WIRELESS WORLD RESEARCH FORUM HUDDLE 2025

SHURE

Immersive Audio Production in Live Events

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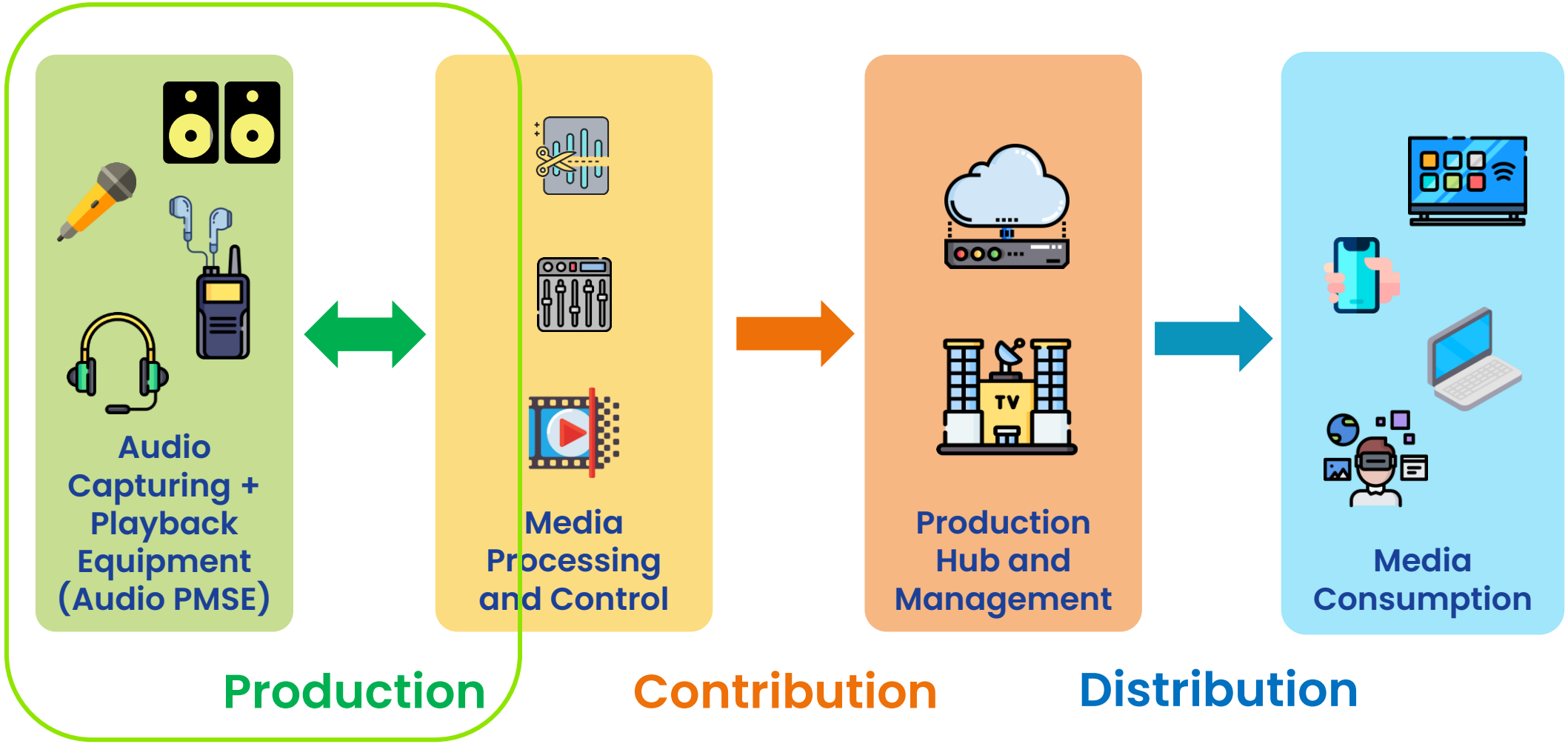
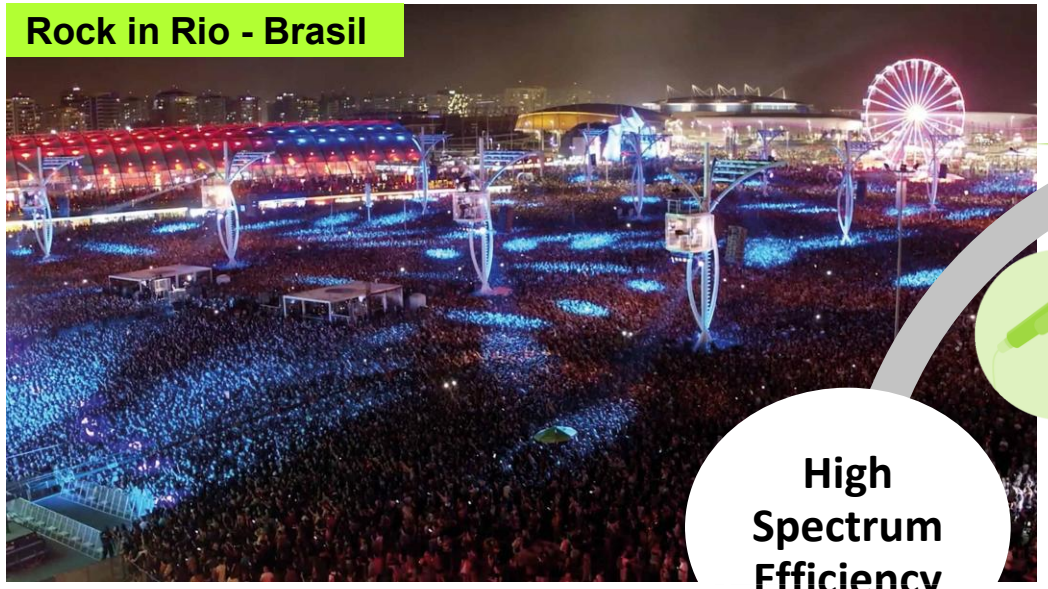
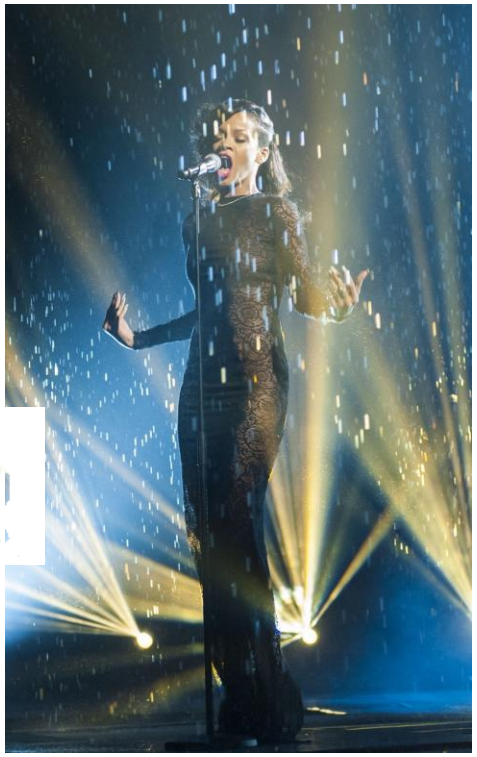
Content Delivery Chain



