Review of Optimization Paths for Collaborative Development Between Next-Generation Communication Technology and Media Technology Industry (Postprint)

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

Abstract

[Objective] This study offers an in-depth analysis of the background and current status of collaborative development between communication technology and media technology industries, summarizes existing problems and deficiencies, proposes optimization pathways and recommendations, and provides strong support for their collaborative development; [Methods] This research primarily employs literature review and qualitative research methods to conduct relevant investigations; [Results] The study concludes that collaborative development between communication technology and media technology industries represents an inevitable trend; however, urgent issues remain to be addressed, including lagging edge computing implementation, suboptimal technology route selection, weak applicability of solutions, insufficient coordination in industrial planning, and inadequate data security safeguards; Conclusion The application of communication technology in media technology industry development is both necessary and feasible. To achieve collaborative development goals, it is essential to rationally select technology routes, conduct scenario-based validation, coordinate industrial planning, and strengthen data security safeguards. Furthermore, increasing research investment, enhancing policy support, and improving the safeguard system will provide valuable references for high-quality implementation of this initiative.

Full Text

A Review of Optimization Paths for the Coordinated Development of New-Generation Communication Technology and Media Technology Industries

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Abstract

Purpose: This study provides a detailed interpretation of the background and current status of the coordinated development of communication technology and media technology industries, summarizes existing problems and deficiencies, and proposes optimization paths and recommendations to provide strong support for their synergistic development. **Methodology:** The research primarily employs literature review and qualitative research methods. **Results:** The study concludes that the coordinated development of communication technology and media technology industries represents an inevitable trend, yet several urgent issues require resolution, including lagging edge computing implementation, suboptimal technology route selection, poorly targeted application solutions, weak industrial planning coordination, and insufficient data security protection capabilities. **Conclusion:** The application of communication technology in media technology industry development is both necessary and feasible. To achieve coordinated development goals, it is essential to select appropriate technology routes, conduct scenario-based validation, coordinate industrial planning, strengthen data security protection, increase research investment, enhance policy support, and improve the safeguard system, thereby providing valuable references for high-quality implementation of this initiative.

Keywords: communication technology; 5G technology; media technology; coordinated development; edge computing

CLC Number: TN79

Document Code: A

Article ID: 1671-0134(2023)02-082-05

DOI: 10.19483/j.cnki.11-4653/n.2023.02.016

Citation Format: Gao Xiaohua. A Review of Optimization Paths for the Coordinated Development of New-Generation Communication Technology and Media Technology Industries [J]. China Media Technology, 2023(02):

1. Research Background

Contemporary society has entered the era of network information, with global telecommunications operators expanding their scale. Their relationship with

communication standard-setting is close, with 3GPP (3rd Generation Partnership Project) being the most representative organization. Communication standard formulation must maintain coordination with actual demands to enhance its value and effectiveness, and through standard unification, resolve industrial development barriers to achieve coordinated development and win-win cooperation [4]. The research background is analyzed in detail below.

1.1 Technical Background

Against the backdrop of supply-side structural reform, technology-driven development has become a trend, and all industries should effectively utilize new technologies to enhance their development capabilities. Communication technology, in particular, has seen increasingly sophisticated infrastructure, continuously improving signal transmission and reception capabilities, and gradually strengthening anti-interference abilities, all of which facilitate communication technology application and effectiveness enhancement [5]. For example, 5G technology offers advantages in high efficiency, low latency, and massive connectivity. Its application in media technology can ensure the smoothness, stability, and clarity of relevant information and images, providing strong support for media industry development [6].

MEC (Multi-access Edge Computing) can achieve high-efficiency, low-cost communication objectives in the context of 5G technology, enabling real-time remote operation of certain tasks, eliminating geographical and temporal limitations, and generating corresponding edge computing models [2]. Research indicates a close relationship between communication technology and media industry development, possibly exhibiting positive correlation. However, analysis of current conditions reveals that communication technology development outpaces media industry development, with poor coordination between the two. Evidently, the media industry' s application of communication technology remains insufficient and requires further enhancement and strengthening [3]. During this process, the most critical issue is how to realize edge computing through 5G technology to achieve high-efficiency, low-cost, and high-quality service objectives that promote rapid development of the media technology industry.

