

# Application of Broadcast Television Multimedia Technology in a Computer Network Environment: An Exploratory Analysis

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**Abstract:** Against the backdrop of the digital wave, computer network technology has become deeply integrated with broadcast television multimedia technology, breaking through traditional communication barriers and driving the industry's transformation from "one-way" to "two-way" transmission and from "single" to "diversified" development. Taking the computer network environment as the research context, this paper explores the application paths of broadcast television multimedia technology. It elaborates on the technical foundations supporting integration and the evolution of communication models, analyzes the application of multimedia technology in content production, transmission and distribution, and user interaction, and summarizes the technical and practical challenges while proposing corresponding optimization strategies. Typical cases, such as the CCTV Spring Festival Gala and Mango TV, are examined to verify the effectiveness of technological integration. The study indicates that the integration of computer networks and broadcast television multimedia technology is an inevitable trend for the industry's high-quality development, as it can enhance communication efficiency and quality while meeting users' increasingly diverse needs.

**Keywords:** Computer networks; broadcast television; multimedia technology

## Introduction

With the rapid development of Internet technology, digitalization and networking have become the core directions of industrial transformation. As a key carrier of traditional media, the broadcast television industry is confronted with both the impact of emerging new media and the internal demand for self-upgrading. The widespread application of computer network technology provides

essential support for the innovative use of broadcast television multimedia technology, promoting deep integration between the two and giving rise to new communication models and service forms. Focusing on the application of broadcast television multimedia technology in a computer network environment, this paper aims to help the industry overcome development bottlenecks and achieve digital and intelligent transformation.



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# 1. Foundations for the Integration of Computer Networks and Broadcast Television Technology

## 1.1 Key Technical Support

The deep integration of computer networks and broadcast television relies on the coordinated support of multiple core technologies. High-speed network transmission technology constitutes the fundamental prerequisite for integration. The widespread adoption of 5G technology and the comprehensive coverage of optical fiber networks provide high data rates, low latency, and large-capacity transmission capabilities. These advances effectively address issues inherent in traditional broadcast television transmission, such as video stuttering, blurred audio quality, and slow content loading, while efficiently supporting the delivery of high-definition and ultra-high-definition video and audio content to meet users' demands for high-quality audiovisual experiences. Multimedia encoding and decoding technology serves as the core technical support for integration. Advanced encoding standards such as H.265 and AV1 significantly reduce data volume through efficient compression algorithms while maintaining audiovisual quality. This not only alleviates network transmission pressure but also improves content storage efficiency, thereby providing technical assurance for large-scale content dissemination. Cloud computing and big data technologies further inject intelligence into the integration process. Cloud computing offers elastic computing and storage resources to support centralized content processing and distributed delivery, while big data technologies analyze user behavior data to accurately identify demand preferences. This enables optimization of content creation and personalized recommendation services, driving the evolution of broadcast television technology toward greater intelligence and precision.

## 1.2 Evolution of Integrated Communication Models

Computer network technology has driven the evolution of integrated communication models in broadcast television through three distinct stages. In the initial stage of "traditional media + Internet," communication was predominantly one-way, with broadcast television content simply migrated to online platforms, such as online playback of television programs and network live streaming of radio broadcasts. User participation

was limited, and integration remained superficial. In the intermediate stage of "Internet + traditional media," the industry proactively adapted to network characteristics by introducing new formats such as short videos, online live streaming, and on-demand services. Communication models shifted toward two-way interaction, allowing users to engage with media through features such as real-time comments (danmu) and voting participation. However, content production and distribution were still largely media-driven<sup>[1]</sup>. In the current stage of "full media convergence," supported by technologies such as 5G, virtual reality (VR), and artificial intelligence, a communication landscape characterized by "multi-terminal coverage, multi-scenario penetration, and full-time service" has emerged. This stage achieves a comprehensive digital reconstruction of the entire process of content production, transmission and distribution, and user services. The resulting communication model is flexible and efficient, capable of accurately matching users' personalized needs, and propels the broadcast television industry into a new phase of intelligent and scenario-based development.

# 2. Specific Applications of Multimedia Technology in Broadcast Television

## 2.1 Content Production and Editing

The application of multimedia technology in broadcast television content production and editing has broken through the limitations of traditional models, significantly improving creative efficiency and quality while enriching expressive forms. In the content creation stage, multimedia technology enables the organic integration of multiple media elements, including text, images, audio, and video. By using multimedia production tools, creators can integrate diverse materials to produce high-quality content. For example, documentaries employ animated demonstrations to reconstruct historical scenes, while news programs use data visualization to present complex information. These approaches enhance readability and expressive power, making content easier for audiences to understand and accept. In the editing stage, digital multimedia editing tools have replaced traditional linear editing equipment. Non-linear editing systems allow editors to flexibly perform operations such as clipping, splicing, color correction,

and dubbing, greatly improving editing efficiency while reducing production costs. Moreover, the integration of artificial intelligence-based multimedia technologies further optimizes production and editing workflows. Functions such as intelligent subtitle generation, automated editing, and intelligent color grading can automatically complete certain repetitive editing tasks, reducing manual intervention while ensuring editing quality. As a result, creators are able to devote more energy to content innovation, promoting the diversification and refinement of broadcast television content and meeting the increasingly diverse demands of audiences.

