JVET-AM0235

Implementation of error resilient transmission system for scalable services

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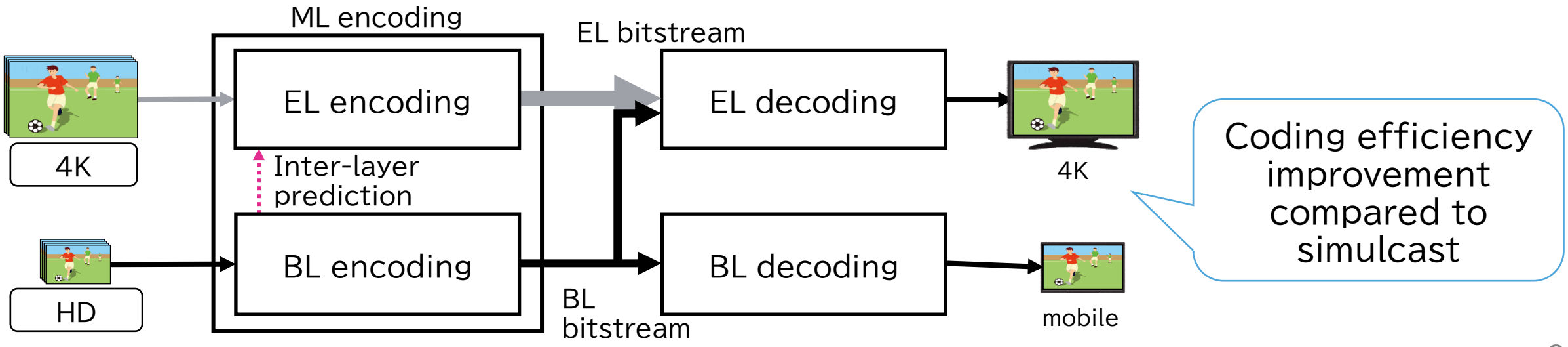
Introduction

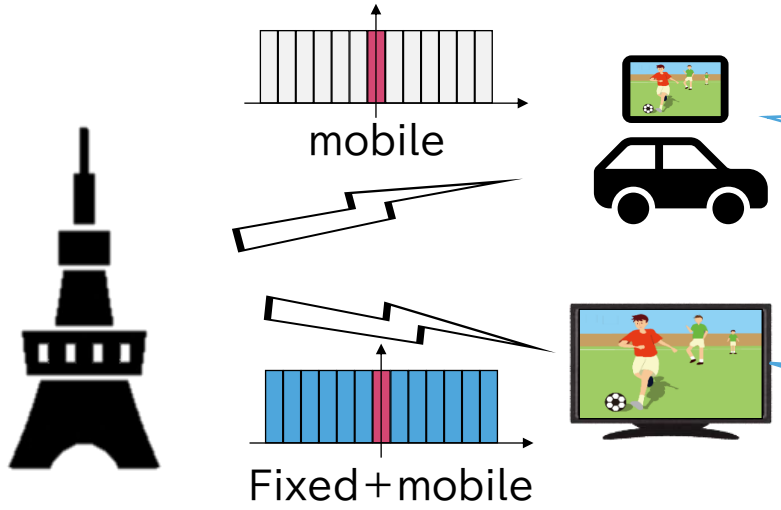
- With an increasing diversity of user environment (devices, network), there is a growing demand for transmission systems that can flexibly adapt video quality and resolution to varying reception conditions.
- **Multi-resolution video services** have gained attention as a promising approach.
  - Multilayer VVC becomes feasible to transmit a base layer that ensures minimum acceptable quality, along with one or more enhancement layers that refine the video quality.

Scalable service using VVC multilayer



Use case of VVC multi-layer coding

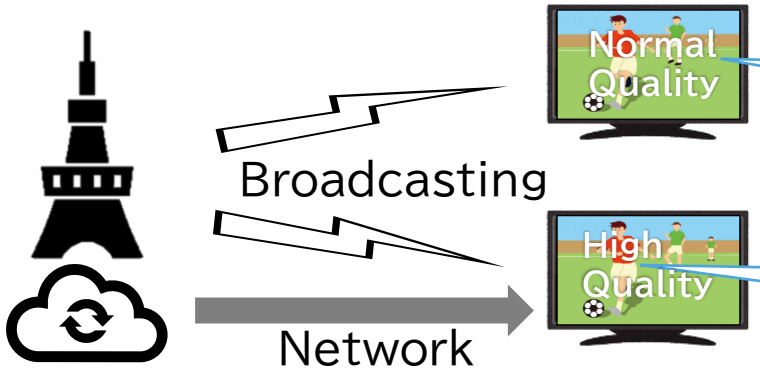
Multi-resolution services via transmission paths with varying reception robustness, using different modulation schemes.



