screens and expansion of TV audience userization applications.

Intelligent virtual anchor platform applications are realized through server-side stream access, enabling intelligent interoperability with the dual-screen integration platform.

4. Application Cases

Since its establishment, the "Nanjing Broadcasting Intelligent Media Dual-Screen Integration Platform" has satisfied at least 14 hours of daily broadcasting across TV, mobile terminals, and large screens, with hundreds of daily bullet-screen interactions. Through large-scale events such as live broadcasting of the "Forest Concert" and "Double Eleven Live Broadcast," the novel multimedia broadcast format has received widespread acclaim, significantly enhancing event impact and providing new perspectives for channel large-scale activities.

The platform' s flexible, low-cost access and broadcast model has revitalized traditional broadcasting channel resources, achieving online-offline interaction for TV channels and creating new business opportunities.

On September 28, 2020, "Live Nanjing"city live broadcast was officially launched, representing an active exploration step on Nanjing Broadcasting Group' s path of all-media convergence development. Leveraging 5G's high bandwidth and low latency transmission capabilities, the platform integrates large and small screens to achieve 4K-5G Live HD real-time large-screen multi-source interactive live broadcasting. Through MCN live e-commerce presentation on TV terminals, multi-channel promotion of various activities, and comprehensive display of city slow-live streams, "Live Nanjing" has gained considerable influence among Nanjing citizens. The group has achieved both social and economic benefits through channel transformation.

Case Study: Zhongshan Mausoleum "Forest Concert" Live Broadcast

During the 2020 National Day holiday, Nanjing Broadcasting Group held four consecutive evening open-air concerts at the Zhongshan Mausoleum Music Terrace. To support concert promotion, "Live Nanjing" used slow-live streaming during daytime hours at the Zhongshan Mausoleum scenic area for city promotion, including scenic slow-live streams, landmark introductions, on-site tourist interviews, and tourist-perspective connection live streaming. During slow-live broadcasts, QR code guidance and crawl prompts were used to attract audiences to learn about the evening concerts, achieving excellent preheating and 引流 (traffic diversion) effects.

When the concert began, the platform employed multi-window, multi-angle live streaming to present the concert scene, comprehensively displaying panoramic views, musician close-ups, and audience reactions, enabling TV viewers to fully experience the concert' s atmosphere. The platform maximized screen space by setting up a "Concert Guide QR Code" through which TV viewers could scan to obtain real-time information about the performed music, including introductions to pieces, composers, and movements. A "Mobile Client Interface" was also established, allowing TV viewers to quickly access the mobile App' s concert special page for more information and real-time interaction. Through comprehensive promotion and live presentation, the four-day concert achieved complete success, enriching citizens' holiday lives while attracting 客流 (visitor traffic) to the Zhongshan Mausoleum scenic area, receiving high praise from municipal government leaders.

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