Emerging 8K services and their applications towards 2020

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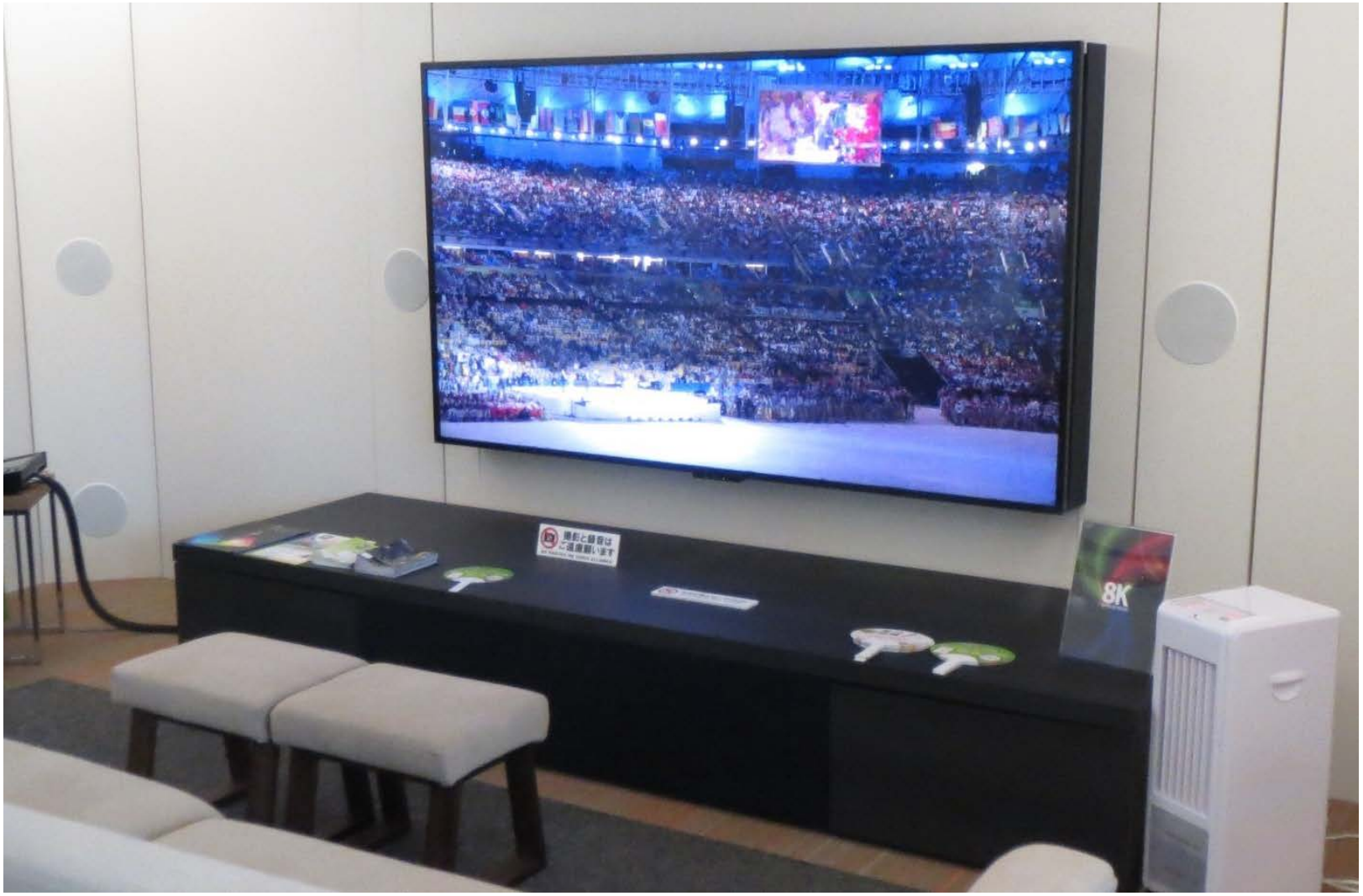
Status of 4K･8K delivery in Japan