1.2 Industrial Background

In the new era, the rapid development of new media has provided vast market space for the revitalization of the media technology industry. Nevertheless, competitive pressure continues to increase, particularly from enterprises with strong technological capabilities that create a "crowding-out" effect on the entire media technology industry [7]. To seize opportunities and better respond to challenges, the media technology industry must advance with the times, emphasizing communication technology research and application to enhance competitiveness. Especially under the circumstances of "network globalization" and "industrial marketization," the media technology industry can only meet customer demands by continuously strengthening its technological advantages.

1.3 Cultural Background

Current society has entered the network information age, with public recognition and usage of network communication technology continuously rising, forming an industrial and cultural background based on network information. Therefore, we must pay attention to market dynamics in relevant areas and satisfy public demands to achieve sustainable development goals [8]. Communication technology constitutes one of the important technologies for media technology industry development. The objective should not simply be meeting needs but rather building technological advantages, establishing targeted communication technology application solutions and service systems, and strengthening technology application effects to achieve high-quality development of the media technology industry [9].

2. Current Status Analysis

2.1 Communication Technology Status

Communication technology primarily transmits and receives information through sound waves, light waves, and electromagnetic waves, with the accuracy of information reception and confirmation affected by power loss during transmission. Relevant technologies mainly include switching technology, wireless technology, digital electronics technology, computer technology, and optical fiber technology [10]. Currently, communication technology has evolved from 1G, 2G, 3G, and 4G to 5G, capable of solving communication problems between people, people and things, and things and things, while providing services such as augmented reality, virtual reality, and ultra-high-definition (3D) video to enhance user experience. Its peak rate reaches 10-20 Gbit/s, interface latency is 1.0 ms, connection capacity exceeds one million per square kilometer, spectral efficiency is more than three times higher than LTE, user experience rate is 100 Mbit/s, and traffic density is 10 Mbps/m^2, demonstrating remarkable effectiveness. According to National Bureau of Statistics data, by July 2022, China had built 1.968 million 5G base stations with over 500 million users [11], widely applied in industry, Internet of Vehicles and autonomous driving, energy, education, healthcare, culture and tourism, smart cities, information consumption, and financial services [12].

2.2 Media Technology Industry Status

The media technology industry involves video edge computing issues, with technical requirements in this area manifested in five aspects: (1) ability to conduct computing at the video edge, providing basic common services such as video acquisition and codec to enhance adaptability for multiple environments; (2) sinking video computing to the edge location to support AI model edge inference and distributed training for centralized learning; (3) selecting virtualization and container technologies to efficiently manage various video edge devices; (4) providing support for unified management and control of edge device platforms

to save management costs; and (5) sharing relevant equipment and chips to enhance their utilization value and reduce equipment and development costs. Additionally, media technology industry development should access all Sub-6GHz frequency bands with super uplink to enhance mobile and fixed network access convenience while saving MEC access resources to achieve "minimization." Under the on-site MEC model, corresponding resources can be shared. For example, using existing mobile routers in media technology parks to complete N3 interface service flow transformation and transmission to MEC.

Based on industrial value chain integration theory, error-correcting code (ECC) adopts the CROSS model, which takes agile connection as the foundation for various functions. In business processing, real-time operations form real-time business services. Data information optimization enhances data utilization value and efficiency, forming data optimization functions. The system possesses intelligent service capabilities, forming an intelligent (Smart) service system. For data information security and privacy protection, a security (Security) system is established to bring value and opportunities to users on the network edge side [13].

2.3 Communication Technology Application Status

Media technology industry development faces digital transformation challenges, requiring 5G edge computing to achieve this goal, thereby alleviating broadband pressure and addressing issues such as latency and computing power cost waste. Edge computing refers to a service model that integrates network information technology, cloud computing technology, data storage technology, and other core functions near objects or data sources to provide proximity services. Its relevant programs are located on the edge side, enabling rapid response, shortening service time, and possessing high intelligence levels and security protection capabilities to meet business requirements.

5G-based multi-access edge computing can provide an IT service environment for mobile network edges, enhancing cloud computing adaptability and computing efficiency while completing caching, transmission, and computing in network edge environments to eliminate latency and enable rapid response. The current status is analyzed in detail as follows: First, industrial positioning of 5G edge computing is reflected in core network 下沉的 UPF (User Plane Function) and wireless-side gNB, continuously enhancing advantages in edge computing components, IoT platforms, and customer resource integration. Second, 5G edge computing technology integration aims to demonstrate "high efficiency"by reducing information transmission and reception latency and effectively utilizing 5G technology to strengthen its carrying capacity and service capabilities. Third, forms of 5G edge computing: from a cloud collaboration perspective, private cloud and edge computing development are closely related, allowing edge computing to be managed within public, private, and hybrid clouds.