## 2.2 Content Transmission and Distribution

Content transmission and distribution constitute the core links of broadcast television communication. The integration of multimedia technology with computer network technology has fundamentally optimized transmission and distribution models, enhancing transmission efficiency and coverage while addressing many shortcomings of traditional methods. Conventional broadcast television transmission primarily relies on wireless signals and cable television networks, which are constrained by geographical conditions and transmission equipment. These limitations result in restricted coverage, unstable signals, and insufficient transmission capacity, making it difficult to satisfy users' needs for accessing high-quality content anytime and anywhere. By contrast, the integration of multimedia transmission technology with computer networks has established a diversified transmission and distribution system, mainly including IPTV, online video platforms, and mobile applications. This system enables multi-terminal transmission and distribution of content. Supported by high-speed network transmission and advanced multimedia encoding technologies, broadcast television content can be efficiently delivered in high-definition, ultra-high-definition, and even 4K/8K formats, while supporting multiple playback modes such as live broadcasting, on-demand services, and replay. Users can access desired content anytime and anywhere through terminals such as televisions, computers, and smartphones<sup>[2]</sup>. In addition, the application of Content Delivery Networks (CDNs) allows content to be distributed to nodes closer to users' geographical locations, reducing network latency and avoiding issues such as buffering and

loading failures, thereby further enhancing the viewing experience.

## 2.3 User Interaction and Service Provision

In a computer network environment, the application of multimedia technology has driven the broadcast television industry to shift from a "content-centered" model to a "user-centered" model, thereby optimizing user interaction experiences and improving service quality. Traditional broadcast television offered relatively limited forms of user interaction, in which audiences could only passively receive content and found it difficult to participate in content dissemination or creation. By contrast, the integration of multimedia technology with network technology has established a diversified user interaction system. For example, in live programs, users can interact in real time with hosts and other viewers by sending real-time comments (danmu), posting feedback, participating in polls, or sending virtual gifts through online platforms, which significantly enhances user engagement and loyalty. In on-demand programs, users are able to personalize their viewing experience by freely selecting content, adjusting playback progress, and setting playback speed. In addition, multimedia technology has promoted the diversification and upgrading of broadcast television services. With the support of big data analytics, media platforms can accurately identify users' viewing habits and interest preferences, enabling personalized content recommendation services that help users quickly locate content of interest. Furthermore, some media platforms have introduced interactive Q&A functions, online activities, and membership services, further enriching service forms and improving user satisfaction, thereby promoting the high-quality development of the broadcast television industry.

## 3. Challenges and Countermeasures in Technological Integration

### 3.1 Technical-Level Challenges

The integration of computer network technology and broadcast television technology faces three major challenges at the technical level. First, the lack of unified technical standards remains a significant issue. Differences between the broadcast television and computer network sectors in terms of content encoding, format conversion, and transmission protocols result in poor interoperability across

platforms and terminals, which negatively affects transmission efficiency and user experience. Second, the cost of technological iteration is high. The rapid emergence of new technologies such as 5G and artificial intelligence requires continuous investment in technological upgrades and equipment renewal. This places considerable financial and technical pressure on small and medium-sized institutions. Third, network security risks are increasingly prominent. Since content transmission, storage, and playback rely heavily on network systems throughout the entire process, they are vulnerable to cyberattacks, malware intrusion, and data leakage. These risks not only threaten the normal dissemination of content but may also lead to the disclosure of user information, thereby undermining media credibility and infringing upon users' rights and interests.

### 3.2 Application-Level Challenges

At the application level, technological integration also faces multiple challenges. First, content homogenization has become increasingly severe. With the widespread adoption of new formats such as short videos and live streaming, some institutions lack innovation and blindly imitate existing models, resulting in uneven content quality. This makes it difficult to attract users and undermines the sustainable development of the industry. Second, user stickiness remains insufficient. Although integrated models provide diversified interactive functions, unstable content quality and imprecise personalized services often lead to aesthetic fatigue among users, making it difficult to cultivate long-term viewing habits and resulting in relatively high user attrition rates<sup>[3]</sup>. Third, there is a shortage of interdisciplinary talent. Technological integration requires professionals who possess expertise in computer networks, multimedia technology, and the broadcast television industry. However, current talent reserves are inadequate, and the capabilities of existing practitioners are insufficient to meet the demands of integrated development, thereby constraining the depth and breadth of technological integration.

