A Preliminary Discussion on the Development Opportunities and Challenges for Broadcasting in the 5G Era: Postprint

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Abstract

In the information age, 5G occupies an extremely critical position in the cyber power strategy. Currently, an increasing number of economies have accelerated the pace of 5G development, aiming to achieve commercial deployment as soon as possible. Meanwhile, the development speed of China' s 5G industry has also gradually accelerated, market demand is gradually expanding, and many industries have achieved remarkable accomplishments under existing technologies and policies, making the application prospects of 5G extremely broad. However, in the process of 5G technology integration and application, many problems and obstacles have also been encountered, and there is still a significant gap from achieving large-scale commercial deployment. Based on this, this paper first provides an overview of 5G, then analyzes the opportunities and challenges faced by broadcasting development in the 5G era, and finally proposes strategies for broadcasting development in the 5G era.

Full Text

A Preliminary Study on Development Opportunities and Challenges in the Broadcasting 5G Era

Abstract: In the information age, 5G occupies an extremely critical position in the national strategy for building a network powerhouse. Currently, an increasing number of economies have accelerated their 5G development pace, aiming to achieve commercial deployment as soon as possible. China' s 5G industry is also developing at an accelerating rate, with market demand gradually expanding. Under existing technologies and policies, many industries have achieved remarkable accomplishments, and the application prospects for 5G are extremely broad. However, numerous problems and obstacles have emerged during the integration and application of 5G technology, and there remains a substantial gap before

large-scale commercial deployment can be realized. Based on this context, this paper first provides an overview of 5G, then analyzes the opportunities and challenges facing broadcasting development in the 5G era, and finally proposes strategies for broadcasting development in this new era.

Keywords: broadcasting industry; 5G era; opportunities; challenges

1. Overview of 5G

1.1 Development History of Mobile Communications

In the early 1980s, the first generation of mobile communication technology was first deployed in the United States, utilizing analog technology and FDMA for communication. Constrained by limited bandwidth, 1G systems were regional mobile communication systems that failed to achieve long-distance roaming capabilities. Representative systems included AMPS, NMT, and TACS, which provided voice services through analog technology. Their drawbacks included high terminal costs and bulky overall designs. In the 1990s, second-generation mobile communication technology emerged, primarily employing digital voice transmission technology to complete the transition from analog to digital calling modes while also providing SMS functionality. After entering the 21st century, third-generation mobile communication technology began to develop, mainly using the 2000MHz band to integrate wireless communication with the Internet, thereby fundamentally transforming network data architecture. With 3G technology application, data rates improved significantly, and smart terminals began playing important roles. Since 2010, fourth-generation mobile communication technology has developed, namely IMT-Advanced, through the integration of 3G and wireless local area networks, primarily including LTE FDD and LTE TDD standards, as well as IEEE' s 802.16m. For 4G technology, downlink rates range between 100-150Mbps, representing a 20-30 fold improvement over 3G peak rates, reaching 1Gbps.

1.2 Basic Development Status of 5G

3GPP has defined three major scenarios for 5G: Enhanced Mobile Broadband (eMBB), Ultra-Reliable Low-Latency Communication (URLLC), and Massive Machine-Type Communication (mMTC). In terms of network speed, 5G represents a hundredfold improvement over 4G technology, with transmission speeds reaching tens of Gbps. From a latency perspective, compared with 4G, the reduction reaches 90%, entering the millisecond level. Regarding mobility, while 4G can support 300km/h, 5G technology will increase this value to 500km/h.

2. Impact of 5G on Broadcasting

2.1 Significant Improvement in Transmission Rates

For eMBB peak downlink rates, the maximum reaches 20Gbit/s. This substantial improvement in transmission rate can satisfy the mobile data requirements for various broadcasting operations. Consequently, under unified standard formats, mobile networks, fixed broadband, and satellite networks can achieve common integration and production, thereby enhancing both signal transmission quality and standards.

2.2 Low Latency and High Reliability

The 5G era has introduced new requirements for broadcasting, particularly the need to adopt elastic management when facing rapidly changing mobile data traffic, which will enhance viewers' experience during live television broadcasts. According to the vision outlined by the ITU, 5G latency will remain below 1 millisecond in future development. This is lower than human physiological nerve reaction latency and also prevents differential perception among audio-visual end users.

2.3 Realization of Large-Capacity Network Connections

The application of 5G technology has dramatically increased network connection density, reaching over one million devices per square kilometer and forming a "ubiquitous network" connection pattern throughout society. Through sensor technology applications, people can interpret information across multiple spaces and dimensions. The arrival of the 5G era has thus brought both enormous opportunities and significant challenges to broadcasting media.