The Edge Computing Consortium (ECC) continuously conducts technological

innovation and integrated application to strengthen effects according to new-era business requirements, primarily focusing on Operational Technology (OT), Information Technology (IT), and Communication Technology. Computing objects mainly involve device domain, network domain, and data domain. In the device domain, pure IoT devices are used for edge-side processing of data directly used for top-level optimization but not participating in control. The network domain must address the problem of non-uniform data transmission standards that hinder effective usage, particularly the coordination issue between IT and OT, which remains a major challenge even with targeted Web-based data transmission. The data domain focuses on data processing-related work, including data processing modes, capabilities, and efficiency, with specific processing content encompassing data format normalization, data classification and storage, data statistical analysis, and data query and interaction, all requiring standardization and normalization.

2.4 Problems in Coordinated Development

Problems in the coordinated development of communication technology and media technology industries are specifically manifested in four aspects: First, the rationality of technology route selection needs improvement. In media technology industry development, the collaborative application of 5G technology requires reasonable and practical technology routes to minimize inefficiency and computing power waste caused by unscientific routes. Current efforts in this area require continued strengthening. Second, poor specificity: coordinated development of 5G technology and media technology industry helps commercialize and industrialize communication technology and enhance its economic value. However, different application scenarios have different requirements for this technology, necessitating targeted application solutions based on actual conditions. Currently, the coordinated development approach remains 粗放 (extensive) and insufficiently precise, yielding poor results. Third, poor industrial planning coordination: a "gap" still exists between communication technology and media technology industries that is difficult to avoid. Therefore, how to achieve coordinated development planning and mutual support constitutes a major challenge. Fourth, data security protection capabilities require strengthening: although requirements and technical levels for data security protection continue to increase, further enhancement is needed, particularly in environments with strong communication interference where data security issues become more prominent.

3. Optimization Paths

Based on the current status and problems facing coordinated development of communication technology and media technology industries, optimization paths are proposed to promote achievement of this objective.

3.1 Rational Technology Route Selection

Technology route selection should adhere to principles of specificity, practicality, economy, and efficiency. To achieve this, environmental surveys and usage requirement analysis must be strengthened before route selection to provide a basis for decision-making. Based on analysis of current communication technology and media technology industry development status, drawing lessons from the typical 2C business development model of the App Store, two paths are established: the "North Slope" and "South Slope." The North Slope refers to collaborating with organizations possessing high professional competence and strong capabilities in platform operations to "purchase" relevant services, reducing overall industrial chain costs while they handle maintenance and service work to enhance effectiveness. The South Slope refers to achieving high connection quality standards primarily through 5G technology for intensive services, becoming a replacement for existing fiber and Wi-Fi networks.

3.2 Scenario-Based Validation

In a market economy, coordinated development of communication technology and media technology industries must emphasize effectiveness validation. Relevant work mainly includes communication coverage, functional comprehensiveness, service efficiency, service quality, and service risk, with communication technology application improvements made based on validation results. For example, scenario validation may reveal that communication technology coverage in relevant areas is only 70% due to insufficient base stations and obstacles/interference between service locations, requiring additional base stations. Furthermore, as competitive pressure on the media technology industry continues to increase, cost control and efficiency improvement become essential. Therefore, financial risk management modules can be added to communication technology services to help media technology enterprises conduct financial status analysis, risk identification and evaluation, and strengthen internal control and cost management.

3.3 Coordinated Industrial Planning

Analysis of MEC App data volume changes in the media technology industry indicates that if quantities grow rapidly in the short term, improvements and strengthening of trust mechanisms between developers and traders are necessary. To achieve this, distributed ledger technology should be adopted to establish secure, transparent, and trustworthy mobile network edge infrastructure. To strengthen effectiveness, government departments are recommended to establish unified "Communication Technology Service Centers"to implement government control over relevant edge infrastructure for greater coordination and standardization. The media industry' s understanding of communication technology application and the products and concepts of communication technology service enterprises in business development require attention. Without consensus, unilateral development planning cannot achieve coordination. Therefore, a

"Media Enterprise + Communication Technology Enterprise Joint Development Mechanism" should be established to create strategic partnerships.