Receives the BL stream via a transmission path with high robustness, designed for mobile reception.

Receives the BL stream via a mobile-optimized robust transmission path, and the EL stream via a fixed-reception transmission path

Service with broadcast and broadband



Receives the BL stream directly from the broadcast signal.

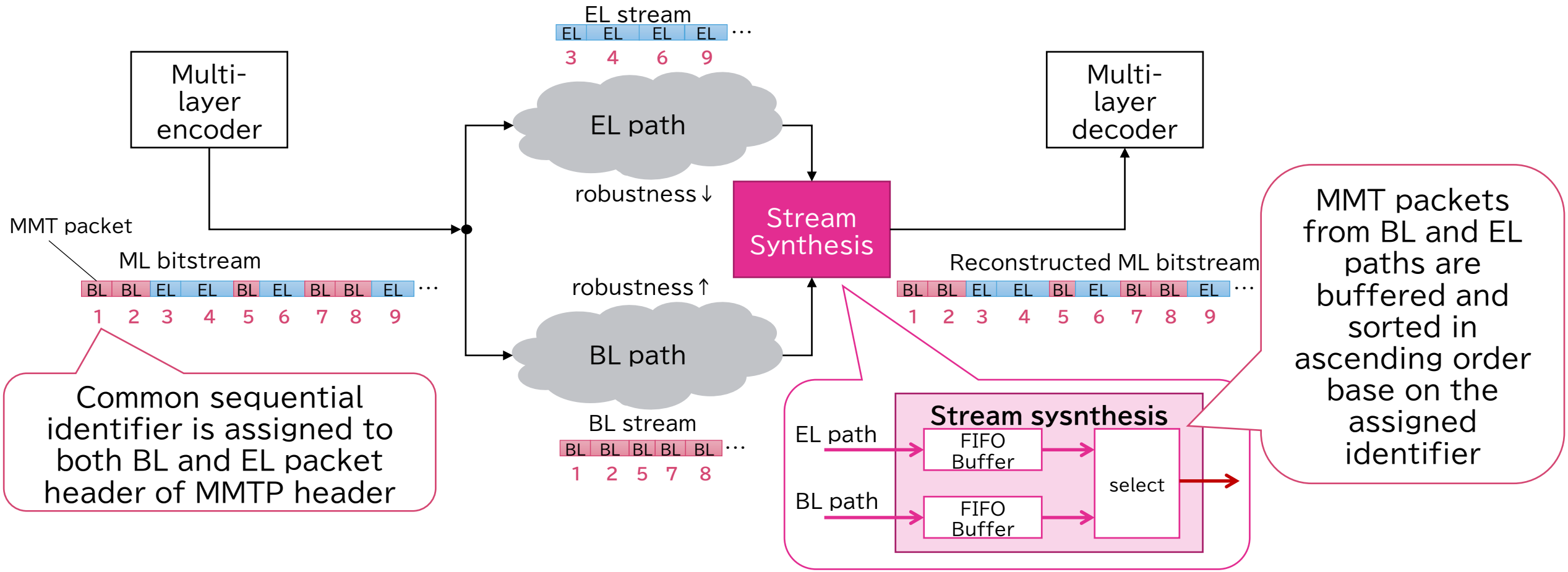
Receives the BL stream from broadcast signals and the EL stream via networks.

A transmission system was developed to accommodate diverse use cases, considering path-specific delay variations and transmission errors.

