Brand-new Sport Viewing Style by Immersive Live Experience (ILE) and Its Standardization Status

Hideo Imanaka
Senior Expert Engineer
Business Intelligence and AI center,
NTT Advanced Technology

Yoshihide Tonomura
Senior Research Engineer
NTT Service Evolution Laboratories,
Nippon Telegraph and Telephone Corporation

Kiyoshi Tanaka
Senior Research Engineer, Supervisor
NTT Service Evolution Laboratories,
Nippon Telegraph and Telephone Corporation

1. Introduction

For large scale sports events like the Olympics and Paralympics, and the World Cups of Soccer and Rugby, beyond being at the venue itself, it has become popular to be able to see live coverage from many countries around the world. Sports events can also be viewed remotely, through theatre distribution services called public viewings or live viewings, giving a feeling of togetherness with other spectators similar to actually being at the event venue. However, current services such as video distribution do no more than display the image on a large screen, and it is difficult to achieve immersiveness or highly-realistic sensations remotely. There is much anticipation for more realistic public viewings and live viewings, which will provide immersive experiences more like actually being at the venue, for the 2020 Tokyo Olympics and Paralympics.

Recently emerging technologies utilizing head mounted displays (HMD), such as virtual reality (VR), augmented reality (AR), and a combination of these called mixed reality (MR), are starting to be used to provide a variety of highly immersive entertainment. These technologies could potentially be used to provide a more immersive sports viewing experience, like actually being in the crowd and cheering on the players. Although wearing an HMD to enjoy such a presentation individually would also be good, it may be difficult to achieve the sense of unity of watching and cheering together with other spectators, as at a public viewing. Wearing an HMD also makes it difficult to enjoy other aspects essential to watching and cheering, such as having a beer at a baseball game.

Immersive Live Experience (ILE) technologies have been studied to realize more realistic, immersive public and live viewings. Beyond just high-definition video and high-quality multi-channel audio, 5th generation (5G) mobile and high-speed broadband communication networks could be used to transmit a variety of data with low latency, such as positions and sizes of players and production data (lighting, vibration, etc.), and to provide new styles of sports viewing through ILE.

This article introduces examples of new sports viewing styles using ILE, and the status of international standardization efforts toward realizing such systems at ITU-T SG16.

2. Brand-new sport viewing style through ILE

2.1 Sharing the excitement

The demand for access to global-scale sporting events through public viewings is growing. This style of viewing promises new synergistic effects due to having like-minded spectators watching the game at the same time, and can also provide benefits that cannot be realized with live viewing, using production effects.

NTT Laboratories' Kirari! immersive telepresence technology uses multiple ultra-high resolution video images and high-quality sound with efficient compression and synchronous transmission to reconstruct a pseudo-3D video representation of the 3D space. It has demonstrated ability to maintain a highly-realistic sensation of presence, even in environments such as public viewings.

