Reflections and Practice on Domestic 4K/8K Ultra High Definition Television Development (Postprint)

Authors: Pu Fang

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

Abstract

Audio-visual communication technology is critical to the development of China' s media industry, enabling the delivery of clearer video with enhanced clarity. Particularly in the context of big data, video technology is advancing toward high-definition standards, with 4K/8K ultra-high-definition technology emerging as a new trend in television development. Accordingly, this paper analyzes the current state and content of domestic 4K/8K ultra-high-definition television development, aiming to provide assistance to relevant scholars.

Full Text

Reflections and Practice on the Development of Domestic 4K/8K Ultra-High-Definition Television in China

Author: Pu Fang, Chongqing Radio and Television Technical Center Satellite Earth Station, Chongqing 400000

Abstract

Audio-visual communication technology is key to promoting the development of China' s media industry, capable of providing users with clearer video and enhanced resolution. Especially in the context of big data, video technology is evolving toward high-definition development, with 4K/8K ultra-high-definition technology becoming the new trend in television development. Based on this, this paper analyzes the current status and content of domestic 4K/8K ultra-high-definition television development, hoping to provide assistance to relevant scholars.

Keywords: domestic; 4K/8K ultra-high-definition television; reflections; practice

With the rapid development of science and technology in China, 4K/8K ultra-high-definition television has entered people' s daily lives. This technology not only provides clearer video but also delivers 1080P resolution screens. Particularly as televisions trend toward larger screen sizes, it becomes essential to strengthen the analysis of the current development status of domestic 4K/8K ultra-high-definition television to ensure the sustainable development of China' s audio-visual communication technology.

1. Development Background of Domestic 4K/8K Ultra-High-Definition Television

In 2017, to promote the development of China's broadcasting industry, 4K ultra-high-definition television was applied in Guangdong Province. Building on the characteristics of domestic 4K/8K ultra-high-definition television, the application of new technologies was strengthened. In this context, China also integrated the actual situation of television technology to promote the combination of 4K ultra-high-definition television application and industrial development, positioning domestic 4K/8K ultra-high-definition television as an important component of the social audio-visual communication undertaking. The development paths and experiences of ultra-high-definition television were actively explored, and transformation plans for the radio, film, and television industry were refined.

By 2018, Guangdong Radio and Television Station launched the first 4K ultra-high-definition channel, providing users with clearer video information and significantly increasing viewership. Research shows that 4K set-top box users have reached 10 million households, laying a foundation for the stable development of domestic 4K/8K ultra-high-definition television in society. Particularly as domestic 4K evolves toward 8K ultra-high-definition television, viewing quality has been further enhanced. Analysis of the characteristics and content of domestic 4K/8K ultra-high-definition television technology reveals that it primarily employs four-color technology, which adds yellow elements to the traditional red, green, and blue (RGB) primary colors, making colors in video images more vibrant [1]. However, due to certain factors, the official market launch of 8K resolution televisions was relatively late. In 2015, the actual resolution of these televisions was not truly high—they were still 4K—and only through proprietary image quality technologies could video quality achieve 8K clarity. To further promote the development of domestic 4K/8K ultra-high-definition television technology, it is necessary to analyze its development trends, improve 8K image quality, and strengthen the widespread application of domestic 4K/8K ultra-high-definition television, thereby continuously promoting the sustainable development of China' s audio-visual communication technology in society.

2. Current Development Status of Domestic 4K/8K Ultra-High-Definition Television

Currently, to meet people' s demands for television clarity, it is necessary to analyze the actual development and application status of domestic 4K/8K ultra-high-definition television. Regarding whether people can watch 8K video, theoretically, 4K/8K ultra-high-definition television video-on-demand requires broadband access above 100M. However, even in economically developed cities like Beijing, Shanghai, and Guangzhou, the average bandwidth still falls short of this requirement.

Furthermore, price is a major factor affecting the development of domestic 4K/8K ultra-high-definition television technology. Similar to when 4K televisions first emerged, 8K televisions are extremely expensive. Additionally, since 8K televisions generally require ultra-large screens, their prices inevitably remain high, which is the primary reason why domestic 4K/8K ultra-high-definition television has not been widely adopted in people' s daily lives.