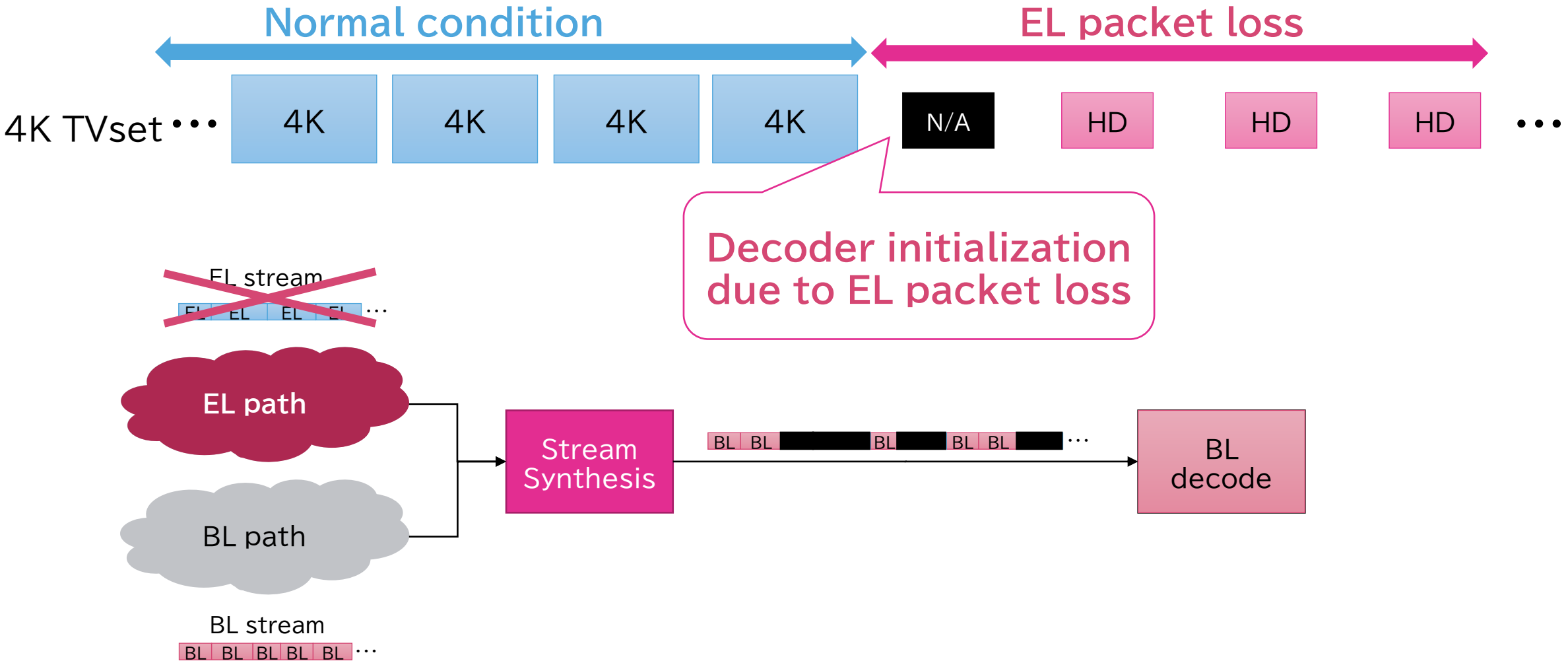
Stream synthesis with delay compensation

The system assumes:

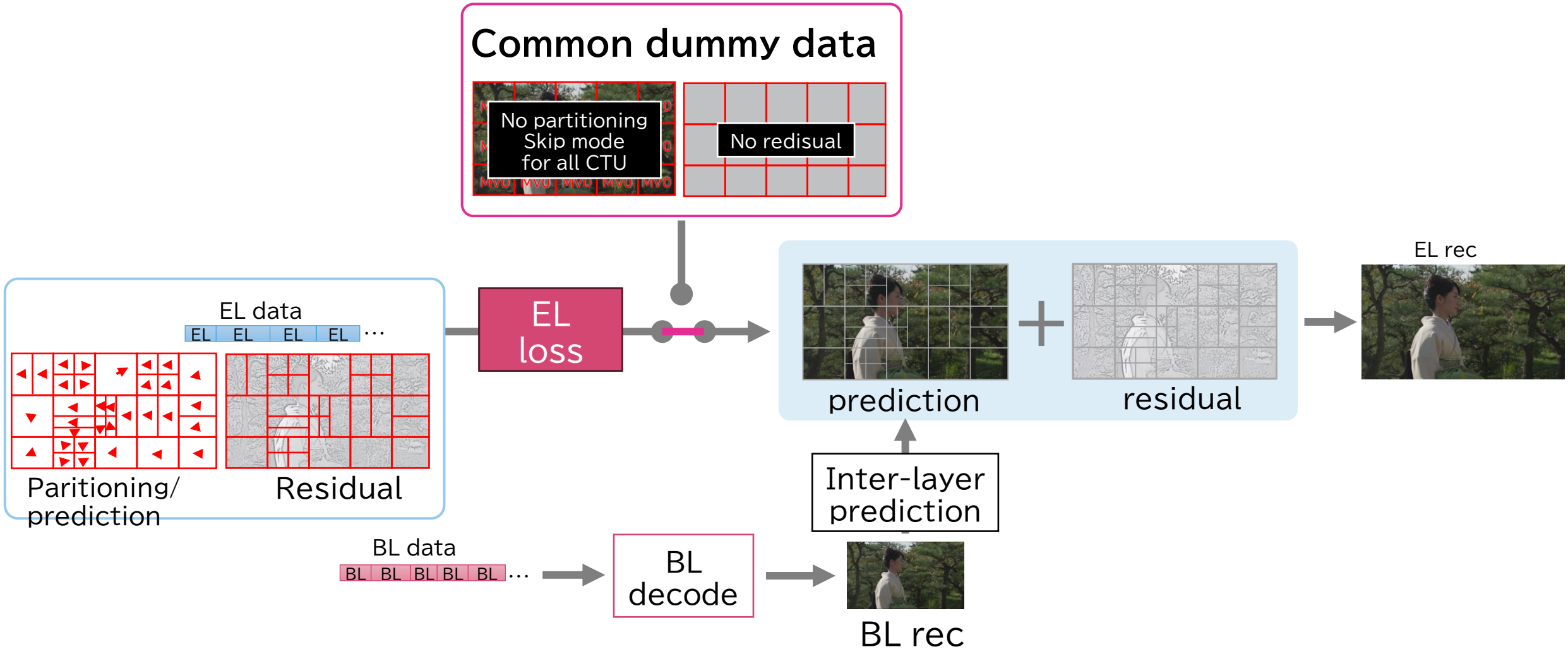
- BL stream is transmitted over a highly robust path, and EL stream over a less robust path
- Packet arrival order may vary due to differences in transmission paths between BL and EL
- CMAF/MMT multiplexing methods are considered for next-generation broadcasting services



