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e-Services at the Tokyo Olympics and Paralympics

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About ITU-AJ

The ITU Association of Japan (ITU-AJ) was founded on September 1, 1971, to coordinate Japanese activities in the telecommunication and broadcasting sectors with international activities. Today, the principle activities of the ITU-AJ are to cooperate in various activities of international organizations such as the ITU and to disseminate information about them. The Association also aims to help developing countries by supporting technical assistance, as well as by taking part in general international cooperation, mainly through the Asia-Pacific Telecommunity (APT), so as to contribute to the advance of the telecommunications and broadcasting throughout the world.

e-Services at the Tokyo Olympics and Paralympics

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When this article is published in February 2018, the 23rd Winter Olympic Games will be happening in PyeongChang, in our neighboring country, South Korea. The much anticipated Tokyo Olympics and Paralympics will be held two years and five months later, in July 2020. In preparation for the Olympics and Paralympics, various hospitality initiatives throughout Japan are currently in progress.

One such hospitality initiative is to develop new e-services using ICT technology. These are not so-called black-box services, but will be provided as services using open products. In particular, the technologies needed to implement these e-services are open from the early stages, not only through demonstrations and testing, but also through open system functionality and interface requirements, and discussion at international standardization meetings. Through discussion in such international venues from an early stage, we hope to develop these technologies globally in the future.

This special feature focuses on work being done in ITU-T SG16 to standardize e-services, and in particular, e-services related to the Tokyo Olympics and Paralympics.

In the first article, Rapporteur of the question under study on digital signage (Q14/16), Mr. Kazunori Tanikawa from NEC, will introduce initiatives related to digital signage. Standardization of digital signage is proceeding as a means to provide information outdoors, on Olympic and Paralympic competitions and also on tourism and disasters, if needed.

The second article, titled "New style of sports watching by Immersive Live Experience (ILE) and its standardization status," was contributed by Mr. Hideo Imanaka, from NTT Advanced Technology and Mr. Yoshihide Tonomura and Mr. Kiyoshi Tanaka from the NTT Service Evolution Laboratories. They work on standardization for question under study on Immersive Live Experience (ILE) (Q8/16), which can provide realistic remote viewing that is almost like being at the sports venue or theatre. The fundamental parts of this technology have already been standardized, and technical standards for international interconnectivity will be standardized in the future.

In the third article, the history and current state of standardization for multilingual speech translation are described by Mr. Shoichi Senda, from the National Institute of Information and Communication Technology (NICT). He describes how an R&D group was formed in Asia, lead by Japan, and later, another at the international level through the ITU-T, together with the efforts, achievements, and future prospects of these pioneers.

The final article, regarding accessibility, was written by Prof. Masahito Kawamori from Keio University, who is Rapporteur of question under study on accessibility—making it easier for disabled and elderly people to access information (Q26/16). Since the United Nations General Assembly adopted the Convention on the Rights of Persons with Disabilities in 2006, it is increasing in importance in countries around the world. This article gives an overview of standardization efforts in Q26, not limited to the Tokyo Olympics and Paralympics.

We expect to accelerate standardization efforts in the future, towards realization of standardized hospitality e-services for the Tokyo Olympics and Paralympics. At ITU-T SG16, we will also continue to work on standardization for other new e-services not discussed in this special feature, such as e-health, Intelligent Transport Systems (ITS), IPTV, and digital financial systems. We invite all those interested to participate in discussion regarding standardization of new e-services and other issues.

Digital Signage

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1. SG16 Question under Study 14 "Digital Signage"

ITU-T SG16 Question under Study 14 (Q14/16) is a relatively new question under study, established at the previous session (2013-2016) with the research theme of "Digital Signage". The question chairman (Rapporteur), Kazunori Tanikawa (NEC), and Associate Rapporteur, Shin-Gak Kang (ETRI, Korea) have been promoting standardization as an e-service for presenting information, mainly outdoors. The current work items are shown in Table 1.

2. Digital Signage and the Tokyo Olympics/ Paralympics

Many participants and spectators will be visiting Tokyo for the Tokyo Olympics and Paralympics, and digital signage is expected to be used as a means of providing a wide range of information services out-of-doors, including notices and warnings regarding sporting events, tourism information, and disaster information in the event of emergency. "Demonstration of disaster and other information provision according to multi-language and other attributes using digital signage" was conducted as part of the 2016 Ministry of Internal Affairs and Communications project, "Research contracts regarding regional demonstrations for implementing an IoT hospitality environment." It included discussion of the Tokyo Olympics and Paralympics, and the results have been published as the Digital Signage Consortium (DSC) Operational Guidelines. (http://www.digital-signage.jp/).

