

5G-based UHD TV/HDTV Contribution



TECHNOLOGY BUREAU

Mei Jianping
2024.10.19

CMG
中央广播电视总台
CCTV CNR CRI CGTN



Overview

5G-based Media
Application Laboratory
(established in 2018)



Technical R&D +
Program Practice

Main research:

- ❑ Portable encoding and decoding transmission technology based on 5G network
- ❑ Development and application of 5G portable devices based on light mobile production and transmission system



Development of 5G-based Media Application In CMG



Multichannel transmission from 16 locations in 12 cities



70th anniversary of National Day



Multiple angles live contribution



The 100th Anniversary of CPC
5G UHD studio on the Winter Olympics train
the Winter Olympics Torch Relay



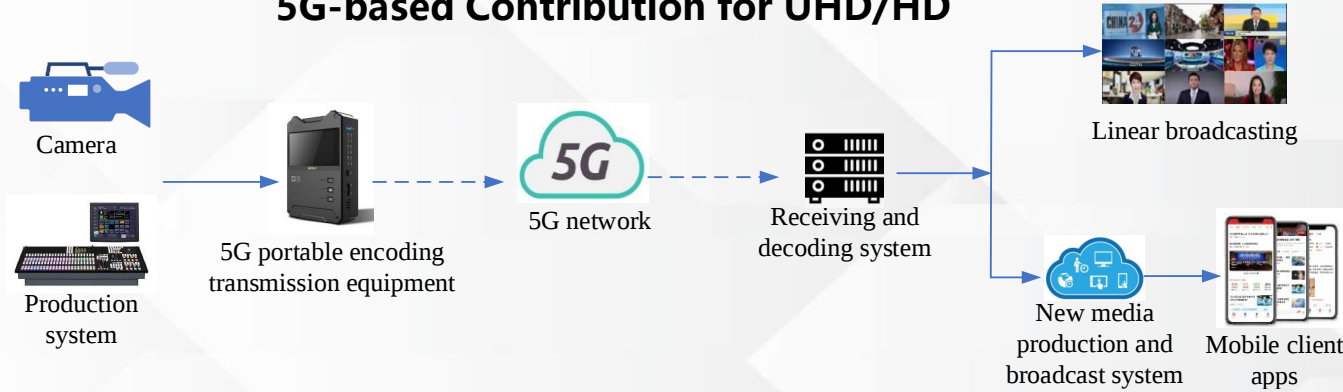
FISU Chengdu
Asian Games Hangzhou

	2018	2019	2020	2021-2022	2022
Encoding Latency(s)	1.5	1.5	1.2	0.8	0.2
New functions	Chipset encoding, wire connection to CPE	Backpack connecting to 5G cellphone via USB connector	Built-in 5G module supports single channel 4K or multi-channel HD transmission Support SRT transport protocol Support Integrated network management system	Channel-Bonding aggregation transmission technology 4-channel HD broadcast switching function Vertical screen encoding Support dynamic bitrate encoding	Reduced size, weight, and power consumption Low latency transmission mode IFB and Tally functions
New Application Scenarios	Fixed Point Transmission	Low-speed mobile transmission under single base station	Low-speed mobile transmission of vertical screen signals in 5G public network environment "Watch the game from different angles" Application	Enables ultra-high-speed mobile transmission across a wide range of base stations Vertical screen signal transmission Simple program production	Low latency, high reliable transmission Further satisfy to remote production
Volume(dm3)/Weight(kg)	6.5/7	2.6/4.7	4.4/5	3.4/4	2.2/1.25
Transmission bitrate range(Mbps)	1.5-60	1.5-80	1.5-160	1.5-200	1.5-70