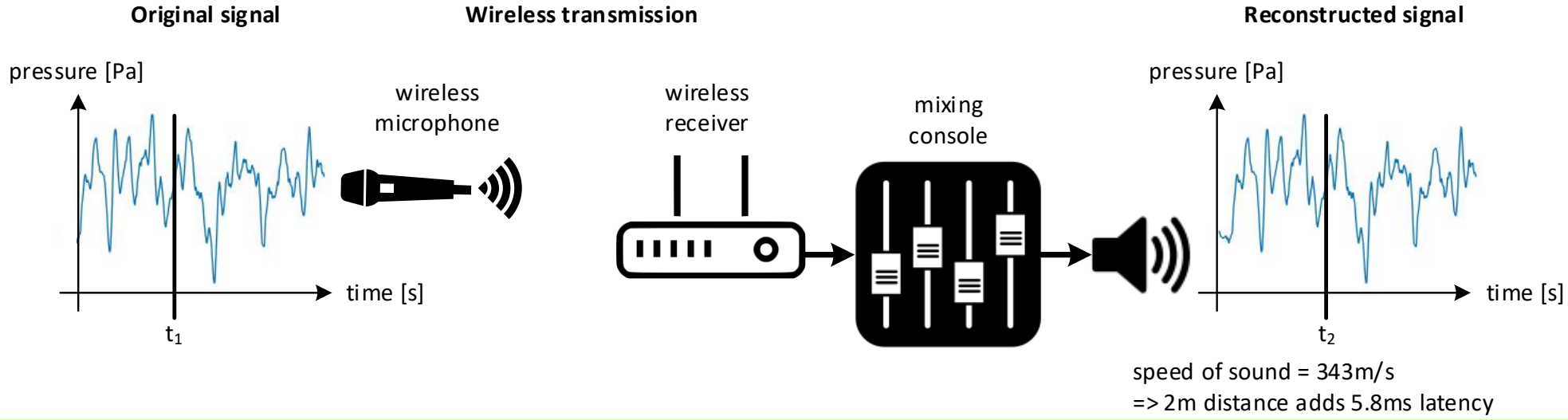
PMSE: Programme Making & Special Events

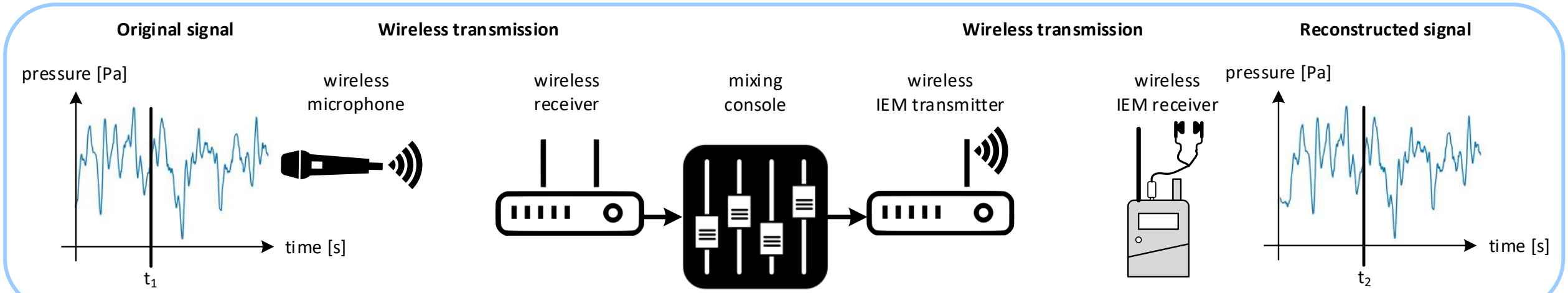
Audio PMSE Requirements





Stringent Latency Requirements

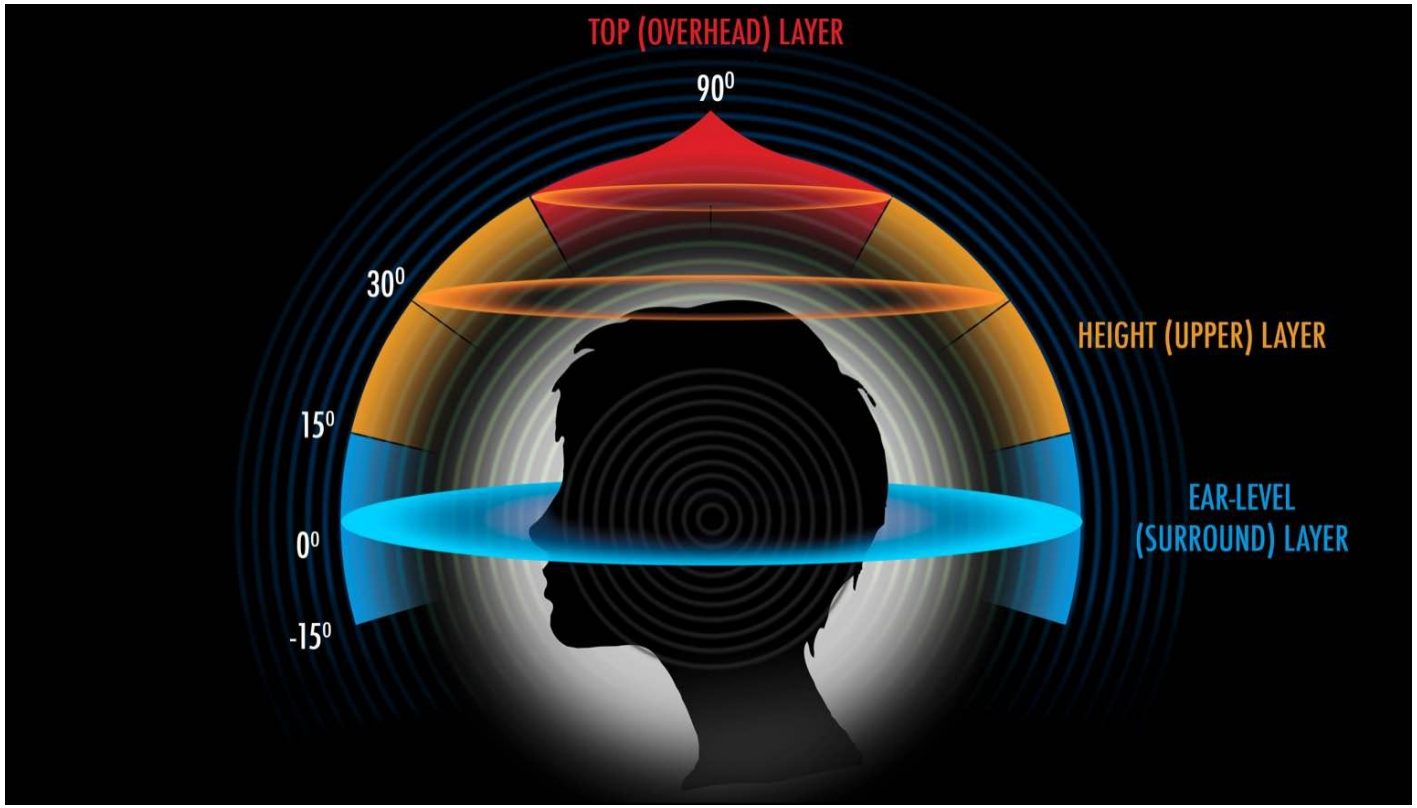




IEM: In-Ear Monitor

Immersive Audio

- Any audio that gives you a sense of space beyond conventional stereo, allowing the user to pinpoint where sound is coming from



Source:
Abbey Road Studios

Capturing Immersive Audio