- For B to C broadcast
  - Test services via satellite launched in 2016
    (with a limited number of receivers and monitors)
  - Commercial services via satellite will launch in 2018
    (with widely available TV sets)
  - Terrestrial system is under study
- For B to C broadband
  - Retransmission of satellite broadcast and hybrid services are under study
- For B to B delivery
  - Technical specifications for public viewing and 4K･8K theaters are under study

Towards 2020 Tokyo Olympic & Paralympic Games, opportunities for enjoying 4K･8K will dramatically increase

Everyone enjoys 4K･8K content all over Japan

- Receivers and monitors for test broadcast services

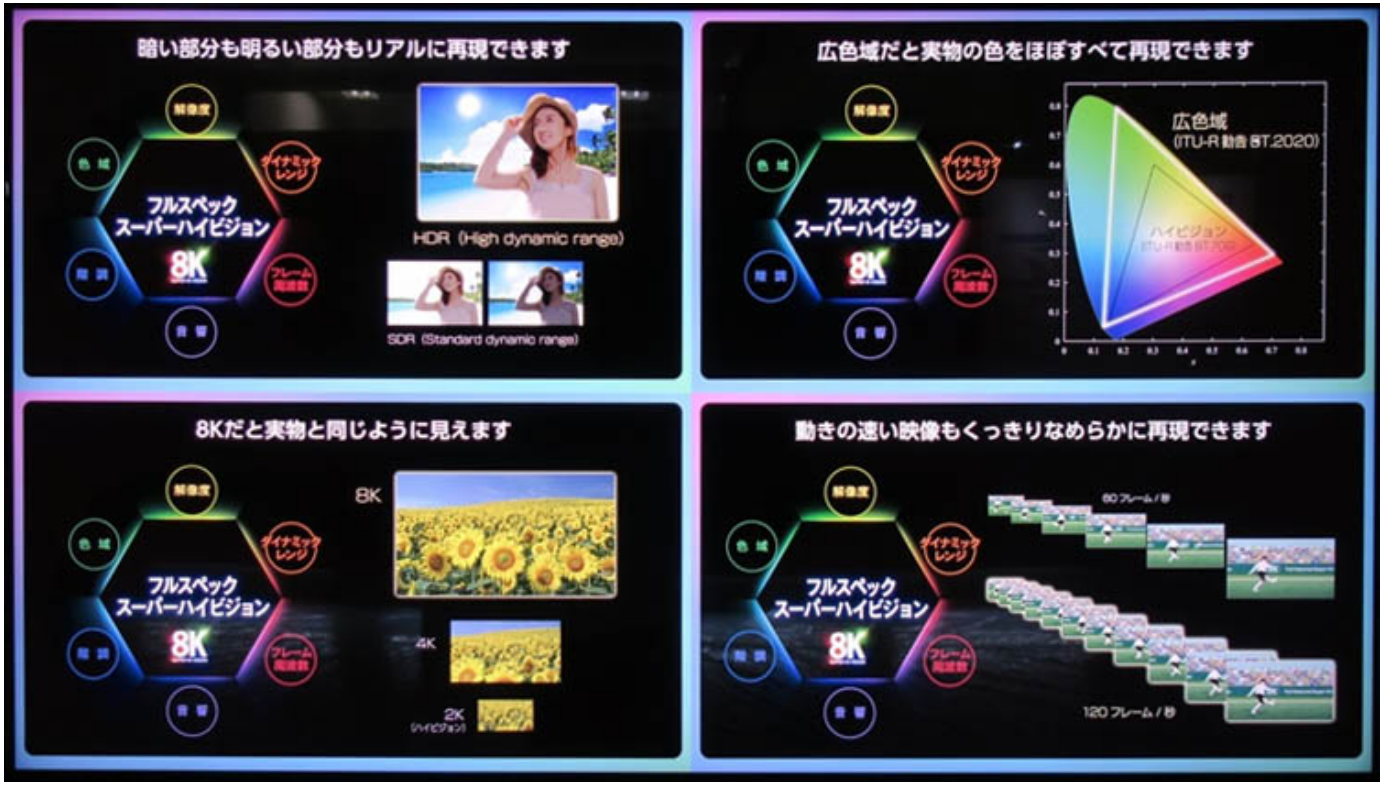


8K, more than resolution

- 8K offers even stronger sense of presence and realness to viewers

High dynamic range

Wide color gamut & 10-bit depth

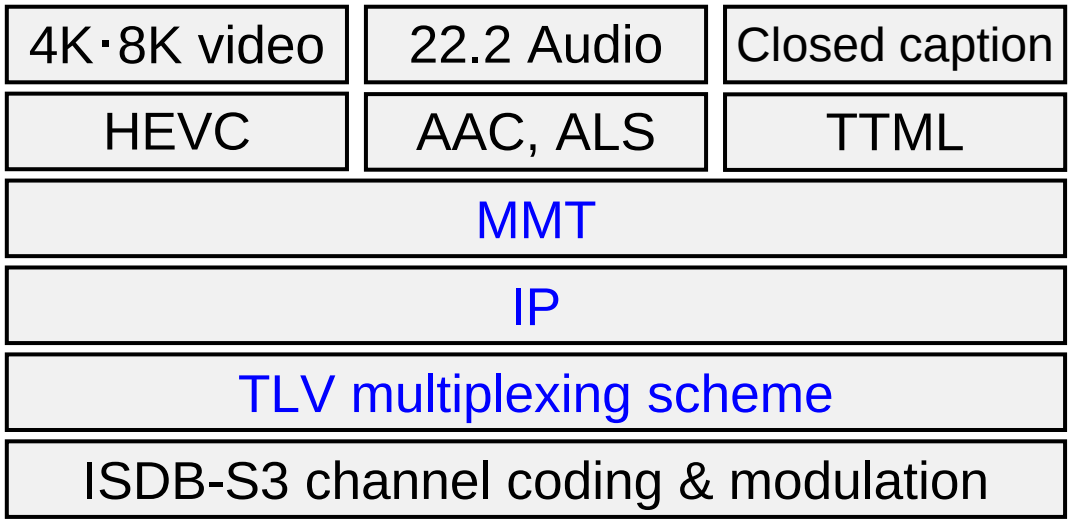


8K

60/P, 120/P

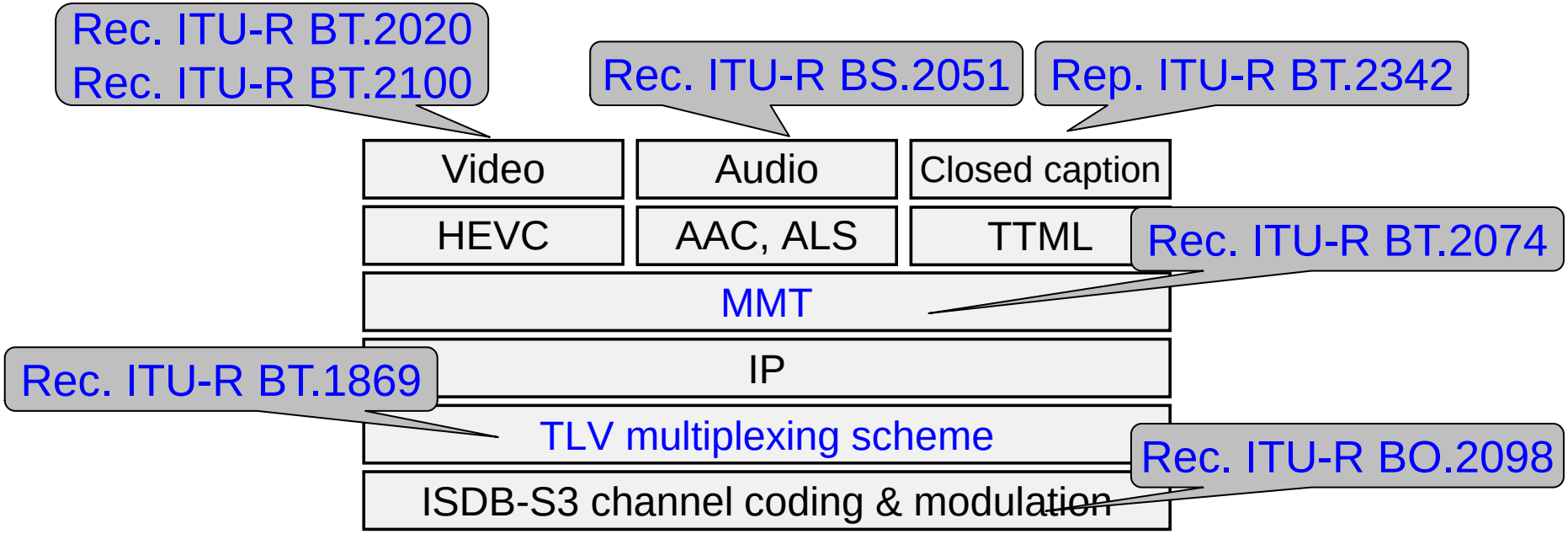
Delivery aspect of 8K broadcasting system