Main Usage Scenarios

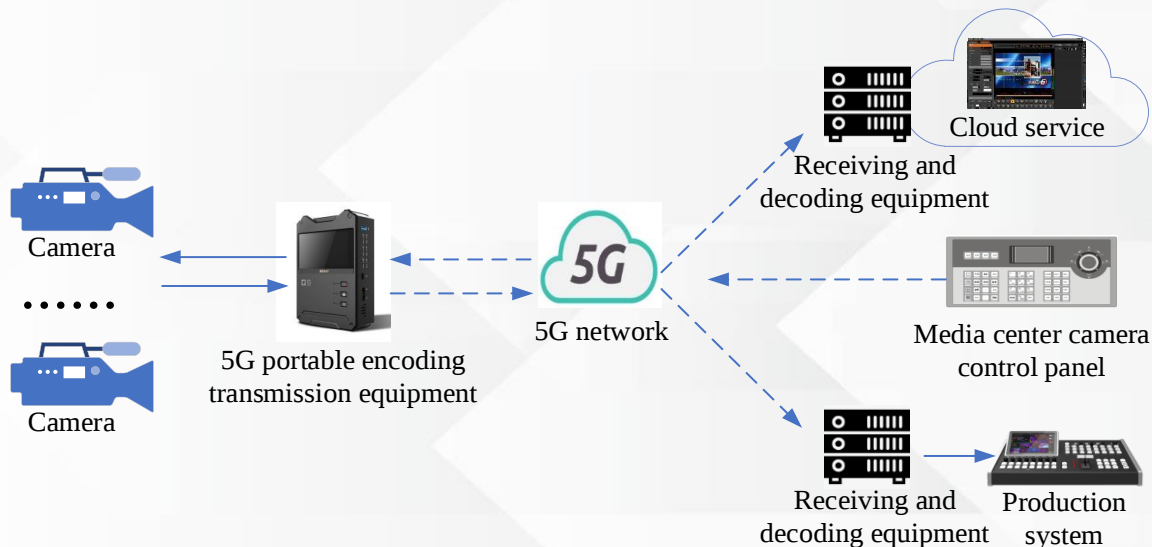
5G-based Contribution for UHD/HD



5G-based Contribution

- ❑ QoS guarantee
 - ✓ RB Reservation
 - ✓ 5QI
 - ✓ Black and White list
- ❑ Multimode
 - ✓ Fixed range in public areas
 - ✓ moving scenarios in public areas

5G-based Remote Collaborative Production for UHD/HD



5G-based Remote Collaborative Production

- ❑ Ultra low latency
 - ✓ 100-300ms
- ❑ Multimode
 - ✓ frame-level synchronized multichannel production
 - ✓ 5G-A UHD lightweight compression real-time production
 - ✓ lightweight AR virtual production.