Beyond price issues, resource availability also poses a challenge. If the 4K resource ecosystem reaches a certain level of development, manufacturers will naturally launch 8K televisions officially, and prices will gradually decrease. Analysis of domestic 4K/8K ultra-high-definition television development trends reveals that 8K ultra-high-definition television offers clear advantages over 4K. First, in terms of resolution, 8K television shows significant improvement, with the most intuitive benefit being higher picture clarity on large screens. Moreover, 8K products have achieved research progress and improvements in color representation, providing more favorable conditions for the development of 8K products. Therefore, in the new era, it is necessary to analyze the trends of domestic 4K/8K ultra-high-definition television.

3. New Trends in Domestic 4K/8K Ultra-High-Definition Television

In the new era, analysis of domestic 4K/8K ultra-high-definition television development trends reveals several key directions:

First, this type of television channel will see a modest increase. This is primarily because the current 4K ultra-high-definition technical standards remain incomplete, with some content still in the formulation stage. Existing professional 4K production and broadcasting equipment is relatively scarce, expensive, and poses significant integration challenges.

Second, researchers are employing multiple approaches to solve content supply challenges in 4K/8K. Although China' s 4K ultra-high-definition television programs have begun broadcasting in the new era, playback source supply remains a major shortcoming in 4K industry development. China' s 4K ultra-high-definition television technology is still in the development phase, lacking comprehensive normalized program production and broadcasting capabilities,

which affects the application of domestic 4K/8K ultra-high-definition television. Therefore, to promote the development of ultra-high-definition television in China' s broadcasting stations in the new era, it is necessary to approach from multiple dimensions, innovate and explore efficient creative models for domestic 4K/8K ultra-high-definition television programs, and promote their development in new directions.

Third, content transmission channels are diversifying. The development of network technology not only provides advantages for information transmission but also enables 4K television programs to reach people' s lives. Research shows that the launch of domestic ultra-high-definition television trial channels will facilitate the dissemination of various program types and content. Furthermore, as 4K television on-demand content continues to increase, cable television networks and IPTV networks are also upgrading and transforming for 4K television transmission, indicating that domestic 4K/8K ultra-high-definition television is developing toward diversification.

Therefore, relevant departments need to analyze the content of domestic 4K/8K ultra-high-definition television, innovate dissemination methods, improve people' s quality of life, and provide audiences with new content and information [2].

4. Advantages of Domestic 4K/8K Ultra-High-Definition Television

In recent years, to promote the development of China' s television media industry, policies and measures have been formulated focusing on ultra-high-definition and mobile content, primarily aimed at further developing audio-visual communication technology in the new era. From a national policy perspective, analysis reveals that China actively encourages the development of the media industry. China Media Group has also formulated new measures based on the actual situation and transformation of media technology dynamics. In 2018, new strategic layouts were proposed after reconsidering development plans. Traditional radio and television media have innovated original audio-visual production methods, though picture and sound quality have not significantly improved. The development and application of 4K/8K ultra-high-definition television in all-media institutions can transform previous development models and innovate existing programs. Additionally, technicians can analyze the advantages of domestic 4K/8K ultra-high-definition television by examining China' s ultra-high-definition television development trends in recent years.

First, UHD ultra-high-definition technology can better restore the authenticity of television images. When viewers watch television using ultra-high-definition technology, it can display four times the information of full high-definition images, with clearer and more delicate picture quality, providing audiences with sharper images.

Second, ultra-high-definition technology has overcome previous limitations of

ultra-large screens and broken through ultra-high-definition layout restrictions. This ultra-high-definition large size can satisfy people' s demands for television picture quality while allowing audiences to experience authentic image quality, enabling Chinese users to have a brand-new 8K live experience. During this process, VR virtualization technologies can be appropriately integrated.

Finally, since domestic 4K/8K ultra-high-definition television also features three-dimensional audio technology, it can provide users with entirely new experiences on new media platforms. Furthermore, analysis of ultra-high-definition business reveals inherent advantages and potential. Currently, Skyworth and Konka produce over 50% of televisions, and 4K/8K ultra-high-definition television has been researched within these products. To strengthen the application of 4K/8K ultra-high-definition television technology, Guangdong Province has implemented broadband construction, enhanced network transmission capabilities, and promoted the development of ultra-high-definition business. Based on this, this paper analyzes the advantages of domestic 4K/8K ultra-high-definition television and examines its future development trends in society [3].

5. Technical Challenges and Solutions

5.1 Video Encoding

Analysis of ultra-high-definition television characteristics reveals that compared with existing high-definition television, its image width and height are twice as large. Additionally, considering increased frame rates, the total data volume is more than four times that of previous videos. Therefore, to improve video quality, higher requirements must be placed on compression encoding.