- Enables hybrid services, in which broadband are used together with broadcast to deliver content
- Uses IP-based media transport for hybrid services
  - MPEG Media Transport (MMT): for media synchronization
  - IP: for common interface between broadcast and broadband
  - TLV multiplexing scheme: for efficient transport of IP packets



*TLV: Type Length Value *TTML: Timed Text Markup Language

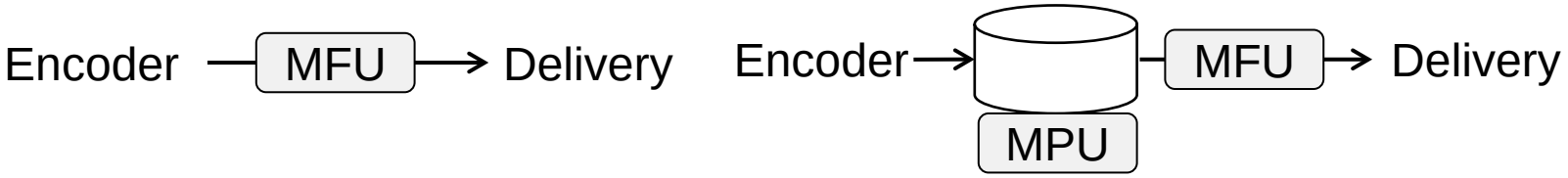
Related ITU-R Recommendations/Reports



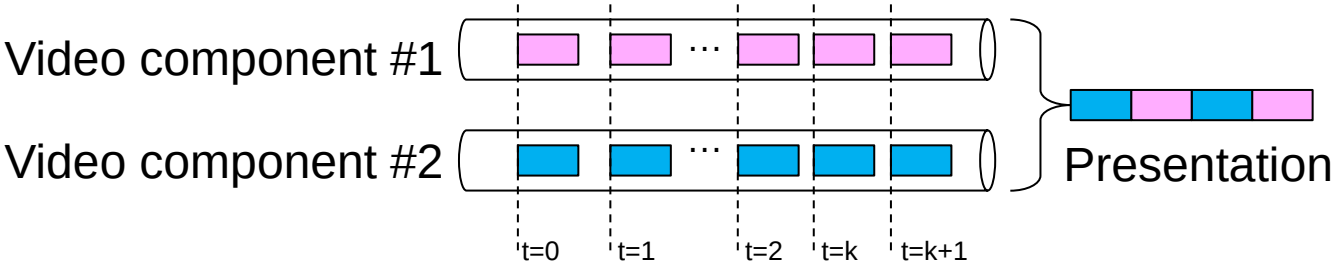
- Rec. ITU-R BT.2020, "Parameter values for ultra-high definition television systems for production and international programme exchange"
- Rec. ITU-R BT.2100, "Image parameter values for high dynamic range television for use in production and international programme exchange"
- Rec. ITU-R BS.2051, "Advanced sound system for programme production"
- Rep. ITU-R BT.2342, "Production, emission and exchange of closed captions for all worldwide language character sets (latin and non-latin) "
- Rec. ITU-R BT.2074, "Service configuration, media transport protocol, and signalling information for MMT-based broadcasting systems"
- Rec. ITU-R BT.1869, "Multiplexing scheme for variable-length packets in digital multimedia broadcasting systems"
- Rec. ITU-R BO.2098, "Transmission system for UHDTV satellite broadcasting"

Benefits of MMT for broadcast and hybrid services

- Low-latency encapsulation
  - Supports real-time streaming and file-based streaming