Channel:

- Each capturing device (mic) is routed to its own channel / speaker
- Fixed location dependency between source and sink
- Output of capturing device is a raw mono audio stream

Object:

- Each of the audio sources (mics) is encoded independently
- Renderer at reproduction side positions the audio
- Output of capturing device is a raw mono audio stream with positional metadata

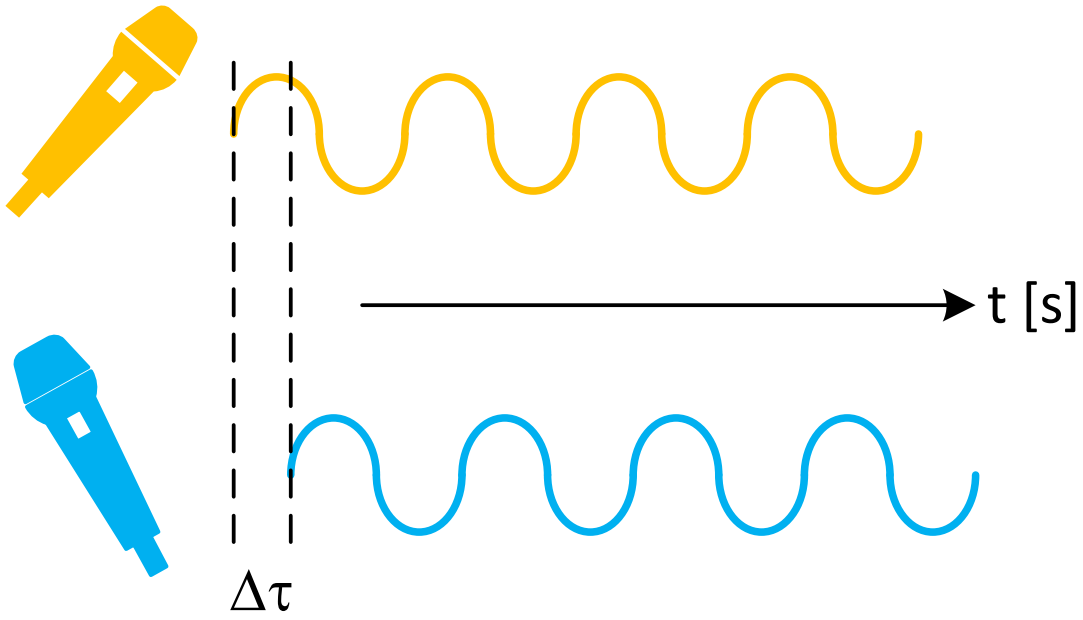
Ambisonic:

