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Analysis of Converged Media Live Streaming Platform Construction and Interactive Technology Application Postprint

Authors: Sun Dongfang, Liu Deshuang, Xu Chunfang

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Abstract

As media convergence accelerates, mobile live streaming has become the primary method in converged media news reporting. This paper begins with the development of converged media communication platforms, discusses how to construct a converged media communication technology platform within traditional studio environments, elaborates on the integration of converged media live streaming and interactive systems, and aims to contribute to relevant research.

Full Text

Preamble

Analysis of the Construction of Converged Media Live Streaming Platforms and the Application of Interactive Technology

Sun Dongfang[1], Liu Deshuang[2], Xu Chunfang[3]
(1. Bozhou Radio and Television Station, Bozhou, Anhui 236800, China; 2. Suzhou District Converged Media Center, Jiuquan, Gansu 735000, China; 3. Yunhe County Converged Media Center, Lishui, Zhejiang 323600, China)

Abstract: As media convergence accelerates, mobile live streaming has become the primary method in converged media news reporting. This paper begins with the development of converged media communication platforms, discusses how to construct converged media communication technology platforms in traditional studio environments, and elaborates on the integration of converged media live streaming and interactive systems, hoping to provide assistance for related research.

Keywords: converged media; live streaming platform; interactive technology; live interaction; visual communication

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China' s media sector is currently undergoing significant and profound transformation. With support from cloud computing, big data, and other technologies, the excavation of media content data and user service data has enhanced television program production quality, further satisfying audience viewing demands and improving the market competitiveness of broadcasting organizations. The combination of interactive production and signal sources, under their mutual promotion, facilitates the integration of multiple technologies in converged media studios, including unified management of SDI signals/IP signals and the design of diverse interactive modes. This enables hybrid scheduling of both signal types under the converged media switcher. Furthermore, to achieve multi-channel live program broadcasting, converged media studios have established multi-channel streaming signals, with network live streaming encompassing several single-point PGG mobile live signals and multi-site PGM signals, blurring the structural boundaries between signal sources and making interaction the primary characteristic of new media broadcasting. This achieves comprehensive coverage of studio broadcast venues, fully utilizes production sites, and satisfies users' multi-dimensional viewing needs on mobile terminals, thereby enhancing the audience viewing experience.

1. Development of Converged Media Communication Platforms

In today' s landscape of intermedia convergence, new media live streaming has attracted substantial attention through its novelty and interactivity, demonstrating tremendous development potential with information technology support. Multi-platform integration has also driven the transformation of traditional media toward converged media, making the combination of converged media live streaming and interactive technology a driver of new media business. China' s broadcasting industry is currently shifting away from traditional, singular program acquisition, editing, and transmission methods toward integrated business processes and creating multi-screen program broadcasting models. For instance, CCTV's program recording process requires support from a comprehensive program studio information interaction system, which manages the entire station' s comprehensive program studio cluster. While this interactive platform enriches program production interaction models, traditional studio cluster construction cannot fully meet the requirements of all-media network live streaming, necessitating architectural design on traditional video systems.[1]

In recent years, with the development of broadcasting technology and the advancement of media convergence, mobile client applications have increased and expanded their coverage, leading to rapid growth in demand for new media network live streaming. Against this backdrop, various television channels and programs have successively conducted live broadcasts through all-media platforms, not only ensuring strong program ratings but also expanding the new media network live streaming user base through diversified methods. Therefore, to utilize network live streaming technology under the premise of interactive technology application, we must analyze it from a comprehensive hardware perspective, encompassing converged media switching and streaming components to enable flexible switching of studio visuals.[2]

2. Approaches to Constructing Converged Media Communication Technology Platforms in Studio Environments

Currently, CCTV has added converged media live streaming and interaction to its comprehensive program studio cluster system. The final stage of this entire process involves repeated application of new media technology to achieve deep integration between television and network media, enabling high-quality program broadcasting on both television and new media terminals. Converged media studio live streaming interactive systems are realized through the integration of internet and broadcasting production technologies, such as on-site studio interaction with online users and the implementation of interaction between users' mobile screens and television large screens.

2.1 Converged Media Live Streaming Switching Subsystem

In addition to the studio's application system modules, the converged media live streaming switching subsystem also has its own local area network, achieving interconnectivity with SDI signals and traditional studios. The converged media live streaming switching subsystem supports both SDI signals and IP signals, and is compatible with UDP, RTP, RTMP, and HTTP protocols during transmission to meet the needs of both pulling and pushing streams. Furthermore, by recording from the system studio, all live streaming signals are assigned IP addresses, allowing audiences to interact with studio hosts through live interfaces on mobile phones or computers. Simultaneously, live messages sent by netizens can be received in the studio, enabling two-way interaction that increases studio popularity, enhances program attention and interaction volume, and strengthens the connection between broadcasting organizations and users with the support of new media technology. Meanwhile, it is necessary to expand studio interaction scenarios and achieve multi-angle live streaming, which also requires technical implementation.