3. Opportunities for the Broadcasting Industry in the 5G Era

3.1 Ultra-High Transmission Rates Broaden Broadcasting Channels

The 5G era will drive substantial improvements in cable television information transmission speeds, making them smoother and preventing errors and latency issues during viewing. Television program materials can bypass compression procedures and be smoothly transmitted back through equipment such as cameras and microphones. With 5G technology support, broadcasting programs can also be produced and broadcast in real time, thereby improving live broadcasting efficiency. Some scholars propose that future news production spaces will undergo tremendous changes—after hosts finish reading their lines, scene footage will be presented immediately. With the emergence of mobile terminals and news applications, specific on-site conditions can be provided to audiences. The application of 5G technology has made mobile live broadcasting possible. For example, in 2018, Chengdu TV Station cooperated with China Telecom to conduct a "5G+Satellite Interactive TV Live Broadcast" featuring three scenes

(including a 5G-covered bus) and a satellite TV live room on the same screen, with all performers perfectly cooperating to sing the song "Chengdu." During the live broadcast, the signal remained stable and TV picture quality was exceptionally clear. The 2019 CCTV Spring Festival Gala Shenzhen sub-venue transmitted 4K ultra-high-definition content through 5G networks, providing national TV audiences with superior viewing experiences.

3.2 Ultra-Low Latency Further Enhances Broadcasting Service Experience

The rise of 3G networks reduced latency to 100 milliseconds, while 4G networks achieved 20-30 milliseconds. Now with 5G technology support, end-to-end latency will be within 1 millisecond. Through 5G network application, many media application scenarios can be realized, such as real-time on-site experiences and collaborative media content production.

3.3 Extension of Broadcasting Terminal Platforms Through IoT

Supported by sensors, the Internet of Things demonstrates capabilities far superior to human perception, greatly improving both the breadth and depth of sensing while significantly enhancing accuracy, thereby substantially improving news transmission reliability and accuracy. The IoT relies on the development space created by 5G technology, primarily collecting information through sensors and processing it on big data platforms in the background. 5G can connect 100 billion data points, strengthening the integration of people-to-people and people-to-thing connections through information technology. Traditional news media were constrained by television and broadcasting limitations; however, now everyone can collect and transmit information, weakening the role of traditional media. In the information collection process, the broadcasting industry uses smart terminals for program production with remarkable results. In 2014, CCTV cooperated with Baidu to broadcast news related to "Data Says: Spring Festival Travel Rush," presented in H5 format on terminals. This news concept involved scanning China' s Spring Festival travel conditions through GPS systems. Although the idea was promising, due to technological limitations and insufficient funding, it failed to achieve satisfactory results and ultimately did not attract public attention. The rapid development of 5G technology will help media become increasingly mature in technological development, data transmission and sharing will become more widespread, and media news information will have more development opportunities.

3.4 Utilizing Ultra-Large Bandwidth to Promote Multi-Technology Integration

In the network era, connections between countries and regions have become closer, and the pace of technology convergence has accelerated. Various technologies are no longer used independently but must match each other to maximize their value. Network bandwidth typically refers to the amount of data

transmitted within one second. For 5G technology, its ultra-large bandwidth advantage provides fundamental conditions for the integrated development of big data, cloud computing, artificial intelligence, and IoT technologies. In the broadcasting field, network transmission will become increasingly dependent on 5G technology. New technology development should be based on artificial intelligence, demonstrating that different technologies have achieved joint application, paving the way for smart broadcasting development.

3.5 Personalized News Programming Enhances User Experience

Modern media development pays great attention to user interests, gradually reflecting personalized characteristics in information services. However, due to technological discontinuity, comprehensive customization has not been achieved despite mastering large amounts of information and matching users according to their interests and hobbies. The popularization and application of 5G technology will utilize wearable devices to grasp users' real-time situations and needs, comprehensively and accurately collecting personal data to allow customers to enjoy personalized customized services [1]. In the future, with 5G technology support, the broadcasting industry will enable users to obtain services such as VR news live broadcasting, gradually creating immersive experiences that make users feel as if they have entered the news scene, allowing them to deepen their understanding of news content from multiple perspectives.

4. Challenges Facing Broadcasting Development in the 5G Era

4.1 Severe Shortage of Professional Technical Talent

Current 5G technology development is in its initial stage, with very broad future development space. The broadcasting industry will become increasingly dependent on 5G technology in its development, with main operational technologies including VR, artificial intelligence, and IoT. The application of these latest technologies places higher demands on technical personnel, who must possess relatively high network literacy. However, network technical personnel are far from meeting actual needs, especially in the broadcasting industry where relevant technical personnel are seriously insufficient. Due to talent shortages in broadcasting industry development, the application of 5G technology relies heavily on external talent, thereby bringing adverse effects to its own development.