Main Contents



5G-BASED CONTRIBUTION



5G-BASED REMOTE COLLABORATIVE PRODUCTION

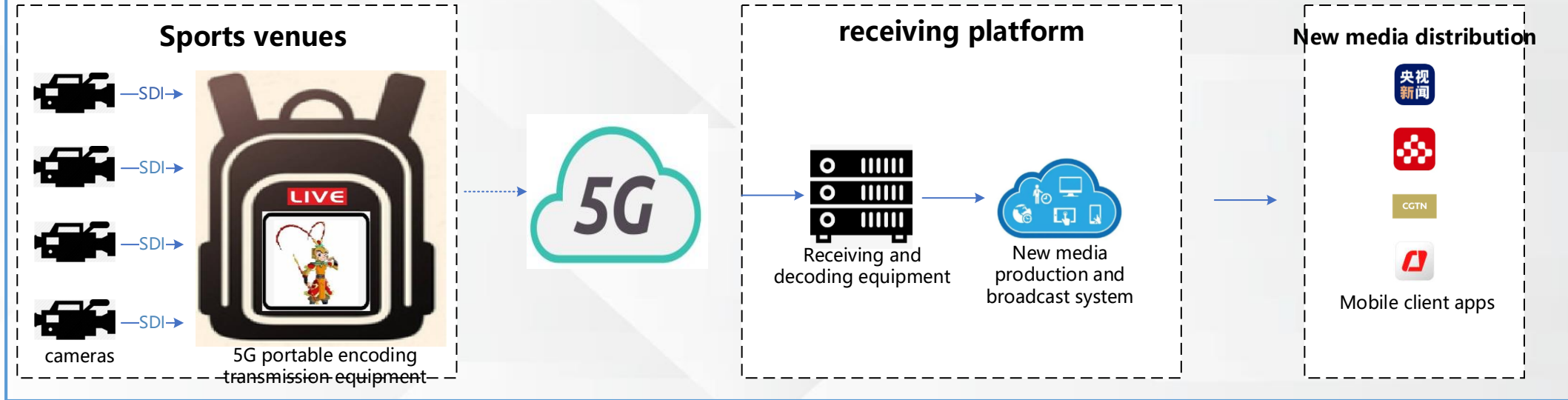


5G PORTABLE PRODUCTION AND TRANSMISSION SYSTEM



Multi-view Live Contribution

Multi-view live contribution system architecture

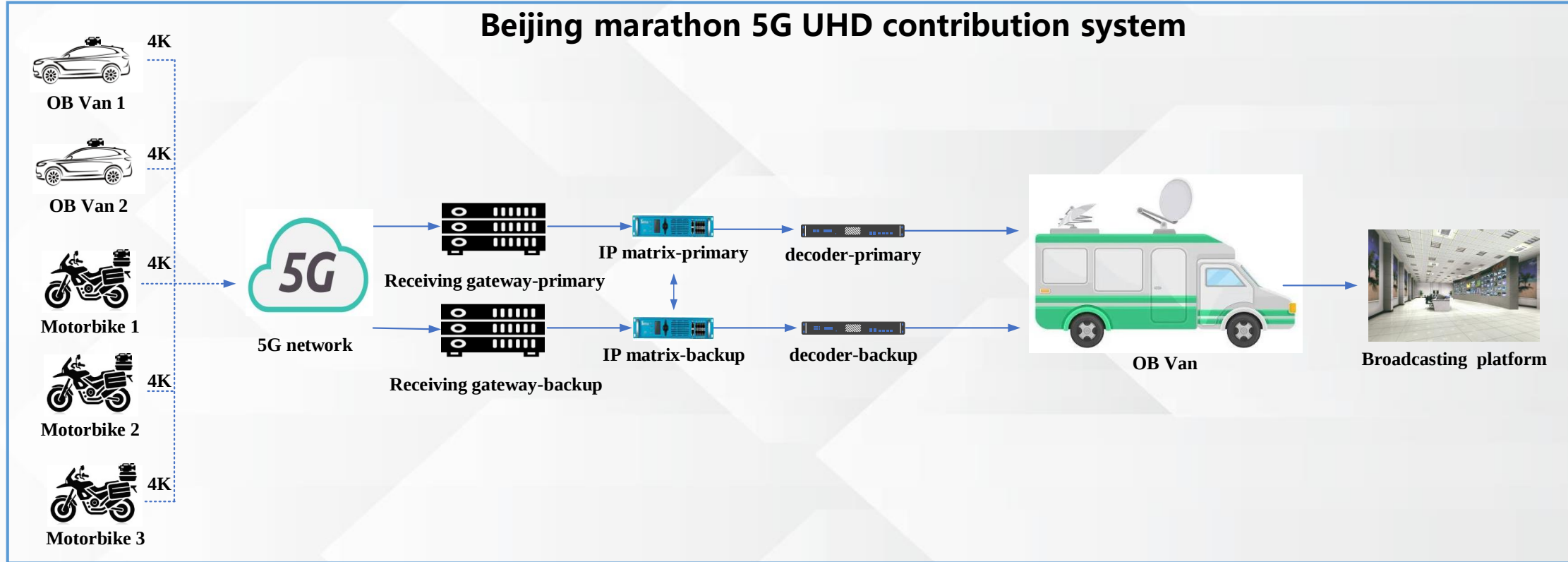


Frame-level synchronized transmission

- ❑ 4-channel HD signals (SDI) input
- ❑ Lightweight video switch function
- ❑ AES (Advanced Encryption Standard) encryption