In Table 1, the draft recommendations H.DS-PISR, "Service requirements and a reference model on information services in public places via an interoperable service platform," and H.DS-FIS, "Framework for interactive service," were work items proposed by Japan as a base for these guidelines. H.DS-PSR handles requirements for establishing a common operating platform for digital signage, so that information of consistent quality can be provided efficiently and reliably in a multi-vendor, multi-operator environment. H.DS-FIS describes a framework for advanced information services beyond conventional one-way presentation of information by information providers on large-screen displays, linking smartphones to digital signage systems and responding to the characteristics and demands of individuals. HSTP.DS-WDS "Technical Paper on Digital signage: Web-based digital signage," is also important regarding linking with smartphones, so this study is proceeding while exchanging information with W3C, in order to realize a lightweight, richly expressive implementation using Web technologies such as the widely available HTML5.

3. Discussion overview

The SG16 meeting was held from October 12 to 16, 2017 in China (Macau), and the Q14/16 deliberation topics are introduced below.

The objective of this meeting was to complete H.782 "Metadata" (previous abbreviation: H.DS-META), so there were two intervening meetings (teleconferences) to move toward completion, and in this meeting, deliberation focused chiefly on consistency between this specification and related recommendations, and on revising wording. Consent was received at the SG16 Plenary meeting. The basic service specifications

Table 1: Q14/16 Work items

Code	Title	Editor
H.DS-AM	Digital signage: Audience measurement	M. Huh (ETRI), H. Yamamoto (OKI)
H.DS-ASM	Digital signage: Metadata for alerting services	M. Huh (ETRI)
H.DS-CASF	Common Alerting Service Framework for Digital Signage	M. Huh, W. Hyun, H. Park (ETRI)
H.DS-DCI	Digital signage: Display device control interface	S. Kang, C. Lee (ETRI)
H.DS-FIS	Digital signage: Framework for interactive service	K. Tanaka (NTT), S. Kwon, S. Kang (ETRI)
H.DS-PISR	Digital signage: Service requirements and a reference model on information services in public places via an interoperable service platform	K. Tanikawa (NEC)
HSTP.DS-Gloss	Technical Paper on Digital signage: Use-cases regarding interactive services	H. Kim (ETRI), K. Tanaka (NTT)
HSTP.DS-WDS	Technical Paper on Digital signage: Web-based digital signage	S. Kwon (ETRI), K. Tanaka (NTT)

Table 2: Basic service metadata

Category	Summary	Metadata example
Terminal linking	Terminal initialization data, specifications, and operating state.	TerminalId, Location, TerminalStatus, DisplayInformation, CapabilityList, etc.
Connected device related	External devices connected to dedicated terminals	InteractiveDeviceID, Type, Status, EventDataType, EventAction
Content	Content data for presentation	ContentId, Title, Synopsis, KeywordList, Genre, MimeType, Productiondate, etc.
Server	Information regarding various servers	ServerId, Location, Password, etc.
Playlists	Content display sequencing information	PlayListId, Priority, PlayOrder, ContentIDRef, TargetRegion, Duration, etc.
Play logs	Terminal operation data history	LogItemType, ContentIdRef, PlayStatus, StartDateTime, Duration, etc.
Schedules	Data distribution schedule management information	ScheduleId, PublicationDateTime, SendDateTime, DeliveryMethod, etc.

for digital signage (mainly one-way information presentation from service provider to viewer on dedicated digital signage terminals) are summarized in H.780 "Service Requirements", H.781 "Architecture", and H.782, which is discussed here. The basic service metadata is categorized as indicated in Table 2.

As mentioned above, H.DS-PISR is an important discussion theme for Japanese participants, introducing a usage concept for the Interoperable Service Platform that is now under consideration. Figure 1 presents a concept in which, in the upper part of the figure, original data is sent from information sources, in the center it is converted to a common format by the Interoperable Service Platform, and is then distributed to dedicated digital signage terminals or terminals owned by viewers. It also shows the potential for use in combination with external cloud services.