4.2 Mobile Media Services Intensify Competition

In the 5G era, opportunities and challenges coexist for broadcasting industry development. Traditional broadcasting media face an increasingly competitive market, with their market share becoming smaller, while emerging media develops rapidly and gradually enters public view. Especially after the creative power of various small and micro platforms is released, the threshold for the

broadcasting media industry in the 5G era will become increasingly lower. In video transmission, self-media, UGC, and industry big data will play increasingly important roles, prompting traditional broadcasting media to accelerate reform and innovation. Currently, smartphones are very popular, and the application of numerous mobile apps diverts users. Besides television, people can also use mobile phones to receive news information [2]. Navigation software applications appear more convenient compared to car radio; through news apps, better services can be obtained than watching TV news. Similarly, music app applications have led to a substantial reduction in radio listeners. Major operators, supported by 5G technology, have also expanded their business to the mobile communication field. For example, at the end of 2018, Zhejiang Mobile applied 5G technology in drones to achieve full-course mobile HD live broadcasting of the Hangzhou International Women' s Marathon. In addition, the broadcasting industry is continuously exploring transformation strategies in its development, gradually broadening development channels, and moving beyond simple content production and output.

4.3 Regulatory Difficulties Increase Substantially

In the 5G era, the threshold for the media industry will be greatly reduced. The application of short video software such as Douyin and Kuaishou has diversified news transmission channels and enriched transmission content. However, due to the lack of strong supervision for various video software, some content may easily bring adverse effects to minors, which puts forward strict requirements for supervision work and also increases the workload of regulatory departments.

4.4 Issues Arising from Emerging Business Formats

In today' s rapid development of 5G technology, broadband has also been greatly improved, and network support capabilities are becoming stronger. Major operators have gradually launched unlimited data plans, causing tremendous changes in users' previous habits and driving the development of many new industries and business formats, which have strong attraction to users and also make the broadcasting industry face severe tests in future development.

5. Strategies for Broadcasting Development in the 5G Era

5.1 Adhering to Content as King

In the 5G era, modern program forms and content are quite different from before, but what we call the 5G era represents only an efficiency improvement upon other excellent channels, not requiring it to become the sole media transmission channel [4]. In such a competitive environment, broadcasting must fundamentally consider users' essential needs and improve program quality and content levels to gain a firm foothold in this highly competitive environment and achieve stable, healthy development.

5.2 Adhering to Collaborative Development

Under the 5G era background, China will establish a large number of base stations to meet development needs, with quantities reaching 2-3 times the current number of base stations. Different from the other three major operators, broadcasting possesses substantial hardware and software resources that can achieve effective integration with 5G. Regarding the Internet of Things, wired networks must recognize that it represents revolutionary technology that will bring enormous changes to various social fields, transforming from being human-centered to being centered on both people and things. Wired networks need to achieve symbiosis with the Internet of Things, forming new industrial development concepts, and intensifying research on connection services between people and people, people and things, and things and things. The broadcasting industry should leverage its frequency band advantages based on current coverage to accelerate IoT development pace, which can not only reduce investment but also facilitate efficient resource utilization and smooth integration. Simultaneously, broadcasting' s "boundaries" should be appropriately weakened to enable better development in the 5G era and achieve deep integration with other technologies.

5.3 Fully Applying Artificial Intelligence Technology

The 5G era has laid a solid foundation for artificial intelligence development. In the broadcasting industry' s development process, content should gradually evolve toward ultra-high definition, 5G, and AI directions. With AI assistance, higher-quality content can be precisely transmitted to users, and through the development of smart IoT set-top boxes, functions such as multi-modal interaction, device linkage, and intelligent voice can be promoted, truly satisfying users' personalized needs.

5.4 Reserving Standard Formats

To network and intellectualize diverse, proprietary, and non-uniform equipment, the control plane and data plane should be separated to ensure further expansion of elasticity [5]. This approach can simplify each adaptation and provide favorable conditions for equipment management. It is necessary to start from actual needs, customize and tailor various functional devices, ensure more flexible networking, and utilize cloud computing, big data, and artificial intelligence technologies to enable deep intelligent management of resources and data in custom systems, thereby achieving truly efficient utilization of existing resources.

In summary, the broadcasting industry faces enormous tests in the 5G era, yet it is also full of development opportunities conducive to promoting transformation and innovation. Through the application of artificial intelligence, big data, and cloud computing technologies, the role of 5G technology in the broadcasting industry can be fully leveraged to satisfy users' personalized needs. Entering the 5G era, the broadcasting industry must clearly understand the development landscape and actively respond to various challenges brought by 5G technology

application to lay a solid foundation for future development.

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