Conventional Movement Contribution



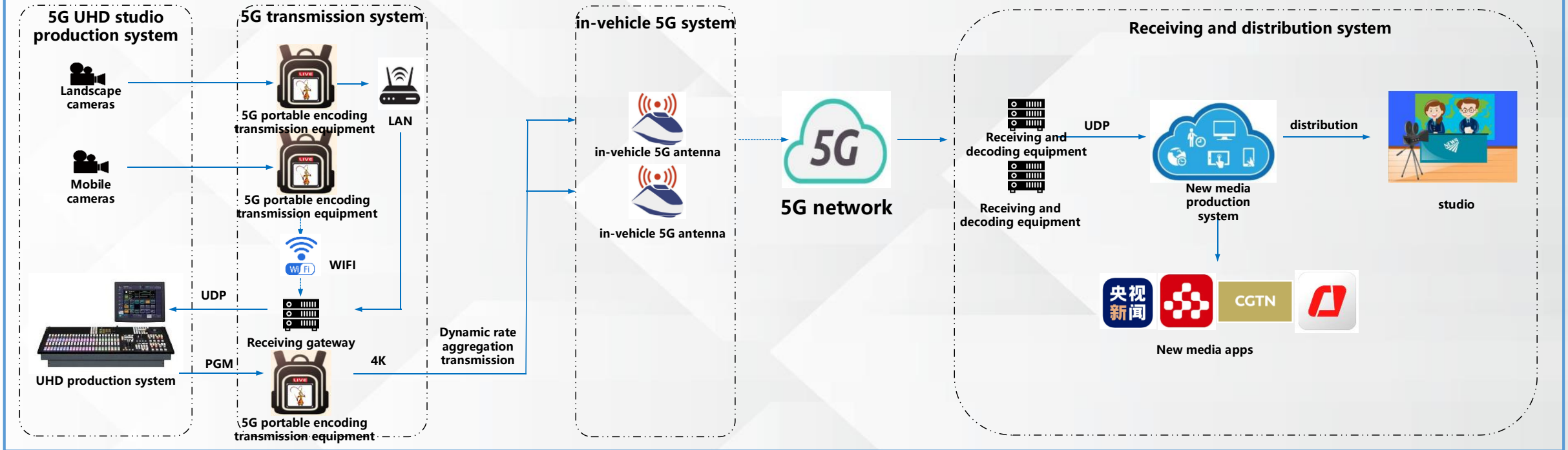
Optimized Encoding Technology

- ❑ Dynamic bitrate adjustment
- ❑ Intelligent stream splitting and multi-channel concurrent transmission
- ❑ Real-time call and map presentation



High-speed Movement Contribution

High-speed railway 5G UHD studio system in 2022 Beijing Winter Olympic Games



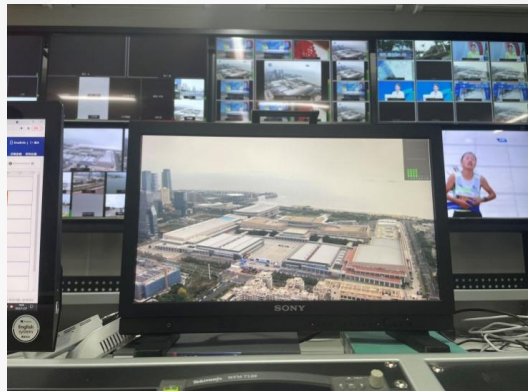
Improved 5G Transmission Technology

- ❑ Doppler frequency offset compensation
- ❑ Cells combination technology
- ❑ Spatial isolation
- ❑ Enclosed and semi-enclosed environments signal penetration loss compensation
- ❑ Multi-user multi-service security isolation technology



Low-altitude Flight Contribution

Low-altitude flight contribution system



Key Technology

- ❑ Ground base station "1+X" beamforming
- ❑ Helicopter airborne shark fin omni antenna
- ❑ Lightweight adaptation of drone 5G portable encoding transmission equipment