2.2 Proof of Concept with table tennis viewing

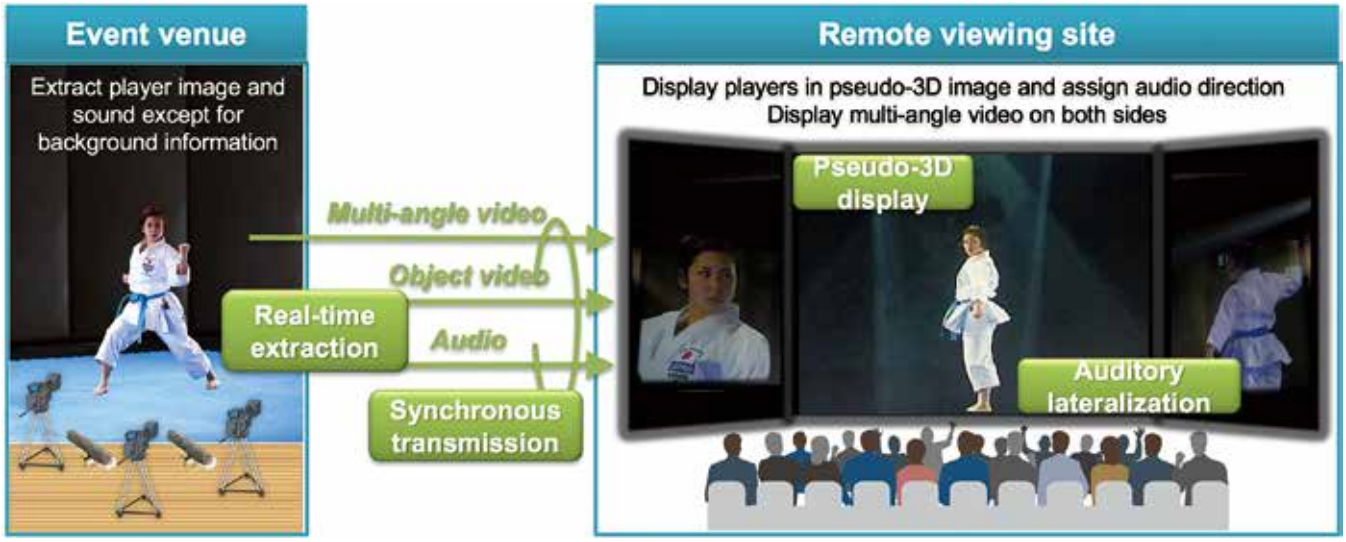
In a table tennis demonstration, the system was used to reconstruct the space of the actual venue very realistically using pseudo-3D images of the players mapped onto a real table-tennis table at the remote site, and positioning the sound images at the locations of the corresponding objects. Figure 1 is an example with the table-tennis match projected into the space using ILE. In this example, a real table and a real master of ceremonies (MC) are shown with pseudo-3D images of the players mapped over them.

2.3 Live coverage of Karate

In another example, live coverage of a karate competition was given by extracting images and sound in real time and transmitting them synchronously to the remote location. Figure 2 shows an example of remote live coverage distribution of a karate "Enbu" competition using ILE. Images of the performance by the player at the competition venue are extracted in real time (separating the image of the player from the background), images and sound from multiple cameras are sent synchronously to the remote viewing site, and all are presented as live coverage. A pseudo-3D image of the karate athlete was shown at the viewing location, together with simultaneous images centered on the face

Figure 1: An example with the table-tennis match projected into the space using ILE

■ **Figure 2: An example of remote live coverage distribution of a karate "Enbu" competition using ILE**

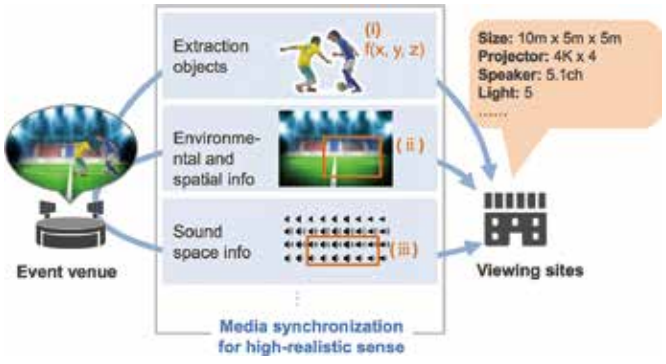


and from behind, providing production effects not possible when viewing at the real venue.

3. The need for and objectives of ILE standardization

The goal of the brand-new viewing style using ILE is to provide a realistic viewing experience, like actually being there, from anywhere in the world. In addition to distributing the experience to multiple locations simultaneously, ILE can also connect viewers with each other at the viewing venue, providing an even stronger sense of togetherness. When implementing such a system, event organizers are usually different from operators of public viewing venues, so an interface specification for international media transmission is needed. Spatial information in addition to the video data from the event location is needed to reproduce the event using pseudo-3D video at the viewing venue as shown in Figure 3.