- Synchronization of audio & video from different channels
  - UTC-based presentation timestamp
  - Identifying media components with IP address
- Combination and switching of media components
  - Self-decodable structure for audio & video signals



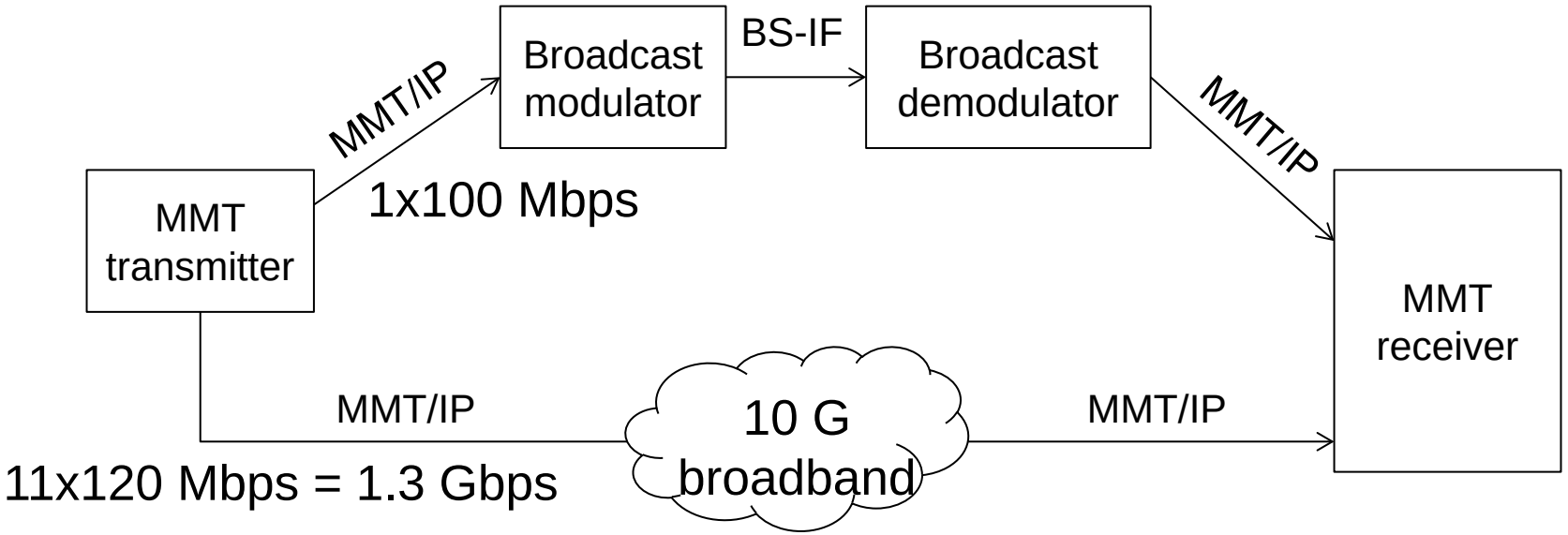
*MFU: Media Fragment Unit *MPU: Media Processing Unit

Technical elements on use cases

Use case		Technical elements		
		Media transport	Error resiliency	Session management
Broadcast (fixed reception)	Multicast	Rec. ITU-R BT.2074	Not required	IGMPv4, MLDv2
Broadband (retransmission, hybrid services)	Multicast		AL-FEC	IGMPv4, MLDv2
Broadband (hybrid services)	Unicast (unidirection)		AL-FEC	RTSP
Broadband (VoD, hybrid services)	Unicast (bidirection)	ISO/IEC 23008-1	TCP	HTTP