5.2 Signal Transmission

Comparing domestic 4K/8K ultra-high-definition television with the current 1920$×$1080 progressive scan television standard, the former demonstrates excellent signal transmission speed. Research shows that UHDTV1 and UHDTV2 increase per-frame information transmission volume by four times or sixteen times. Analysis of per-frame information transmission volume reveals it approaches 4 billion pixels per second, with extremely high transmission data rates, which poses challenges for China' s ultra-high-definition television transmission. Therefore, when applying domestic 4K/8K ultra-high-definition television technology, it is necessary to analyze signal transmission characteristics in advance, examine issues in terrestrial digital broadcasting and cable television transmission, and formulate advanced transmission solutions [4].

5.3 Cable Television Transmission Trials

In recent years, to promote 4K/8K ultra-high-definition television development, Japan' s Panasonic Corporation announced at CES2015 the launch of a 4K-supported Blu-ray player with added 4K resolution support. However, this

UHD Blu-ray player still has certain limitations—it remains a prototype and has not been marketed.

5.4 Display Terminal Research

Previous ultra-high-definition television technology had display terminal issues that prevented processing of graphics and images in televisions. When applying graphics and image processing technology, the processing of both graphics and images is included to better achieve upgrades from previous high-definition televisions.

5.5 Display Panel Technology Application

Currently, when formulating and analyzing liquid crystal television product panels in China, technologies such as LCD and OLED are generally employed. In this process, LED offers more advantages than LCD technology, featuring ultra-thin design and high light transmittance. Therefore, television manufacturers such as Sharp and TCL have adopted LED display technology in producing 4K/8K ultra-high-definition televisions. Since OLED also features self-illuminating characteristics with obvious advantages in contrast ratio and color gamut, it has been effectively applied in domestic 4K/8K ultra-high-definition television production [5].

Although China solved the three-color luminous lifetime issue as early as 2007, the technology remains immature, primarily due to high costs. If analyzing OLED in terms of resolution, we find that 4K ultra-high-resolution products have relatively high quality, but their sizes are limited by manufacturing technology. Currently, a new QLED display technology has been effectively applied. Since QLED is a novel technology between LCD and OLED that is invisible to the naked eye—consisting of particles with diameters less than 10 nanometers—its application in ultra-high-definition television production can better improve television picture clarity and provide audiences with more exquisite images.

5.6 Video Interface Research

Analysis of domestic 4K/8K ultra-high-definition television video interfaces reveals two primary access methods. The first is HDMI, which has been effectively applied by television manufacturers such as Samsung, Toshiba, and Sony. These manufacturers generally adopt the HDMI 1.4 interface when producing ultra-high-definition televisions. Although this method supports 4K ultra-high-definition signal transmission, its duration is relatively short and cannot exceed a frame rate of 24 frames per second for playing ultra-high-definition video [6]. While this method can meet the playback needs of some 4K movies, it performs poorly with dynamic high-frame-rate content. Additionally, there is another interface technology: DisplayPort high-definition digital technology. The application of this technology in display interfaces can enhance the high definition

of 4K/8K ultra-high-definition televisions and enable different information integration.

6. Development Strategies

6.1 Strengthening Application of Advanced Technology

When analyzing the development of domestic 4K/8K ultra-high-definition television, China' s first provincial-level 4K production and broadcasting full-chain system has been perfected, with technology and systems developing rapidly over two years. For example, when analyzing 4K technology, Guangdong Radio and Television Station established a platform to optimize and perfect the 4K production and broadcasting full-chain technical system.

In this process, applying IP/4K studio clusters and various advanced technologies can promote the stable development of China' s radio and television industry in society, establish and build new television programs, enrich their content, and subsequently create production-to-broadcast chains. This optimizes the production workflow of 4K/8K ultra-high-definition television, further strengthens China' s cable network broadcasting technical capabilities, and improves the formulation of ultra-high-definition television technology solutions [7].

6.2 Strengthening Policy Support

To better support 4K programs and enrich their content, Guangdong Province needs to analyze content collection and production based on Guangdong' s development characteristics, formulate relevant policies, and provide conditions for the development and application of 4K/8K ultra-high-definition television. Additionally, to attract more social creative forces and ensure that domestic 4K/8K ultra-high-definition television content meets people' s requirements and increases viewership, it is necessary to comprehensively analyze measures for forming 4K content, innovate attraction and copyright distribution models, and provide conditions for the stable development of 4K television in future society. Based on the current application status of domestic 4K/8K ultra-high-definition television, comprehensive solutions should be formulated.