■ **Figure 3: Example technologies for realizing ILE**



MPEG and other standardization bodies have recently studied standards related to VR, and parts of these standards, such as image formats, could be applicable for ILE. However, ILE requirements differ from those of VR with an HMD in that large numbers of people are watching. As such, it is essential that international standards for ILE be created, including standards for international media transmission, so that sports events can be viewed all over the world. Existing MPEG and other standard specifications for media transmission, compression and formats could be used, but international standards on how to use MPEG specifications (profiles) and interfaces for international transmission of media will need to be created by the ITU-T in order to realize ILE.

4. Status of ILE standardization at the ITU-T

4.1 Overall ILE standardization trends at SG16

NTT proposed establishing a new Question to study ILE at the June 2015 meeting of SG16, and it was approved in October at the World Telecommunication Standards Assembly, which is a general assembly meeting of the ITU-T. Study of ILE standardization officially began with Question 8 under Study Group 16 (Q8/16) at the January 2017 meeting of SG16. Note that Dr. Hideo Imanaka (one of the authors) is the Rapporteur for Q8/16.

With support from Japan, South Korea, China, and Brazil, Q8/16 is studying draft Recommendations for ILE service scenarios, ILE requirements, functional frameworks, and MPEG Media Transport (MMT) profiles for ILE. To raise awareness of ILE, three workshops on ILE have also already been held with ITU-T members and others, to share information. This has included the state of VR study at MPEG and DVB (Digital

Video Broadcast), and prospects for immersive services at NTT, Fraunhofer (Germany), KT (South Korea), and China Mobile.

4.2 Study of service scenarios

A draft Recommendation summarizing ILE service scenarios (H.ILE-SS) is being studied from a proposal by South Korea. As shown in Figure 4, several scenarios have been considered, including one which is for viewing live coverage of sporting events. Other possibilities include entertainment scenarios such as music concerts and theatre, and telepresence scenarios such as remote lectures and speeches.

Draft Recommendation H.ILE-SS summarizes ILE service scenarios from Japan, South Korea, and China, and an appendix describes concrete use cases and service concepts, including the Kirari! from NTT. This draft Recommendation is to be completed before the end of 2018.

4.3 Study of requirements

The definition and requirements for ILE services are summarized in the ILE requirements draft Recommendation, H.ILE-Reqs. ILE is defined as follows:

Immersive Live Experience (ILE): the shared viewing experience which stimulates emotions within audiences at both the event site and remote sites, as if the ones at remote sites wandered into substantial event site and watched actual events in front of them, from high-realistic sensations brought by a combination of multimedia technologies such as sensorial information acquisition, media processing, media transport, media synchronization and media presentation.

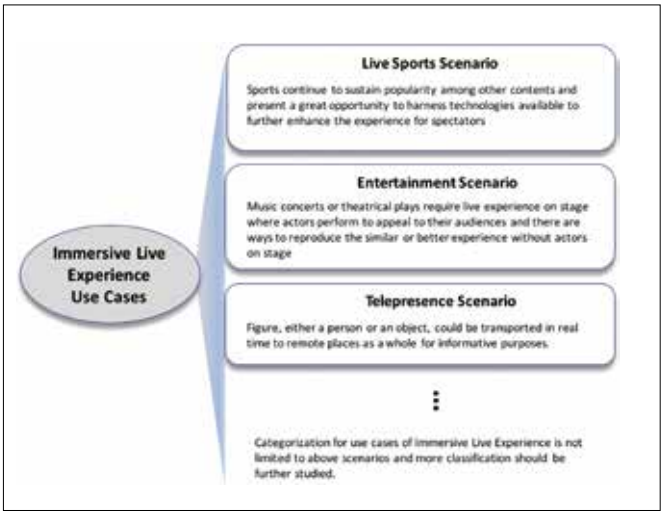
The current draft Recommendation indicates 13 requirements for realizing ILE. The main essential requirements are as follows.

- The direction of sound is reproduced at the viewing venue.
- The spatial environment is reproduced at the viewing venue.
- Video, sound and spatial information must be synchronized.
- Multiple types of media, such as video, sound and spatial data, can be processed to reproduce a virtual space at the viewing venue.

