UHD World Association
世界超高清视频产业联盟

Technical requirements of network transmission of UHD video and audio broadcasting system for "Bai Cheng Qian Ping"

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Contents

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1 Scope

This document specifies the technical requirements for network transmission of UHD video and audio broadcasting system for "Bai Cheng Qian Ping".
This document is applicable to the transmission network in the UHD video and audio broadcasting system for "Bai Cheng Qian Ping".

2 Normative References

The contents in the following documents, through normative references in the text, constitute indispensable provisions of this document. Among them, the dated reference documents are only applicable to the version corresponding to that date; For undated references, the latest version (including all amendments) is applicable to this document.
RFC7761 Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification
RFC2236 Internet Group Management Protocol, Version 2
RFC3376 Internet Group Management Protocol, Version 3
RFC8200 Internet Protocol, Version 6 (IPv6) Specification
RFC8986 Segment Routing over IPv6 (SRv6) Network Programming
RFC8279 Multicast Using Bit Index Explicit Replication (BIER)
RFC9343 IPv6 Application of the Alternate-Marking Method
GB/T 17975.1-2010 Information Technology - Generic Coding of Moving Images and Associated Audio Information - Part 1: Systems
YD/T 1990-2019 Overall Technical Requirements for Optical Transport Network (OTN) Network
T/UWA 012.1-2023 Technical Requirements for programme broadcasting of UHD video and audio broadcasting system for "Bai Cheng Qian Ping"
T/UWA 012.2-2023 Coding of UHD video and audio broadcasting system for 'Bai Cheng Qian Ping' : system
T/UWA 012.3-2022 Coding of UHD video and audio broadcasting system for 'Bai Cheng Qian Ping' : video

3 Terms and Definitions

The following terms and definitions are applicable to this document.

3.1 Ultra high definition video and audio programme

UHD video and audio programme include 4K UHD video and audio programme and 8K UHD video and audio programme. Refer to T/UWA 012.1-2022 for the definition of 4K UHD video and audio programs and 8K UHD video and audio programs.

3.2 Bai Cheng Qian Ping

'Bai Cheng Qian Ping' means 'a hundred cities and a thousand large screens', which is a public promotion project, refers to the 8K UHD HDR image and 3D audio played on over a thousand large screens at commercial streets in more than hundred major cities.

4 Abbreviations

The following abbreviations are applicable to this document.

DR Designated Router
IGMP Internet Group Management Protocol
IP Internet Protocol
OTN Optical Transport Network
PIM Protocol Independent Multicast
QoS Quality of Service
RTP Real-time Transport Protocol
UDP User Datagram Protocol
SRv6 Segment Routing over IPv6
BIER Bit Indexed Explicit Replication
MSR6 Multicast Source Routing over IPv6

5 UHD Video and Audio service

'Bai Cheng Qian Ping' UHD video and audio live broadcast service includes 4K UHD video and audio live broadcast programme and 8K UHD video and audio live broadcast programme. According to 'Bai Cheng Qian Ping' UHD video and audio transmission system video and audio coding: video (T/UWA 012.3-2022), the bitrate of 4K UHD video and audio live broadcast programme shall not exceed 40Mbps, and the bitrate of 8K UHD video and audio live broadcast programme hall not exceed 120Mbps.

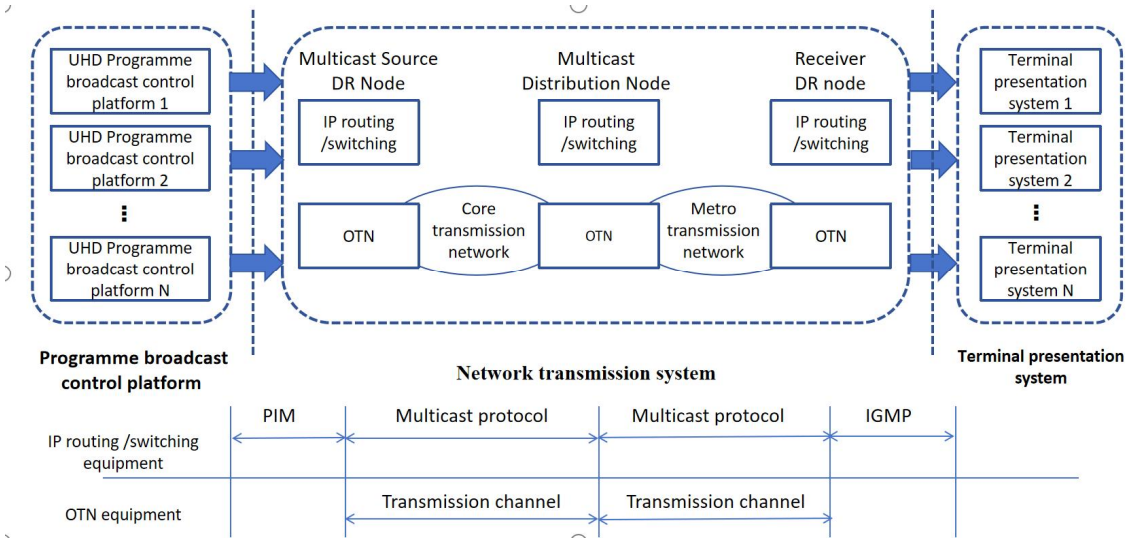
6 Network transmission system

'Bai Cheng Qian Ping' UHD video and audio network transmission system refers to Figure 1, which includes three parts: programme broadcast control platform, network transmission system and terminal presentation system. Live video streams from programme broadcast control platform are transmitted to the large screen terminals around the country for presentation through network multicast. The equipment types of the network transmission system mainly include IP routing/switching equipment and optical transmission equipment. IP routing/switching equipment is mainly responsible for receiving multicast streams and providing multicast routing protocols. Optical transmission equipment is mainly responsible for providing end-to-end UHD video and audio transmission channels.