Edge computing security protection functions depend heavily on network service capabilities. For relevant customers in media technology vertical industries, targeted security protection systems can be established based on requirements. Regarding UPF and core network security protection: UPF, as a core network user plane element, has 分流设备 (shunting equipment) deployed at edge locations with relatively low physical security levels to prevent mutual attacks between edge and core. SMF and UPF require mutual authentication to prevent policy forgery. For media aspects, UPF connects to the core network primarily through transmission networks, requiring transmission security protection. UPF can forge data packets to launch DDoS attacks, maliciously forwarding large amounts of unwanted traffic to small-capacity MEC Apps for personal purposes. For edge service security protection, two aspects must be emphasized: security capability openness and basic security functions. Basic security functions provide specific security assurance capabilities when providing security equipment and tools, including vWF, vIPS/IDS, and transmission channel encryption.

4. Implementation Measures

4.1 Strengthening Policy Support

First, relevant government departments should provide policy incentives by promoting integration of communication technology and media technology industries through policies that embody coordinated development concepts, providing impetus for high-quality implementation. For example, offering tax incentives and interest-free loans for relevant projects can stimulate research investment and reform initiatives among communication technology and media enterprises. Second, the institutional system should be improved. In the network information era, communication infrastructure maintenance and data security protection require corresponding institutional systems to reduce problem occurrence. Both communication technology service enterprises and media technology enterprises should establish systems including maintenance management, security protection, and information review systems. The government should also improve legal systems to pursue legal liability for malicious destruction of communication infrastructure, ensuring coordinated development. Finally, "regional + global" coordinated strategies should be formulated. Coordinated development should be guided by national guiding ideology and strategic layout for rational regional development planning, utilizing existing resources to avoid cost waste from repeated renovations. For instance, communication base station construction and service system design in a region must consider media technology industry park construction and development needs for targeted design that minimizes resource waste.

4.2 Increasing Research Investment

Coordinated development requires increased research efforts to strengthen synergistic effects through technological advancement. This paper proposes a "government + enterprise + research institute + university" four-in-one integrated model to establish a "Communication Technology and Media Technology Industry Coordinated Development Technology R&D Project." The government plays a leading role by providing policy support and other assistance. Enterprises provide funding support. Research institutes and universities handle specific research work, laying a solid foundation for relevant initiatives.

Regarding wireless key technologies, 5G technology designs unified technical solutions for low and high frequencies, but to demonstrate precision and efficiency, further refinement can divide frequencies into "low, low-mid, mid, mid-high, and high" bands with separate technical solutions for each. For 5G network key technologies, service modules can be designed based on requirements. Specific research should establish "real-time + dynamic + precise" service modules for media technology industry development needs, enabling timely adjustments. For example, using big data technology and cloud platforms to analyze customer and industry information in real-time, comparing it with media technology enterprises' own development to identify deficiencies and problems. Taking the 2020 COVID-19 pandemic as an example, relevant technologies can be used to statistically analyze its impact on media businesses, examining the relationship between public health emergencies and media technology industry development to provide technical support for strategy formulation under normalized pandemic conditions.

4.3 Improving the Safeguard System

First, accounts and passwords should be properly configured. When using communication technology, accounts and passwords must be established according to user requirements to avoid security issues from improper usage. Integration with identification technologies such as fingerprint and facial recognition should be implemented to strengthen security management. Second, the human factor must be emphasized. In the coordinated development process, people constitute an important influencing factor, requiring enhanced personnel quality. Communication technology personnel should possess awareness of integration with the media industry and relevant product R&D, continuously improving relevant competencies. Media enterprises should enhance all staff' s understanding of communication technology, use it rationally, strengthen usage capabilities, and conduct relevant work with high quality and efficiency. Leadership must increase investment to promote enterprise digitalization, informatization, and intelligent transformation.

Conclusion

In summary, coordinated development of communication technology and media technology industries has become an inevitable trend. However, how to achieve coordinated development goals and strengthen synergistic effects has become a core social concern. This study concludes that edge computing represents a key point in the application of communication technology in media technology industry development. It can break traditional cloud computing boundaries and represents another important development following cloud computing, enabling efficient access with powerful network architecture. According to predictions and analysis by relevant professionals, edge computing will become an important tool for enterprise management and operations within the next decade. Using communication technology to promote media technology industry development and conducting communication technology R&D based on media industry needs with clear objectives has become the trend for both technology and industry development. Therefore, research investment must be strengthened to create a "Communication Technology and Media Technology Industry Coordinated Integration Mechanism," laying a solid foundation for relevant work.

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(Editor: Zhang Xiaojing)

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