Main Contents



5G-BASED CONTRIBUTION



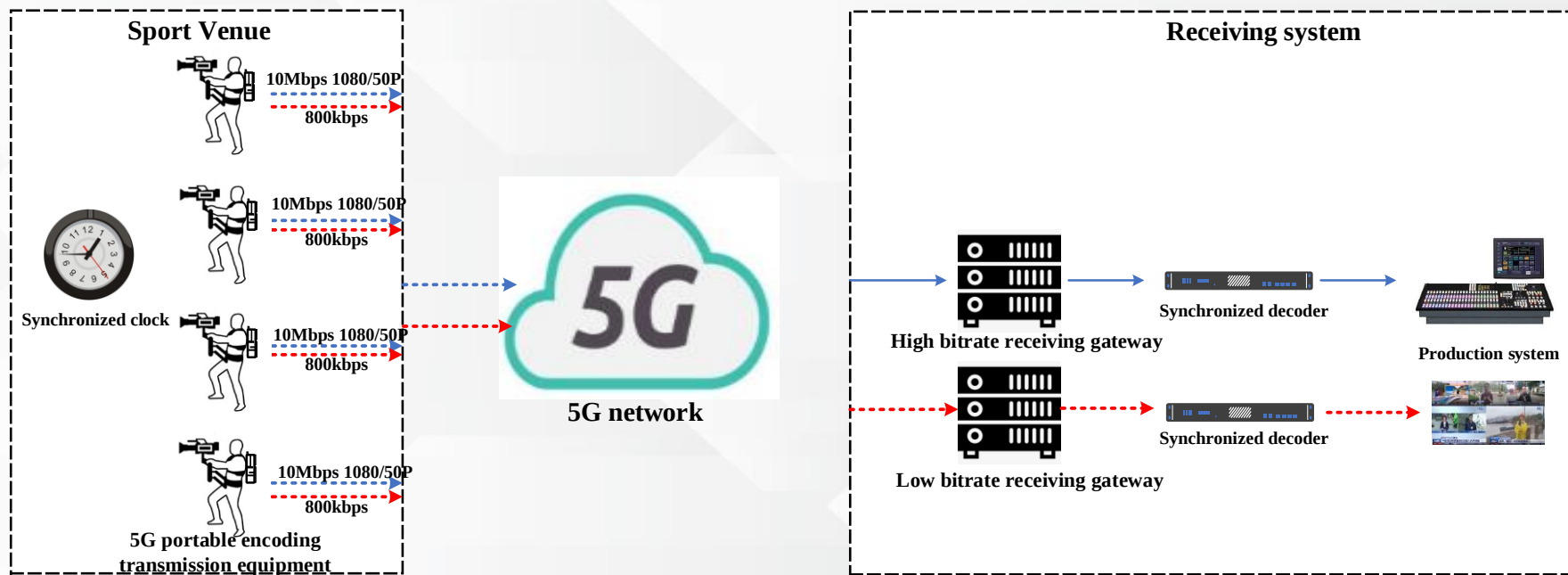
5G-BASED REMOTE COLLABORATIVE PRODUCTION



5G PORTABLE PRODUCTION AND TRANSMISSION SYSTEM

Multi-channel Signal Parallel Production

Remote production multi-channel frame-level synchronized transmission system



Key Technology

- ❑ Camera remote control based on GRE tunnel over 5G public network
- ❑ Frame-level synchronized transmission of multi-channel signals for multi-equipment



5G-A+JPEG XS lightweight compression hybrid production

Exhibiting Environment

- 3 × JPEG-XS (10:1/16:1) 5G-A
- 1 × SMP2110 Ethernet
- end-to-end delay: 100ms
- TALLY and remote control based on 5G