- Full 360-degree sphere is captured from a single point
- Capturing device is a mic array with at least four transducers
- Output of capturing device: raw mono audio streams with positional metadata or ambisonic stream

Required New Features

- Positioning / location tracking of sound capturing devices

- Tight synchronization of the output audio streams of the various capturing devices used to create the final immersive audio stream



Why 6G?

- At present, there is no wireless technology available that offers all aforementioned functionalities with the required quality
  => applications / use cases for 6G are currently being collected and specified, as the definition phase is still ongoing.

- Standardized technologies lead to highly integrated solutions
  => reduces the costs of developing new products

- Content production encompasses a wide variety of different wireless technology
  => possibility to combine all under 6G

Functionalities Covered by 5G

- Non-public networks (NPN) that can be deployed in an agile and ad-hoc way
- Periodic deterministic data packet transfer
- Low-latency real-time communication
  - standardized 5QI supporting a packet delay budget of 5ms
- Clock synchronization and time-sensitive communication

Potential New KPI Requirements

Scenario	# of active UEs (Note 1)	Max. UE speed [km/h]	Max. service area [m²]	Synchronicity [µs] (Note 2)	Max. E2E latency [ms] (Note 3)	Positioning accuracy [m] (Note 4)	Min. packet error rate	User data rate UL [Mbit/s] (Note 5)	User data rate DL [Mbit/s] (Note 6)
UE device type A: microphone array									
large-scale event	15 - 80	50	500 x 500	1 - 10	0.5	0.5 - 1	10^{-6}	5 - 20	0.5 - 2
small-scale event	1 - 15	10	50 x 50	1 - 10	0.5	0.5 - 1	10^{-6}	5 - 20	0.5 - 2
UE device type B: single transducer microphone									
large-scale event	50 - 300	50	500 x 500	1 - 10	0.5	0.5 - 1	10^{-6}	1.2 - 2.5	0.5 - 2
small-scale event	4 - 50	10	50 x 50	1 - 10	0.5	0.5 - 1	10^{-6}	1.2 - 2.5	0.5 - 2

Note 1: the figures are estimated assuming a steady increase in the use of wireless mics based on the development of the last decades
Note 2: according to 5G-MAG report on "Time synchronization services for media production over 5G networks"
Note 3: more stringent values compared to TS 22.263 [67], Table 6.2.1-1 as immersive audio requires higher processing time for encoding and decoding
Note 4: estimated range based on experience with current immersive audio productions
Note 5: range from uncompressed audio with 24bit / 48kHz up to 24bit / 96kHz as for immersive audio uncompressed audio is preferred and there is no compression mechanism for immersive audio available at this point in time
Note 6: range from compressed audio up to uncompressed audio with 16bit / 48kHz for the use in IEMs

Summary

- Very stringent requirements on latency for live scenarios
- Isochronous nature of the audio signal requires periodic deterministic packet transfer
- Location tracking and synchronization at application layer are new required features to support immersive audio production
- Work is currently underway to incorporate the potential new requirements into 3GPP TR 22.870: “Study on 6G Use Cases and Service Requirements”


Thank you for your attention!
Any further question?
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