Multicast service request process: the terminal presentation system initiates a multicast join request through the IGMP protocol, and network transmission system sends the request to the multicast source through the multicast protocol.

Multicast service distribution process: the multicast source is connected to network transmission system through the PIM protocol, and UHD live broadcast service stream is connected to the network through multicast. The live streaming service is transmitted through the transmission network from the multicast source to the terminal presentation systems via provincial/city multicast distribution nodes for presentation.

FIGURE 1 **UHD Video and Audio Network Transmission System**



7 Requirements of network transmission

7.1 Requirements of network capability

The transmission network provides a dedicated transmission channel for 'Bai Cheng Qian Ping' UHD video and audio services. The technical requirements for specific interfaces, slicing, QoS and protection refer to YD/T 1990-2019.

The core capabilities of transmission network should meet the requirements listed in in Table 1.

Table 1 **Requirements for key capabilities of transmission network**

No.	Core capabilities	Describe
1	Guaranteed bandwidth	End-to-end bandwidth guarantee, immune to the impact of other business traffic bursts.
2	Link reliability	The service cannot be interrupted, and the protection switching time is less than 50ms.
3	Service security	Service isolation and on-demand encryption.
4	Stable low delay	Stable latency and independent of network load
5	Management and control capability	Rapid end-to-end delivery and prioritized protection of service.

7.2 Requirements of network performance indicator

The network performance indicators of UHD live video and audio services should meet the requirements listed in Table 2.

Table 2 **Requirements for the network performance indicators of UHD live video and audio services**

Service type	4K live broadcast service	8K live broadcast service

Network performance indicators	Bandwidth	⩾ 50Mbps	⩾ 150Mbps
	Delay	＜ 100ms	
	Packet loss rate	⩽ 10^{-6}	
	Availability rate	⩾99.99%	

7.3 Requirements of Multicast protocol deployment

The multicast protocol shall meet the requirements listed in Table 3.

Table 3 **Requirements of Multicast protocol**

No.	Item	Technical requirements
1	PIM	Compliance with RFC7761
2	IGMPv2/IGMPv3	Compliance with RFC 2236 and RFC3376
3	Media type of IP transport stream	Support the transport stream from IP bearer network, and the type of the media stream conforms to the transport stream in GB/T 17975.1-2010
4	UDP/RTP transmission methods	Support the transport stream from IP bearer network, and the bearer video stream protocol meets the UDP and RTP transmission methods specified in T/UWA 012.2-2022

The deployment of multicast protocols should meet the following requirements.

1) Multicast sources must be compatible with the PIM protocol, use IP multicast addresses, and transmit data in IP multicast packets.

2) Using multicast IP to differentiate between different services, deploying multicast protocols end-to-end in the transport network to distribute services.

3) Multicast receivers must be compatible with the IGMP protocol.

4) IPv4 multicast support is required.

7.4 Requirements of optional protocol deployment

Optional protocol deployment shall meet the requirements listed in Table 4.

Table 4 **Requirements of optional protocol**

No.	Item	Technical requirements
1	IPv6	Compliance with RFC8200
2	SRv6	Compliance with RFC8986
3	BIER	Compliance with RFC8279
4	MSR6	Recommend reference to draft-lx-msr6-rgb-segment[3]
5	Network Slicing	Recommend reference to draft-ietf-teas-enhanced-vpn[4]

6	Flow detection	Compliance with RFC9343

The deployment of other protocols meets the following requirements:

1) IPv6/SRv6: support IPv6/SRv6 protocol, support service path planning and flexible service optimization.

2) New multicast protocol: support for BIER and MSR6 protocols, simplifying the multicast deployment process and increasing scalability by eliminating the need for intermediate nodes to maintain multicast group states.

3) Network slicing: Deploy network slicing and use slicing technology to reserve network resources for video services to avoid the interference from other services.

4) Flow detection: Through flow detection technology, collect the real-time information (such as bandwidth, link status, latency, and jitter etc.) of critical services for quality visualization. It is used to accurately locate and isolate network failures, ensuring that network transmission quality meets service requirements.

References

[1]GY/T 307—2017 Ultra High Definition Television System programmes Production and Exchange Parameter Values

[2]GY/T 315—2018 High Dynamic Range TV programmes Production and Image Exchange Parameter Values

[3]draft-lx-msr6-rgb-segment: RGB (Replication through Global Bitstring) Segment for Multicast Source Routing over IPv6 (https://datatracker.ietf.org/doc/draft-lx-msr6-rgb-segment/)

[4]draft-ietf-teas-enhanced-vpn: A Framework for Enhanced Virtual Private Network (VPN+) (https://datatracker.ietf.org/doc/draft-ietf-teas-enhanced-vpn/)