In the figure, data is sent directly to terminals through the

Figure 1: Concept of Interoperable Service Platform

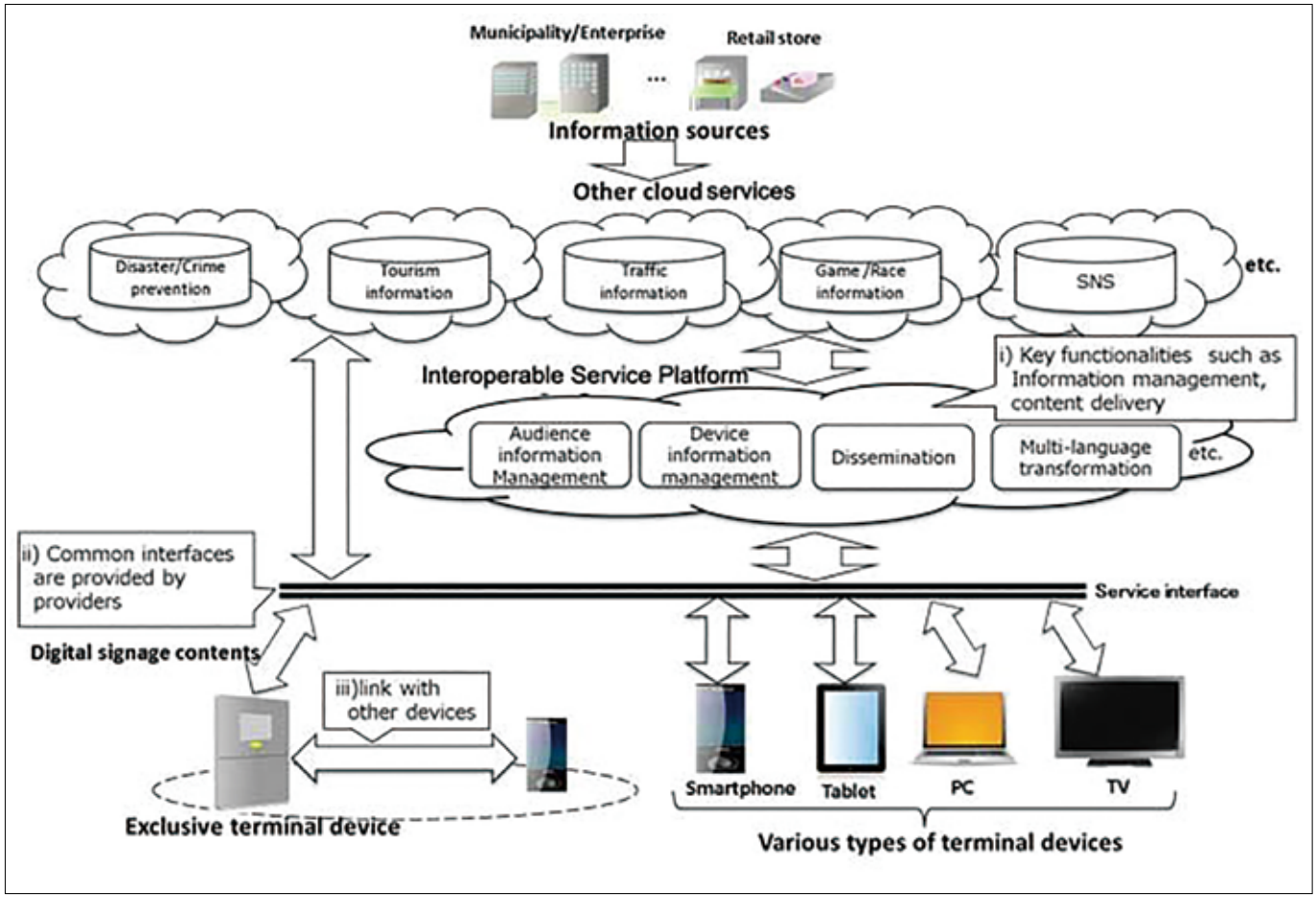
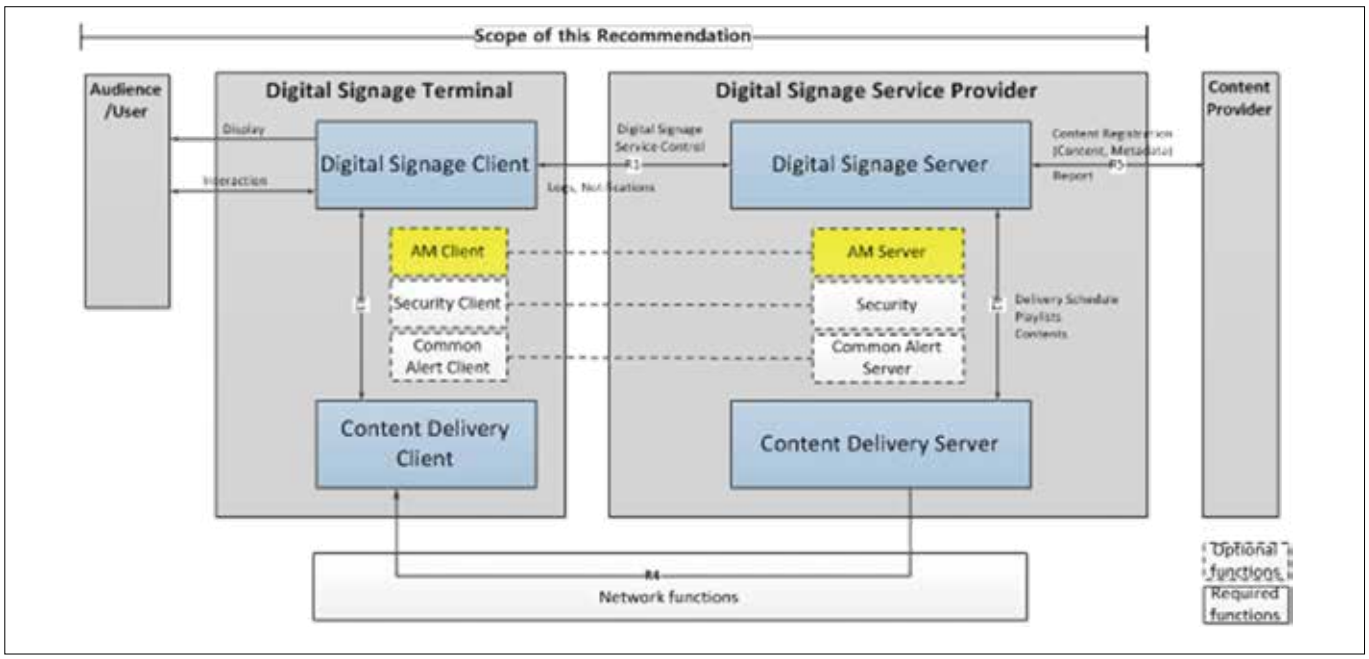