As the core component of the working system, the converged media live streaming switching subsystem combines streaming media signals and SDI signals based on the traditional studio management system. This technological im-

provement avoids the need for extensive encoder deployment. Specifically: First, preliminary deployment is carried out using VMC1 and Tricaster460 input modules, which provide multi-channel stream pulling capabilities and multi-channel SDI input/output, enabling mixed switching of SDI signals and IP signals. Second, SDI signals and synchronization signals connect to the studio's audio-visual system in the studio environment.

Graphics packaging signals are compatible, with mainstream graphics packaging servers capable of independently outputting packaging signals to large screen equipment, or connecting to the converged media switcher through other means to input rendered packaging content into the converged media switching system. Additionally, PGM signals with real-time interactive data can be transmitted to traditional studios or to CCTV' s new media integrated publishing platform for new media terminal information release in the network live streaming environment.[3]

Streaming equipment requires support from encoding and transcoding devices, specifically the RM9010-HD-SDI model, which supports 8 channels of HD-SDI and SDI input. With this technical support, studio camera signals and PGM signals are sent to CCTV's new media integrated publishing platform, providing tremendous convenience for network live streaming. This process uses coaxial cable patch panels to synchronize studio audio-visual and signal systems, and after connecting to the television station' s network layer, creates a lightweight system for streaming signal fusion production. This system ensures security under the premise of an independent converged media live streaming switching subsystem without affecting the original studio system, allowing normal program broadcasting from the studio. Furthermore, to enhance system scalability, sufficient space must be reserved at equipment interfaces and racks.

2.2 Converged Media Information Interaction Subsystem

The converged media information interaction subsystem matches the converged media live streaming switching subsystem, with interaction servers and virtual machines as its core components. The software platform on interaction servers can capture data such as visitor numbers, comments, and bullet chats. For example, users on live streaming platforms like Tencent, Douyin, and Kuaishou can participate in current programs using mobile phones, becoming interactive audience members in the live room. After backend review, they can share their viewpoints, and other online viewers can access the nicknames and avatars of commenting audience members. Additionally, the acquired data transitions through an isolation zone of the filtering subnet and is ferried into the studio system, where it is displayed on large screen rendering equipment and online packaging servers, enabling multi-platform interaction of data in the network live streaming terminal of the converged media switching system.

During the statistics and release of interactive information, big data computing is required to analyze information obtained from new media terminals, includ-

ing user location information, comment information, topic discussion scope, and topic popularity. First, big data includes online user numbers, voting information, and messages, which can be displayed on television screens to show interaction counts, as well as the geographic distribution, numbers, and age structure of viewing and interacting users, satisfying users' sense of participation in the all-media platform. Second, in the real-time scrolling message section, user comments are analyzed and replied to, and after screening, the comment content is displayed in the topic discussion area to form an incentive mechanism.[4]

For instance, during the guest liking segment, users can like comments based on their content through mobile phones. After presentation on the television screen, this allows the program to gauge audience evaluations of guests and also enhances guests' initiative in speaking, thereby improving overall program quality.[5]

3. Application of Converged Media Live Streaming and Interactive Systems

3.1 Integration of Live Streaming and Interaction

As network signals and coverage improve, the number of video live streaming platforms is also increasing annually. The real-time interactive technology brought by the internet offers numerous advantages, such as setting discussion hotspots during video live streaming and attracting attention through bullet chats and ranking lists. The television industry has developed professionalism over many years that ensures video quality, but traditional studios are constrained by regional factors during live streaming, which is not conducive to broader user participation in program scenes and affects program creative space. Converged media satisfies people's needs for watching television programs through multiple channels, thereby enhancing program influence. This includes services for television audiences such as voting, commenting, and surveys, as well as program live streaming, on-demand viewing, voting, and commenting.[6]

Informatized studios connect studios with internet data, allowing data transmission to studios and interfacing with studio large screen packaging systems and in-studio interaction systems. Users open interaction entrances during live streaming, enabling converged media live streaming traffic entry. Therefore, in current television program live streaming processes, live interaction is typically treated as a tool to effectively combine the advantages of traditional media and establish a broader user base.[7]

3.2 Application of Converged Media Live Streaming Interactive Technology in Program Production

3.2.1 "Global Chinese Music Chart" CCTV Music Channel's "Global Chinese Music Chart" is a weekly program that integrates interactive comment sections based on program requirements and production design, including weekly

singer chart voting, interactive logic design, program preview article editing, and coordination with live streaming segments. The program also established official Weibo and WeChat public platforms where audiences can participate in voting and topic discussions upon entering the page. For example, after WeChat authorization and information filling, users can participate in live program discussions after review, select singers they support, and have audience geographic information displayed on screens in map form.