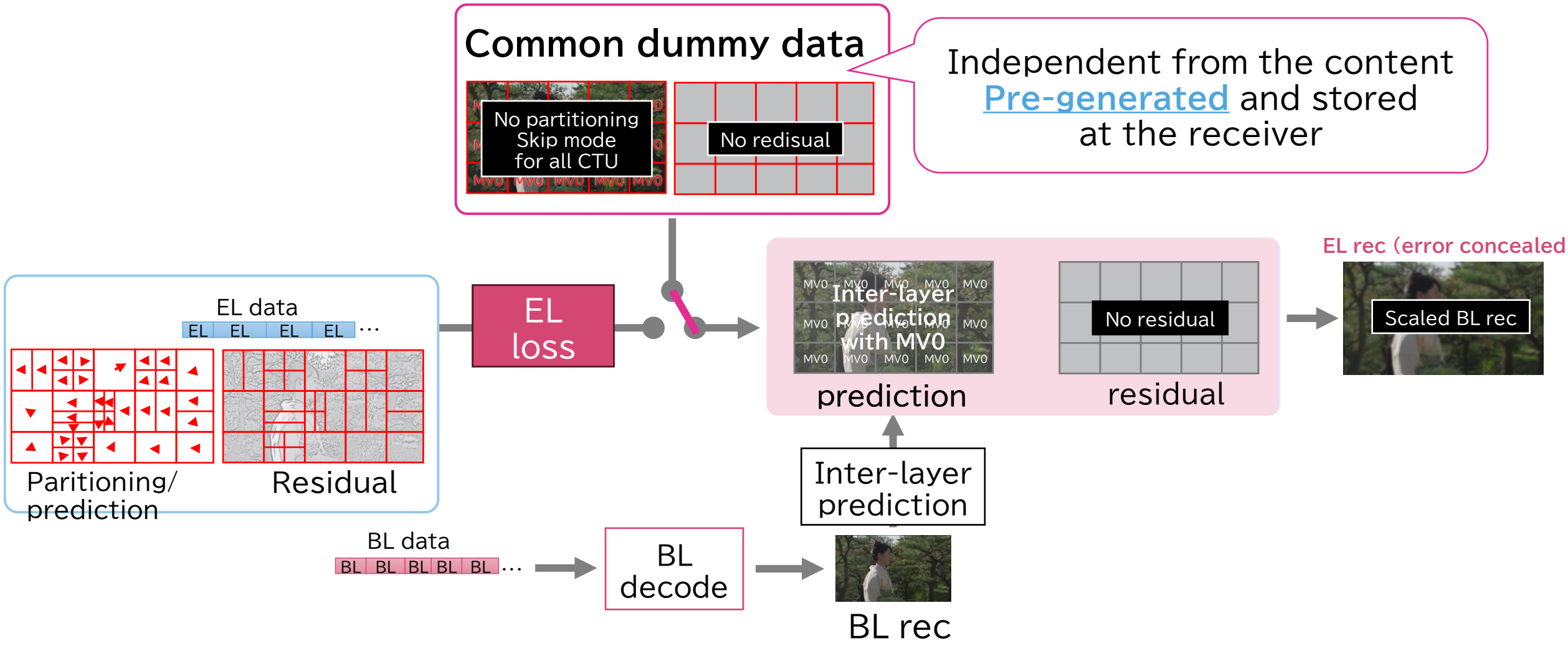
Temporal video interruption



Error concealment



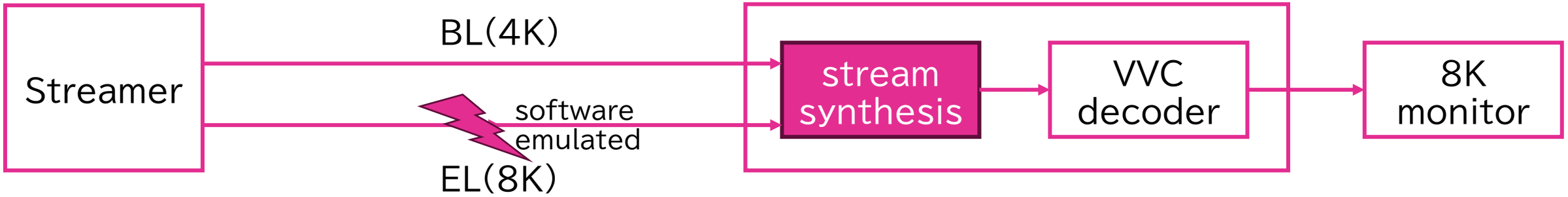
Error concealment



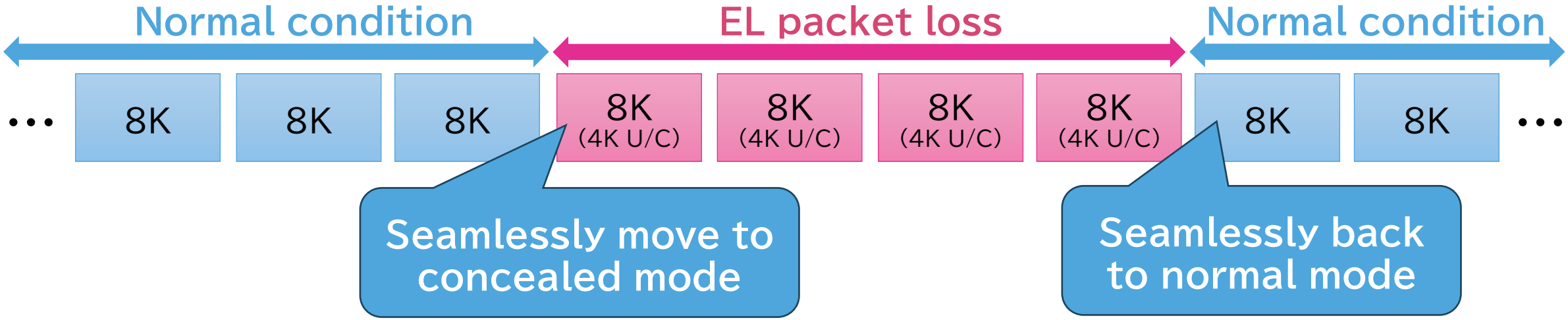
Even when EL data loss occurs, decoder keeps to decode ML bitstream (though it results outputing upscaled BL picture)

System validation

Each path was connected to a receiver equipped with a stream synthesis process implementing both delay compensation and error concealment functions, as well as a VVC real-time decoder capable of multi-layer decoding.



Temporary packet loss in the EL path triggered the substitution of missing data with the pre-generated dummy data and confirmed VVC decoder keeps decoding without any video interruption



Comparison (Normal)

Comparison (Error concealed)

Conclusion

- The development of a transmission system for multi-resolution video services utilizing VVC multi-layer coding was reported.
- Traditionally, in video coding standards including VVC, transmission errors have been considered a systems issue, no specific behavior was defined for the decoder in the event of such errors.
- It is recommended that future video coding standards consider incorporating error-handling mechanisms within the specification itself, as part of a broader effort to improve service reliability and user satisfaction.