Figure 2: Collection of audience information



service platform, but to this point, most of the study has focused on having content converted by the service platform and then sent back to the systems of each service operator, who will then distribute it to their terminals.

At the previous meeting, H.DS-PIS was treated as a requirements document, but at this meeting, Japan submitted additional high-level system requirements reflecting the content of the guidelines mentioned earlier, as well as metadata specifications, and these were approved. System requirements needing consideration include specifications for terminal Push notification services. Metadata needing consideration includes data shared between Interoperable Service Platform and service providers and required for content conversion, such as content creation and creator data. It is also expected that guidance services will use requests from viewers and attributes from their smartphones (language type, terminal type, etc.), so requirements for the handling of Personal Identifiable Information (PII) were also added. These were based on Recommendation X.1058, issued by ITU-T SG 17, which handles cross-disciplinary security issues. The document is to be completed at the next SG16 meeting, in July.

H.DS-AM "Audience Measurement", examines requirements, system functionality and metadata for gathering information about digital signage viewers, such as the number of viewers and staying times. As shown in Figure 2, collection of audience information is considered an additional functionality for digital signage (dotted lines). It is based on the H.741 series of specifications already released, on collection of IPTV viewer data. This meeting focused discussion on overall consistency of specifications and defining terminology. The document is also to be completed at the next SG16 meeting.

4. Future plans

Two intervening teleconference meetings, in March and May, are planned before the next SG16 meeting, to work toward completion of H.DS-PISR, H.DS-AM, and H.DS-DCI. We are anticipating that the Tokyo Olympics and Paralympics will provide an opportunity to raise awareness of digital signage as a public resource, and we need to study and organize use cases and system specifications toward advanced use of this resource. We continue to look forward to active participation from Japan in the relevant fields.