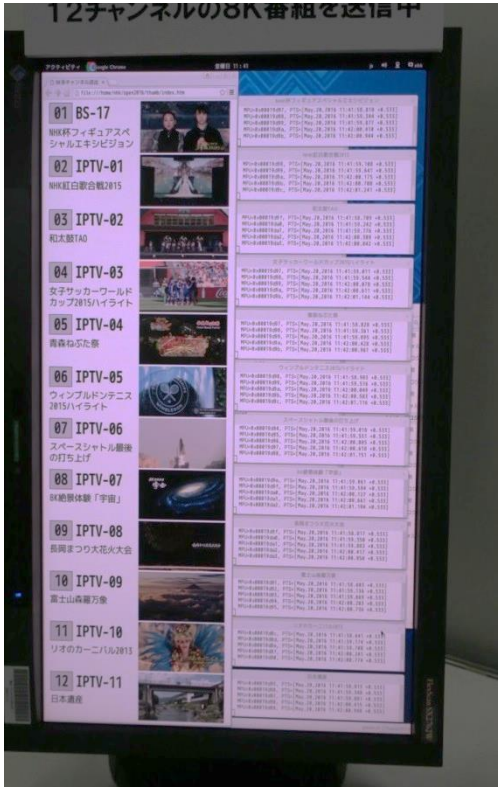
Demo #1: 11-channel 8K delivery over broadband

- Used 10G-EPON as broadband
  - 10 G broadband available in limited areas
- Transmit 11 programmes on broadband
  and 1 programme on broadcast
  - Approx. 11x120 Mbps including AL-FEC for broadband
    and 100 Mbps for broadcast



Channel change between broadcast and broadband

Transmitter



1
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11
12

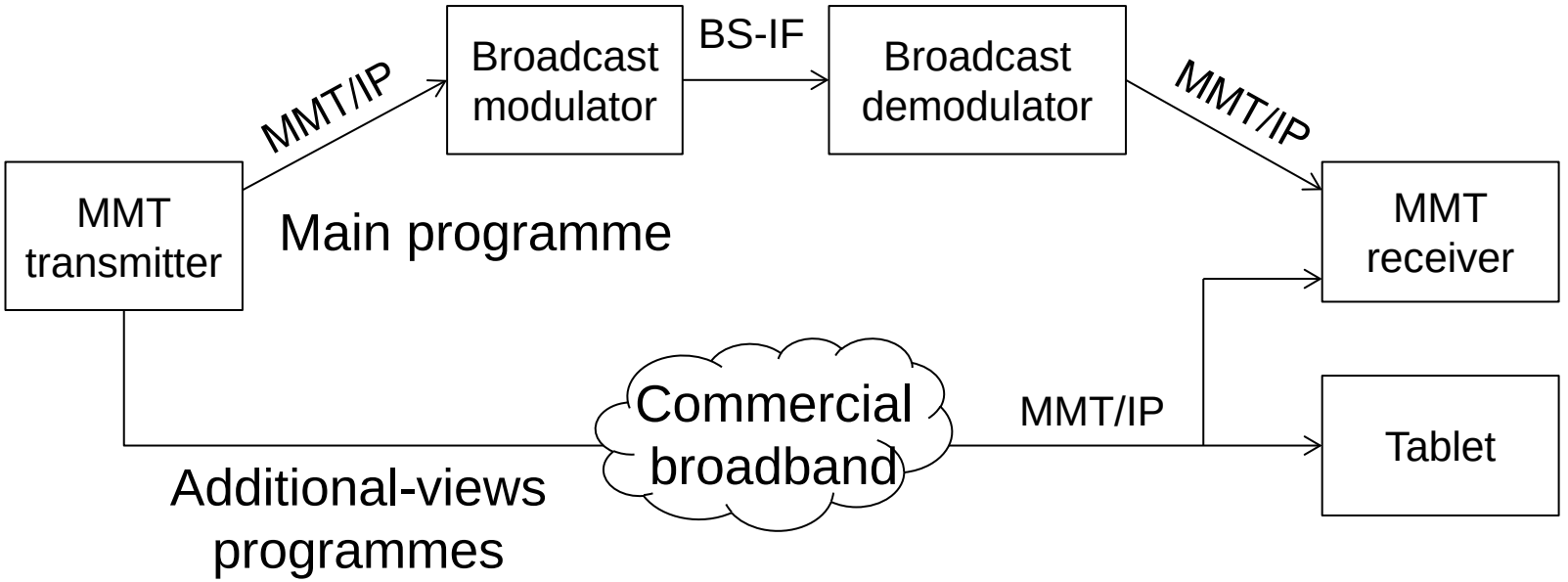
One programme for broadcast
and
Eleven programmes for broadband
(with AL-FEC)