In the program studio' s network live streaming system, main and backup lines each have four channels of signal sources, including PGM main and backup director room fixed positions, makeup room fixed positions, and mobile live streaming positions. The studio network live streaming system' s main and backup switcher PGM is an external signal to the studio. The studio network live streaming system sends PGM, switcher PGM, and IP streaming signals to the integrated transmission platform, which then distributes them to new media terminals for network live streaming through content distribution networks. This allows users to freely select interesting video streams on mobile terminals and watch studio live streaming through H5 interactive pages, commenting based on chart singers and live streaming progress.

The converged media live streaming interactive system' s Tricaster460 and VMC IN can mix SDI and IP streaming signals. The graphics packaging server connected to the interactive system can obtain real-time data embedded in packaging templates and output them to the studio large screen. The RM9016-HDSDI encoding and transcoding server primarily implements streaming to the new media integrated publishing platform.[8]

3.2.2 "Hotline 12" CCTV Society and Law Channel' s "Hotline 12" program broadcasts daily. The program' s "Special Program for China Charity Day" and "International Anti-Drug Day Special Program" are simultaneously live-streamed online. CCTV' s mobile client and multiple network broadcasting platforms fully utilize multi-platform convergence advantages to obtain user comment information from new media terminals and feed it back to the studio program scene. Similar to the "Global Chinese Music Chart" program' s live streaming subsystem, it also uses Tricaster460 and VMC IN to mix SDI and IP streaming signals, with encoder servers primarily implementing streaming to the new media integrated publishing platform.

3.3.1 Scene Reconstruction and Visual Communication

Under the converged media background, CCTV News Channel has created the "CCTV News+" client, conducting nearly 10 news live streams daily. The news scene entry uses geographic location markers on maps, followed by digital analysis of news hotspots, enabling switching between large and small screens. Different scenes can also be exchanged and reconstructed through mobile interchanges, thereby enriching scenes, such as presenting studios and news scenes, extending live streaming to social interaction, interaction, and applications. For exam-

ple, "Cloud Road on the Sky" live-streamed the power engineering construction in Tibet, synchronously returning signals from 4,000-meter altitudes. During the live stream, a converged media interactive studio area was set up to present more news background to audiences. In the user interaction segment, journalists interacted through comments and bullet chats.

Furthermore, the combination of users' mobile social networks and news live streaming forms socialized communication, further expanding influence. For instance, during the live stream of the Jiuzhaigou earthquake in Sichuan, simultaneous television and network live streaming presented the People' s Liberation Army' s rescue scene, attracting 1.34 million viewers and likes, with real-time comments exceeding 1,000. New media studio construction primarily targets mobile user terminals, allowing interaction with users during program live streaming. After interviews by journalists and simultaneous explanations by experts, high-quality UGC venues are formed. Additionally, CCTV' s cooperation with WeChat, Weibo, and other platforms with dual media and social attributes can generate multiple rounds of communication, allowing everyone to participate in news events and enhancing CCTV News' influence under the socialized communication model.[9]

3.3.2 Personalized Settings and Immersive Services

CCTV News Media attaches great importance to the service functions of mobile terminal products, emphasizing personalized applications that facilitate users' autonomous search and viewing of programs on mobile terminals. With powerful functions, personalized page settings are implemented to further enhance viewing and browsing quality. In terms of product function development, WeChat public accounts and Weibo can regularly push information and also provide sections for food search, train ticket booking, and hotel inquiry. CCTV' s news network platform is not only a news distribution center but also a service platform for real-time television program viewing, featuring a live streaming window where users can independently subscribe to video content and make program appointments. Additionally, with the powerful digital processing capabilities of network media, users' search records can be stored, after which big data pushes similar news information based on user preferences, saving users' search time. Users autonomously select playback methods and content, enhancing browsing experience.[10]

In summary, current studio program converged media live streaming has been applied in multiple CCTV programs. With the integration of new media technology architecture, support can be provided for media convergence development. As network live streaming and online interaction become more deeply integrated, not only is overall program quality improved and audience viewing needs satisfied, but the influence of converged media communication is further enhanced, promoting the healthy development of China' s media industry.

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Author Biographies

Sun Dongfang (1986-), male, from Bozhou, Anhui, Engineer, research direction: Broadcasting Engineering.
Liu Deshuang (1971-), male, from Jiuquan, Gansu, Engineer, research direction: Broadcasting Television Technology.
Xu Chunfang (1980-), male, from Yunhe, Zhejiang, Engineer, research direction: Broadcasting Television Engineering Technology.

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

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