Cover Art

Ichikawa Ebizou (Picture of kabuki actor Ichikawa Ebizou (1833). It is said that he is playing the role of Toba no Houou (1103-1156).)

Utagawa Kunisada (1786–1865)

Collection of the Art Research Center (ARC)
Ritsumeikan University
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Brand-new Sport Viewing Style by Immersive Live Experience (ILE) and Its Standardization Status

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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

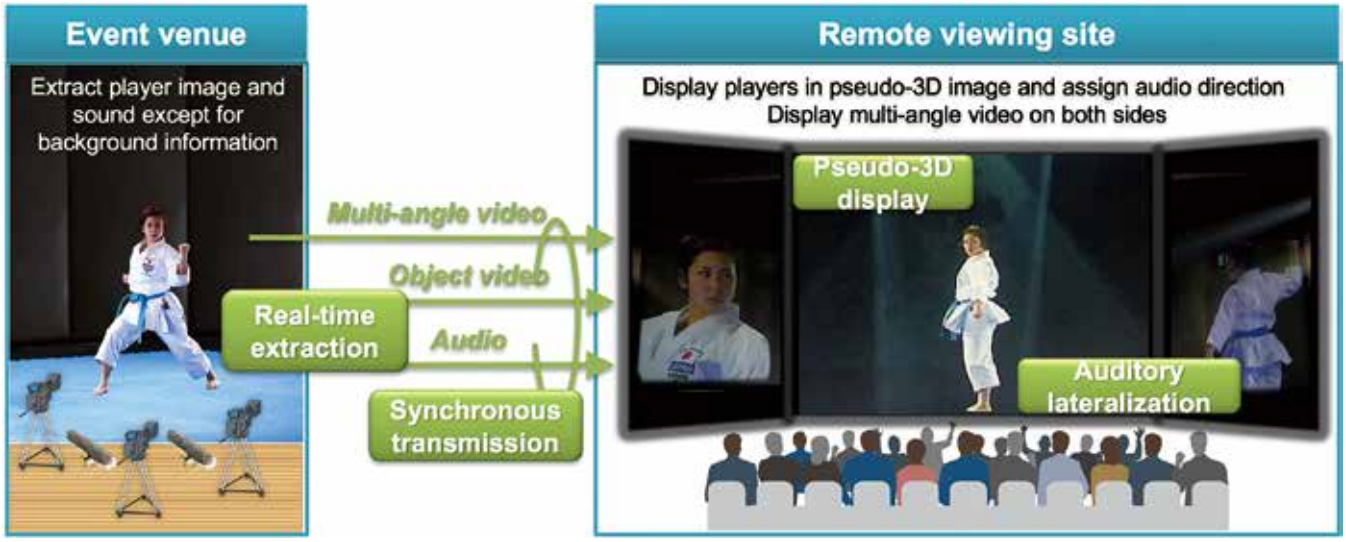
In a table tennis demonstration, the system was used to reconstruct the space of the actual venue very realistically using pseudo-3D images of the players mapped onto a real table-tennis table at the remote site, and positioning the sound images at the locations of the corresponding objects. Figure 1 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**

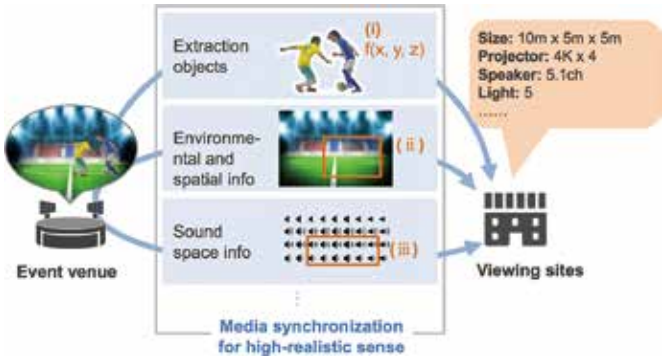


and from behind, providing production effects not possible when viewing at the real venue.

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.