Receiver

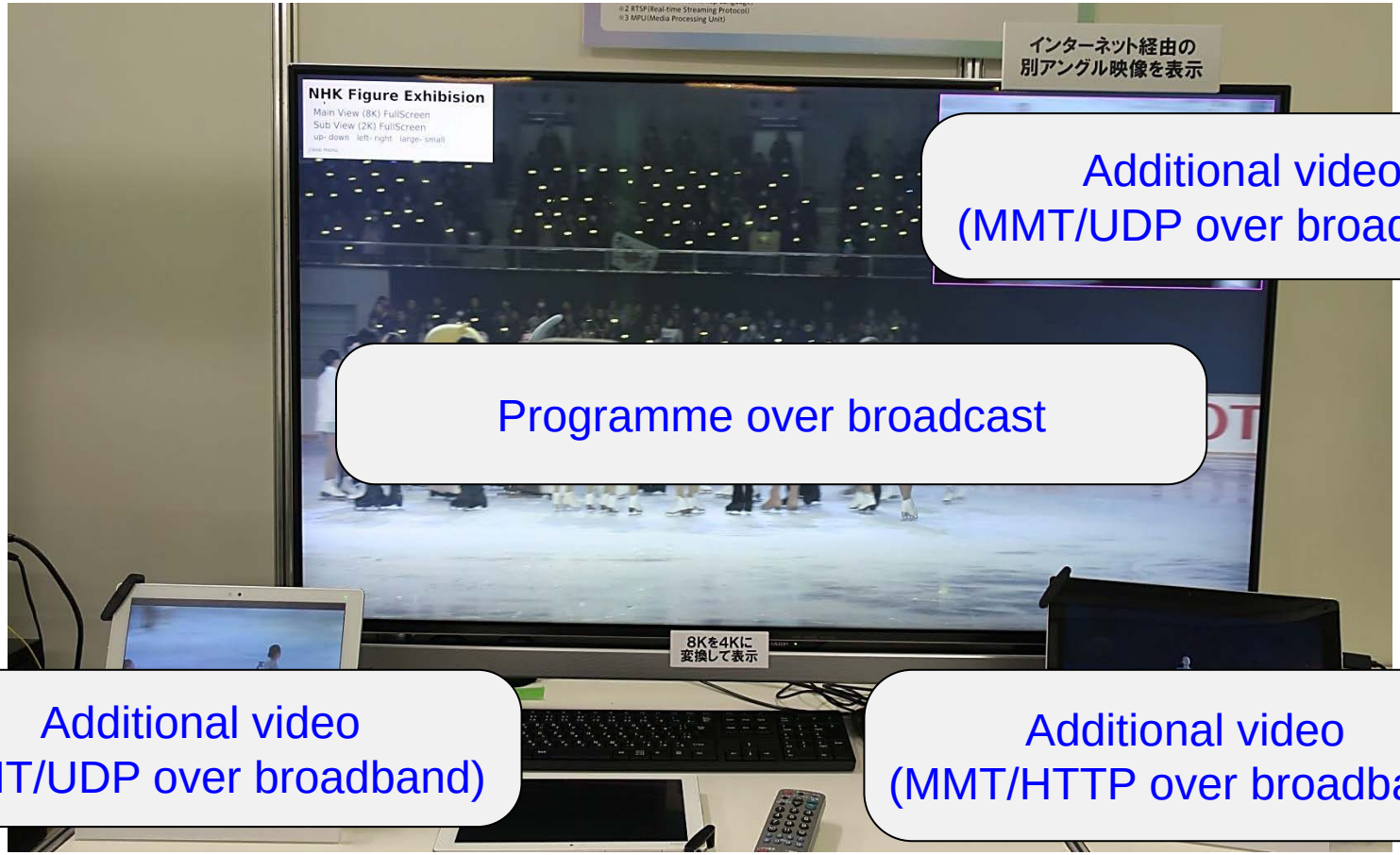
Selected one 8K programme is presented

Demo #2: hybrid delivery over commercial broadband

- Everyone can use this broadband about 40 US$ per month
- Picture in picture and tablet device for presentation
  - Synchronized presentation between programmes