5G-A+JPEG-XS Application in Hangzhou 2023 Asian Games

5G-A超高清浅压缩编码实时制作

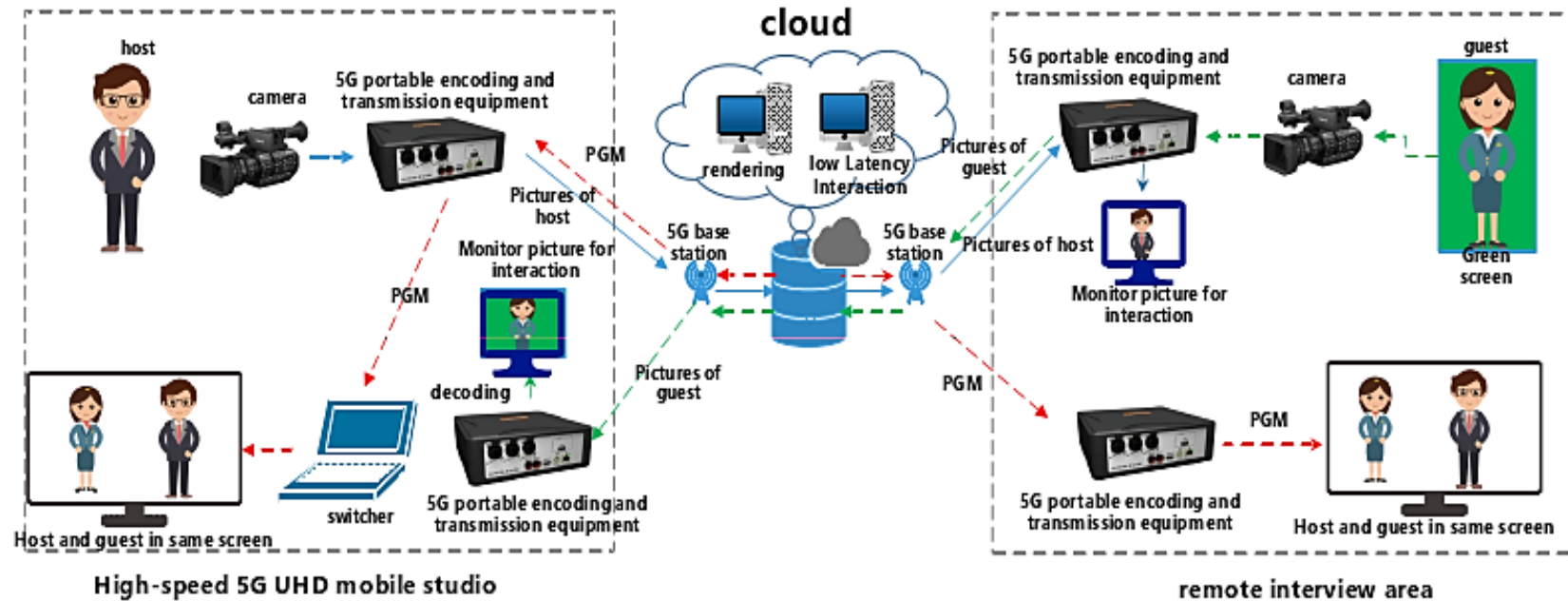
5G-A lightweight
compression decoding
picture
(JPEG XS 4K 8:1 1.1Gbps)





Lightweight AR Virtual Production

5G-based AR presentation system



Key Technology

- ❑ Mobile terminal network acceleration strategies and full-path congestion control algorithms
- ❑ Intelligent video encoding and decoding technology