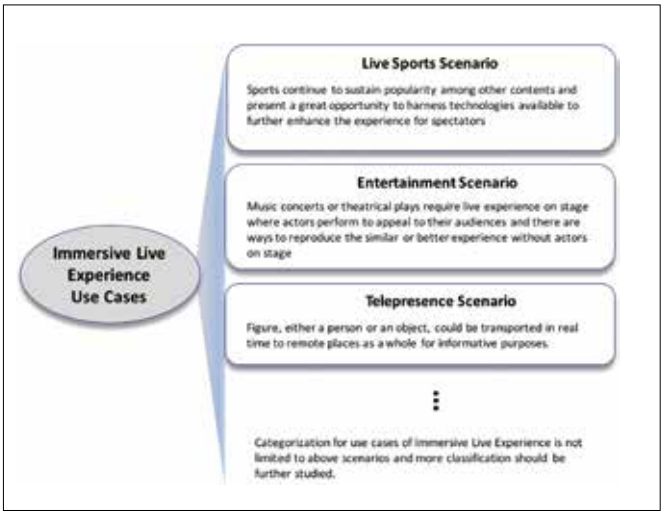
The current draft Recommendation indicates 13 requirements for realizing ILE. The main essential requirements are as follows.

- 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

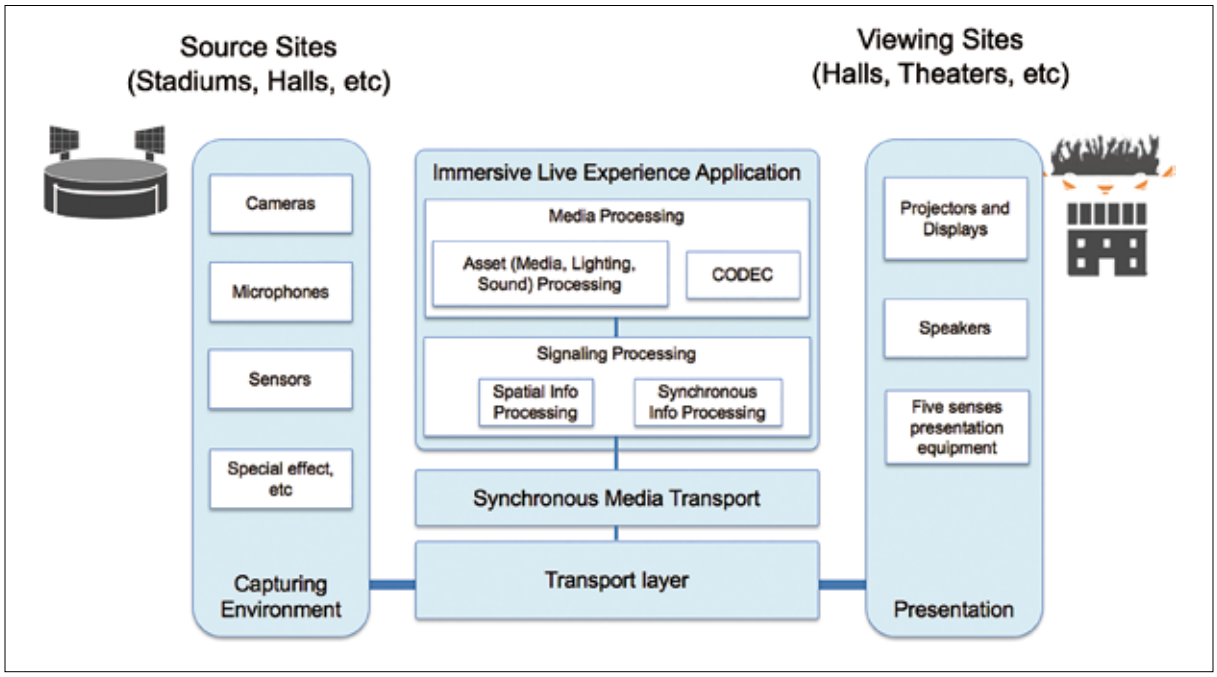
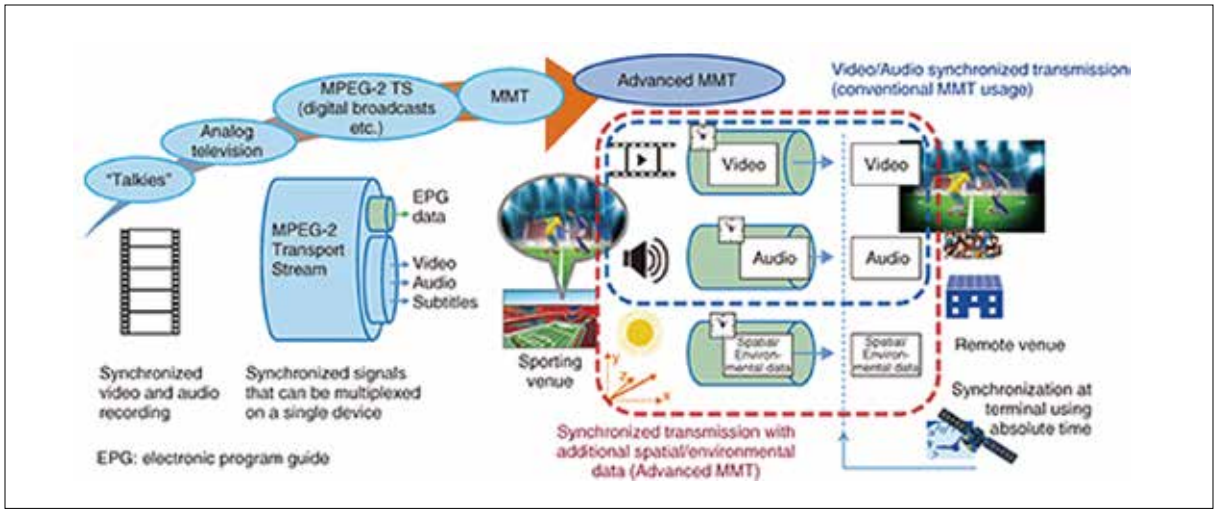