### 3.3 Optimization Strategies and Recommendations

In response to the technical- and application-level challenges encountered in the integration of computer networks and broadcast television multimedia

technology, and in light of actual industry development conditions, the following optimization strategies are proposed to promote deep integration and high-quality development.

At the technical level, priority should be given to promoting the unification of technical standards. Relevant authorities and industry associations should strengthen communication and coordination to formulate unified standards for content encoding, format conversion, and transmission protocols, thereby enabling content interoperability across different platforms and terminals and improving communication efficiency. Second, technological upgrading should be planned in a rational and targeted manner. Broadcast television institutions should align technology investment with their development needs, increase investment in core technology research and development, and focus on strategic deployment of key technologies such as 5G, artificial intelligence, and VR/AR. At the same time, cooperation with Internet enterprises should be strengthened to share technological resources and reduce the cost of technological upgrading. Finally, network security protection must be reinforced. Comprehensive network security management systems should be established, covering the entire process of content transmission, storage, and playback. Regular security inspections and risk assessments should be conducted to prevent cyberattacks and data leakage, thereby safeguarding user rights and interests as well as media credibility.

## 4. Analysis of Typical Cases

### 4.1 Case 1: CCTV Spring Festival Gala 5G + 8K + VR Live Broadcast

As the most influential broadcast television program in China, the CCTV Spring Festival Gala has in recent years continuously promoted innovative integration of computer networks and multimedia technologies. Its 5G + 8K + VR live broadcast practice has become a representative case of technological convergence, fully demonstrating the application value of integrated technologies. In this case, CCTV collaborated with telecommunications operators and technology enterprises to realize 8K ultra-high-definition live broadcasting of the Spring Festival Gala by relying on high-speed 5G network transmission technology. Compared with traditional high-definition broadcasting,

8K resolution offers a fourfold increase in image resolution and more accurate color reproduction, presenting audiences with clearer and more delicate audiovisual effects and breaking through the quality limitations of conventional Spring Festival Gala broadcasts. At the same time, virtual reality (VR) technology was integrated to provide VR live viewing perspectives. Users could watch the gala immersively through VR devices, as if they were present at the live venue, which significantly enhanced viewing experience and user engagement. In addition, with the support of advanced multimedia encoding/decoding technologies and Content Delivery Networks (CDNs), ultra-high-definition content was transmitted efficiently to user terminals nationwide and even globally, ensuring smooth viewing across different regions and devices. The successful implementation of this case not only verifies the feasibility and superiority of multimedia technologies such as 5G, 8K, and VR in broadcast television live broadcasting, but also provides valuable practical experience for technological integration in the broadcast television industry, promoting its development toward ultra-high-definition and immersive directions<sup>[4]</sup>.

#### 4.2 Case 2: Mango TV's "Interactive Drama" Practice

As a leading online video platform in China, Mango TV has launched a new content format—"interactive drama"—by leveraging computer networks and multimedia technologies, becoming a typical case of integration between broadcast television and the Internet. This practice focuses on user interaction and content innovation, achieving a breakthrough in the industry. In this case, Mango TV fully applied multimedia interactive technologies to break away from the traditional "one-way viewing" mode of television dramas. Users can participate in the development of storylines via terminals such as smartphones and computers, with their choices directly determining plot directions and endings, thereby greatly enhancing user participation and loyalty. For example, in the interactive drama *His Smile*, users can select different interaction objects and behaviors for the female protagonist by clicking on the screen, unlocking different plot branches and endings. At the same time, users can engage in interactive activities such as commenting on the storyline and participating in voting, sharing viewing experiences

with other audiences. Moreover, Mango TV relies on big data analytics to accurately identify users' interest preferences. By analyzing viewing habits and choice data, the platform optimizes plot design and content recommendation, further improving user satisfaction. The success of this case fully demonstrates the core role of multimedia technology in user interaction and content innovation, providing new ideas for content innovation and service upgrading in the broadcast television industry and driving its development toward greater interactivity and personalization.

### Conclusion

This paper provides a comprehensive analysis of the application of broadcast television multimedia technology in a computer network environment. It systematically reviews the foundations of integration, specific technological applications, challenges, and corresponding strategies, and verifies the feasibility and value of technological integration through the cases of the CCTV Spring Festival Gala and Mango TV's interactive dramas. The study finds that deep integration between computer networks and broadcast television multimedia technology is an inevitable trend in industry transformation, as it can optimize the entire workflow, enhance competitiveness, and meet users' increasingly diversified needs. In the future, greater investment in innovation and the cultivation of interdisciplinary talent will be required to promote the high-quality and sustainable development of the broadcast television industry.

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