Main Contents



5G-BASED CONTRIBUTION



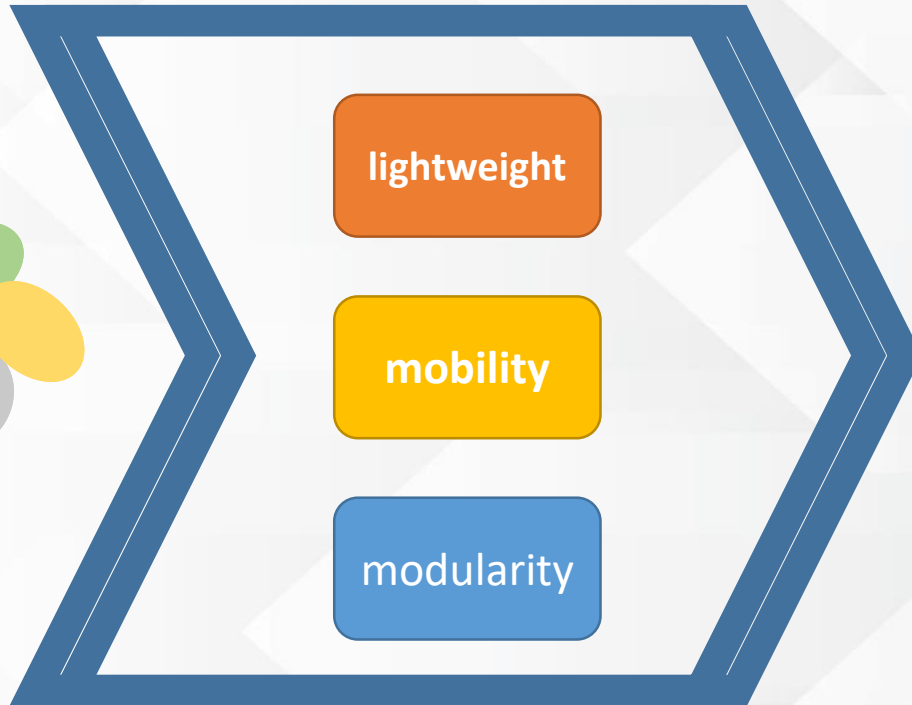
5G-BASED REMOTE COLLABORATIVE PRODUCTION



5G PORTABLE PRODUCTION AND TRANSMISSION SYSTEM



5G portable production and transmission system



- ❑ Portable and always ready to work
- ❑ Convenient shooting, lightweight production and diversified transmission
- ❑ Easy connection to other CMG production systems covering integrated publishing platforms, news cloud, and CMG media cloud



Applications of 5G portable production and transmission system

Combining XR/AR technology

Supporting 2000+ live events
of 300+ programs

Vertical format video/
multiple angles



Voice of China- two Days, One Night



CGTN-Trillion Cities



CGTN-Beautiful countryside



Remote production of the Xi'an
National Games





New ITU Standards

Radiocommunication Study Groups

Source: Documents [6B/17](#).

Subject: Proposed Draft new Report.



Document 6B/TEMP/XX-E.
XX March 2024.
English only.

Sub Working Group 6B-1

WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT
NEW REPORT ITU-R BT. [5GCE]

**Usage Scenarios and Key Technologies of 5G-based UHD TV/HDTV
Contribution and ENG**

Summary of revision

This document mainly proposes 2 revisions for original working document.

1. Reorganize the content of chapter 2.2 "PNI-NPN's QoS Guarantee Technologies". The updated chapter describes how to guarantee QoS of 5G transmission for UHD TV/HDTV in public network with technologies such as 5QI, RB reservation, wireless network optimization, black and white lists.
2. Renumber all the chapters to avoid complicated multilevel numbering.

As the procedure in last meeting in March 2024, this contribution is submitted to WP6B and copied to WP6A and WP6C.

Remaining tasks leading to approval

- Review the title and structure of the document.
- Bandwidth security.
- Check for the chapter numbering.
- Review by November 2024 meeting.

Attachment: WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT
NEW REPORT ITU-R BT. [5GCE] – Usage Scenarios and Key Technologies
of 5G-based UHD TV/HDTV Contribution and ENG

- ❑ CMG has submitted a new ITU Report proposal for ITU-R SG6 in March 2024, and the new Report is expected to be approved in November 2024.
- ❑ CMG plan to submit a new ITU Recommendation proposal for ITU-R SG6 which describes key parameters in 5G-based UHD/HD production and transmission in March 2025.



Future plan

- Continuously keep up with the development of new technologies
- Ultra uplink bandwidth
- Cloud + edge + terminal



Thanks for your attention!



TECHNOLOGY BUREAU

CMG
中央广播电视总台
CCTV CNR CRI CGTN