The H.ILE-Reqs draft Recommendation is to be completed before the end of 2018.

The requirements for implementing ILE services will be studied further in the future.

Figure 4: Examples of ILE service scenarios



4.4 Study of functional frameworks

An overall architecture and identification of interfaces between functional blocks are summarized in the functional framework draft Recommendation, H.ILE-FW. The overall architecture of the ILE system is shown in Figure 5.

The left side of Figure 5 is the Capturing environment, with functionality to collect video and sound at the event venue. The right side is Presentation, with functionality to reconstruct the experience at the remote viewing site. These two are connected by the Transport layer, and also placed between them are ILE Application functions, such as media processing and signal processing.

Three interfaces are envisioned: between capturing functions and the transport network, between transport network and presentation functions, and between transport network and ILE applications.

Draft Recommendation H.ILE-FW summarizes definitions of the various functions in the overall architecture in Figure 5 as well as the technical elements that will be needed. This draft Recommendation is expected to be completed in 2018.

4.5 Study of MMT profiles

One of the main technologies for ILE will be for synchronous transmission of video, sound and environmental data. MPEG has already created a specification for synchronous transport, called MPEG Media Transport (MMT), and this could potentially be applied to ILE.

The concept of synchronous transport of video, sound and spatial information using MMT is illustrated in Figure 6. With conventional digital broadcasting using MPEG2-TS, video and sound must be inserted in the same time frame, but with MMT, video and sound data each contain their own time information, so they can be transmitted separately. Spatial information and stage production information such as lighting can also be sent with time information, making media easy to multiplex.

The purpose of draft Recommendation H.ILE-MMT is to identify MMT functions needed for ILE services, and to specify how MMT is to be used (profiles). Work to create the Recommendation began in September 2017 and it is to be completed in 2019.