Figure 6: Concept of synchronous transport of video, sound and spatial information using MMT



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.

Multilingual Speech Translation

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1. Introduction

Speech communication is the most basic means of communication used by humanity, and telephone services implementing speech communication have been steadily enhanced to the point where it is available "anywhere, anytime, and with anyone." This progress has overcome almost all technical issues related to "anywhere" and "anytime", but implementing "with anyone" involves language differences, which are a major obstacle, and we have not yet reached the point where we can communicate freely with anyone using speech. Actually implementing an automatic translation telephone has been a common human dream since the telephone was invented. Anyone would want such a technology and there have been various attempts and much research in this field, but only now are we beginning to see that it could become practical soon.

With the opening of the Tokyo Olympics and Paralympics, ever increasing numbers of foreign visitors are expected and there is hope that, improving multilingual speech translation technology to a sufficiently practical level, promoting it, and implementing it in society, will facilitate communication with visitors and enable them experience Japanese hospitality directly.

2. History and standardization in the study of speech translation

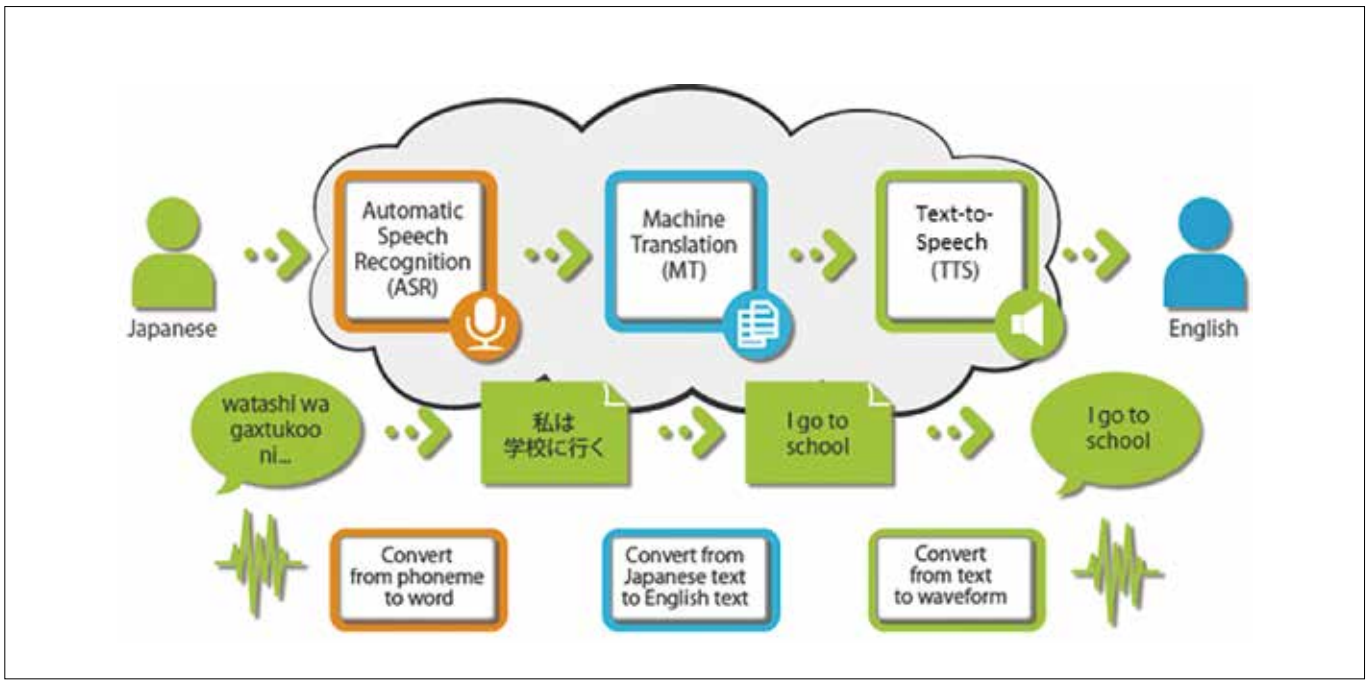
Here we look at the history over many years, of R&D attempting to realize the dream of multilingual speech translation, and also the part played by standardization.