Synchronization of two videos from different paths



Additional video
(MMT/UDP over broadband)

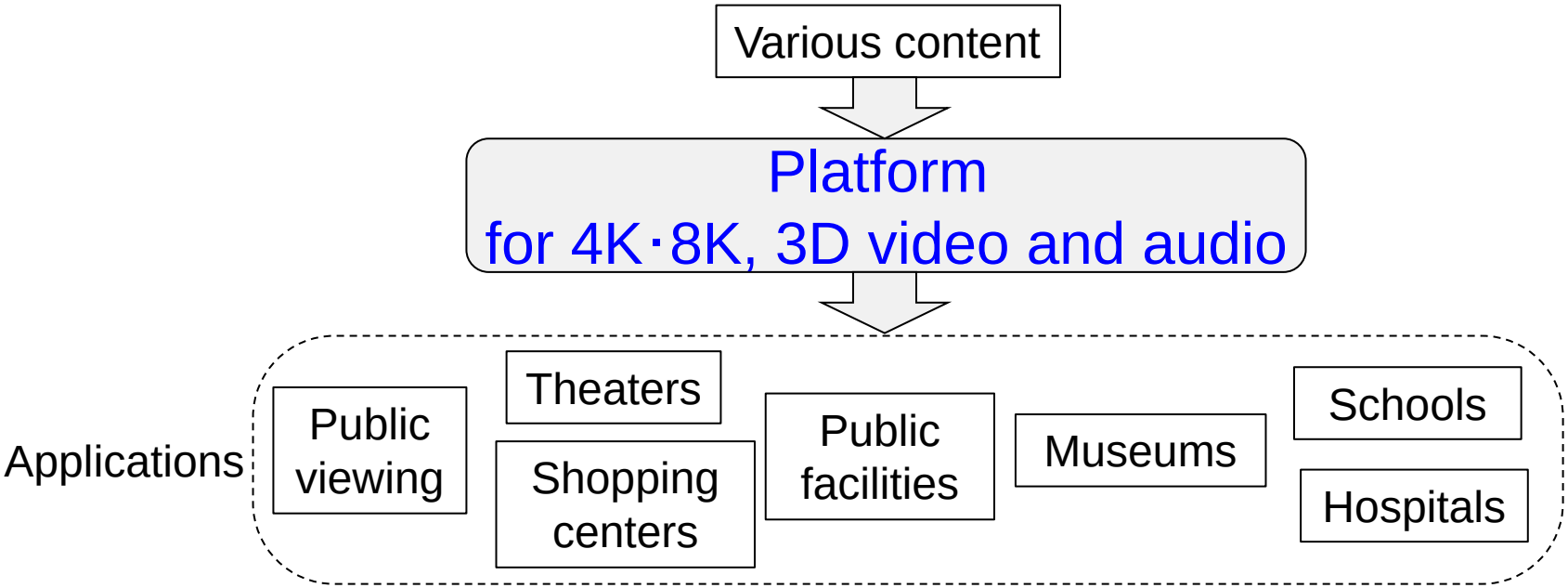
Programme over broadcast

Additional video
(MMT/UDP over broadband)

Additional video
(MMT/HTTP over broadband)

For B to B delivery

- Next Generation Contents Distribution Forum (NexCDi-F) was established in 2016
  - Members include content creators, broadcasters, manufactures, teleco companies, and so on
  - Developing technical specifications for delivering next-gen content including 4K･8K
  - Promoting facilities having large screen for next-gen content



Plan of NexCDi-F towards 2020

- Services will start at limited areas in 2017
- Environments for business will be prepared in 2018
- Services will start until Rugby World Cup in 2019
- Services will spread all over Japan in 2020

Conclusions

- Overview of 4K･8K satellite broadcasting system
  - MMT as media transport protocol
  - Related ITU-R Recommendations
- Demos on hybrid services
  - 11-channel 8K content delivery over broadband
  - Synchronization of multi-view videos
- B to B delivery is also being studied by NexCDi-F for public viewing and theaters

- It is expected that 4K･8K will be widely enjoyed in 2020
- The Tokyo Olympic & Paralympic Games in 2020 will be delivered out to viewers through various channels