Figure 5: Overall architecture of the ILE system

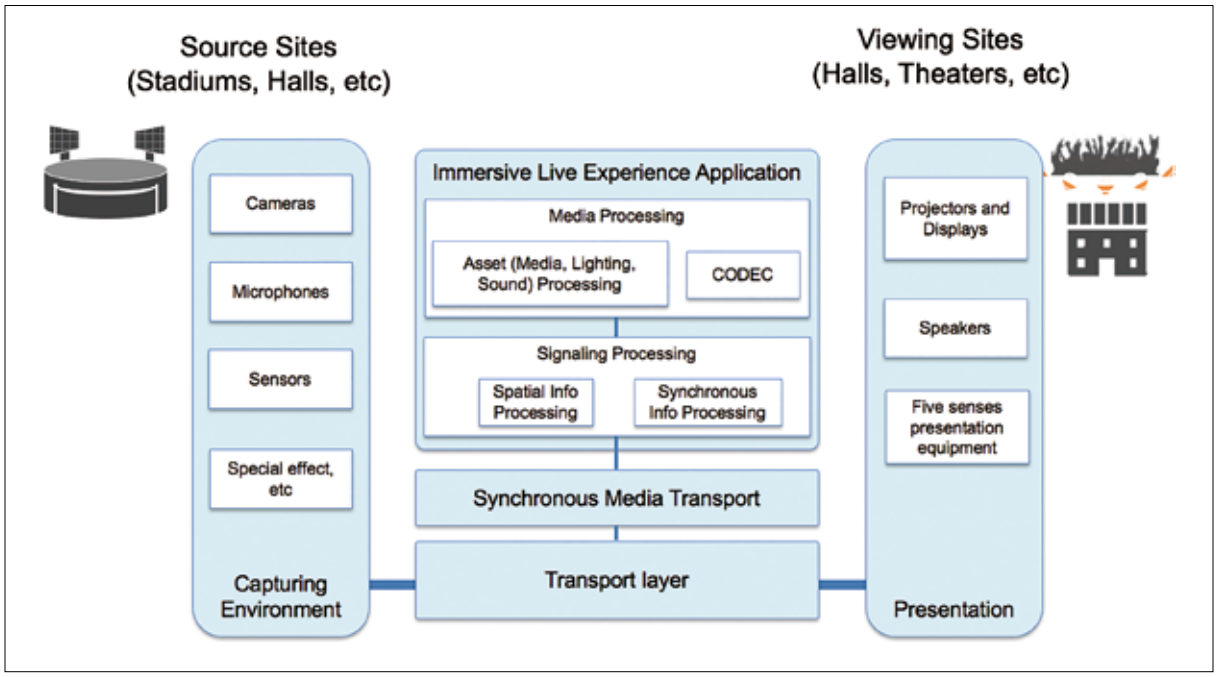
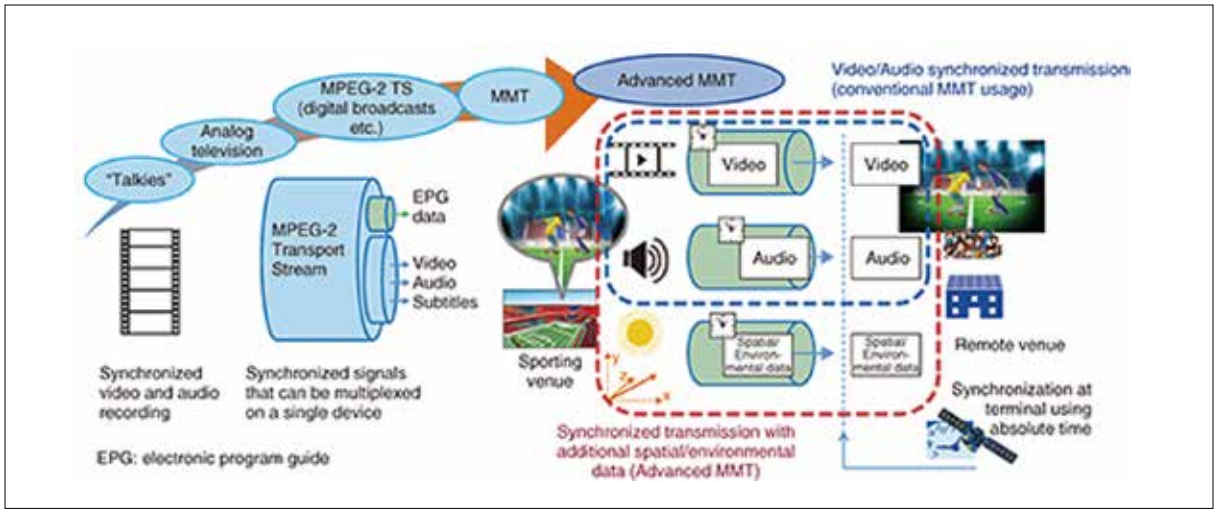


Figure 6: Concept of synchronous transport of video, sound and spatial information using MMT



4.6 Future directions for ILE standardization

Standardization of the basic components for ILE is currently in progress and there are plans to create detailed technical standards for the MMT profiles and interfaces needed to implement international interconnectivity for ILE in the future. Use of standards being studied in other standardization organizations, for technical elements such as VR, is also being considered in order to advance standardization work efficiently.

5. Conclusion

This article has summarized the status of international standardization for ILE, which will enable highly realistic public viewings of large scale sporting events such as the Olympics and Paralympics from anywhere in the world. Through ILE, new viewing styles were proposed for sports, with the goal of providing a sense of realism and togetherness with other spectators that will be like watching at the actual event, from anywhere in the world.

ILE itself is a new type of service, and ILE standardization has only just begun. In order to expand the immersive service technologies being studied in Japan globally, effort to create concrete Recommendations for high priority items is necessary, to quickly create Recommendations for requirements and elemental technologies needed. Use of VR technologies is also a possibility, so it is hoped that collaboration will be strengthened with MPEG and other SDO organizations and contribute to standardization activities from Japan, to realize ILE as early as possible.