For example, to promote 4K television development, Guangdong Province has actively sought win-win development with social capital from all parties. Through multiple methods and channels, it has innovated program content and formats, launched various 4K program products including online interactive and VR visual experience categories, and enhanced the social influence of domestic 4K/8K ultra-high-definition television [8].

6.3 Achieving Rapid Signal Transmission

To promote the development of domestic 4K/8K ultra-high-definition television, content from telecommunications, mobile, and Unicom has been integrated, with operators being reasonably applied to achieve rapid signal transmission.

When analyzing and considering 4K/8K development trends and solutions, technicians also need to strengthen the application of advanced technologies such as VR and AR. Simultaneously, it is important to focus not only on technological development but also on integrating signal information to achieve rapid transmission of 4K ultra-high-definition information content and provide audiences with more video content.

7. Outlook

In the new era, as China' s high-definition television develops, 4K/8K ultra-high-definition television has been applied in people' s lives. Since this involves a large amount of audio-visual industry chain content, information needs to be updated, covering source compression encoding and ultra-high-definition digital television reception codes. To achieve integration of this information content, it is necessary to analyze development trends in the ultra-high-definition technology industry chain in advance and examine current market development situations.

The research on ultra-high-definition technology and application challenges aims to help everyone more comprehensively understand the problems and advantages of China' s ultra-high-definition television in application and development [9]. Currently, although domestic 4K/8K ultra-high-definition television has achieved certain development, its content construction and technical support remain in the operational management phase, with various safeguard measures needing improvement. In this process, technicians need to explore various aspects, accumulate experience, innovate content, achieve integration of different transmission content, and promote network upgrades.

Therefore, to promote the sustainable development of domestic 4K/8K ultra-high-definition television in the new era, it is necessary to introduce new technologies while integrating them with different media, provide new strategies for broadband broadcasting development, actively leverage the role and value of radio and television in social development, and improve efficient collaborative transmission of different information [10].

Conclusion

In summary, previous high-definition television technology can no longer meet people' s requirements. To provide audiences with clearer picture quality, it is necessary to integrate different types of information content and understand the current development status of domestic 4K/8K ultra-high-definition television, thereby further promoting the sustainable development of China' s high-definition television industry.

References

[1] Li Yu. From Analog to 8K: Current Status and Prospects of Ultra-High-Definition Television Development[J]. Sound and Screen World, 2019(1): 17-19.

[2] Wang Wei, Deng Zhengquan, Liang Lingjin. Construction of Guangdong Province' s 4K Television Network Application and Industrial Standard System Framework[J]. China Standardization, 2019(4): 219-.

[3] Zhang Peng. On the Application of 4K Technology in Television Practice[J]. China Media Technology, 2018(11): 69-70.

[4] Zhou Linlin. Observation and Prospect of Domestic 4K/8K Ultra-High-Definition Television Development[J]. West China Broadcasting TV, 2020(1): 196-198.

[5] Zhu Jiang, Chai Yan. Domestic 8K Ultra-High-Definition Development and IPTV Landing Prospects[J]. Modern Television Technology, 2020(11): 42-46.

[6] None. Guangdong Province' s 4K/8K Ultra-High-Definition Video Industry Development Achievements Display[J]. Cable TV Technology, 2019(8): 26-31.

[7] Pu Fang. Research on the Application of Wireless Transmission Technology in 5G in the New Era[J]. China Media Technology, 2020(7): 34-36.

[8] Shandong Electronic Information Industry Comprehensive Service Platform. 2019 World Ultra-High-Definition Video (4K/8K) Industry Development Conference Successfully Held in Guangzhou[J]. Information Technology and Informatization, 2019(5): 3.

[9] Song Changfa, Cheng Qiuping. Developing Ultra-High-Definition Video Must Still Adhere to "Content is King" [J]. China Telecommunications Industry, 2019(6): 56-58.

[10] Zou Liangzi. Jishi Media' s "5G+4K" Ultra-High-Definition OTT Intelligent Service Cooperation Proposal[J]. China Digital Cable TV, 2019(11): 104.

Author Biography: Pu Fang (1988-), male, Chongqing, engineer, research direction: wireless and satellite communication.

(Executive Editor: Hu Yang)

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