At the beginning, different research agencies studied speech translation separately, but individual study had limitations, so in 1991, scientists from around the world, including the USA, Germany, France, Japan, Korea, and Italy, began forming voluntary organizations such as the Consortium for Speech Translation Advanced Research (C-STAR), and they started collaborating by sharing independent research results for each language and integrating them together. Thus, speech translation R&D started in many countries, and an awareness of the need for standard interfaces and data formats grew, to ensure intercompatibility of their work. In particular, the Asian Speech Translation Advanced Research Consortium (A-STAR) was organized in 2006, centered on national research agencies from six Asian countries having many official languages within their regions. The Asia-Pacific Telecommunity (APT) Standardization Program (ASTAP) also began standardization activities. Before long, it became clear that this standardization activity at ASTAP should be done globally, and not be limited to the Asia-Pacific region, so activity was moved to ITU-T SG16, and standardization on a global scale began. As a result, in 2010, recommendations ITU-T F.745, specifying functional requirements for network based Speech-to-Speech Translation (S2ST), and H.625, specifying architectural requirements, were created. A-STAR, which had been restricted to the Asia-Pacific region, was also expanded and reorganized to continue its activities as the Universal Speech Translation Advanced Research consortium (U-STAR). Recently, with advances in Big Data analysis and AI, this once-limited field has begun to produce practical products and services.

3. Implementation of multilingual speech translation

Generally, to realize two-way speech communication between people speaking different languages, the audio signal expressed in the speaker's language must be translated to an audio signal in the language of the listener. For example, Japanese to English translation is implemented as in Figure 1. When the speaker says "watashi wa gaxtukooni…" in Japanese, the audio signal is automatically recognized as "わたしは学校に行く" in Japanese text, this text is machine translated to "I go to school" in English that the listener can understand, and the text is then converted to an English audio signal.

Figure 1: Outline of speech translation



Here, we have described speech translation as implemented by performing Automatic Speech Recognition (ASR), Machine Translation (MT), and Text-to-Speech (TTS) functions in sequence, using the case of Japanese to English translation as an example. This combination of functions can be used to translate between any languages and is not limited to Japanese-to-English. Here, ASR converts the input speech signal into text data, MT converts the input text data into text data in a different language (but having equivalent meaning), and TTS converts the input text data into a speech signal. The details of these conversions depend on the languages and fields being translated. As such, ASR, MT and TTS generally share the basic function of using conversion dictionaries called corpuses for each translated language and field. When building a multi-lingual speech translation system in this way, the engines that realize each of these functions can be designed and developed independently, and multi-lingual speech translation can be achieved more easily by combining engines appropriately, according to the languages and application area (Figure 2).

Figure 2: Architecture of multilingual speech translation

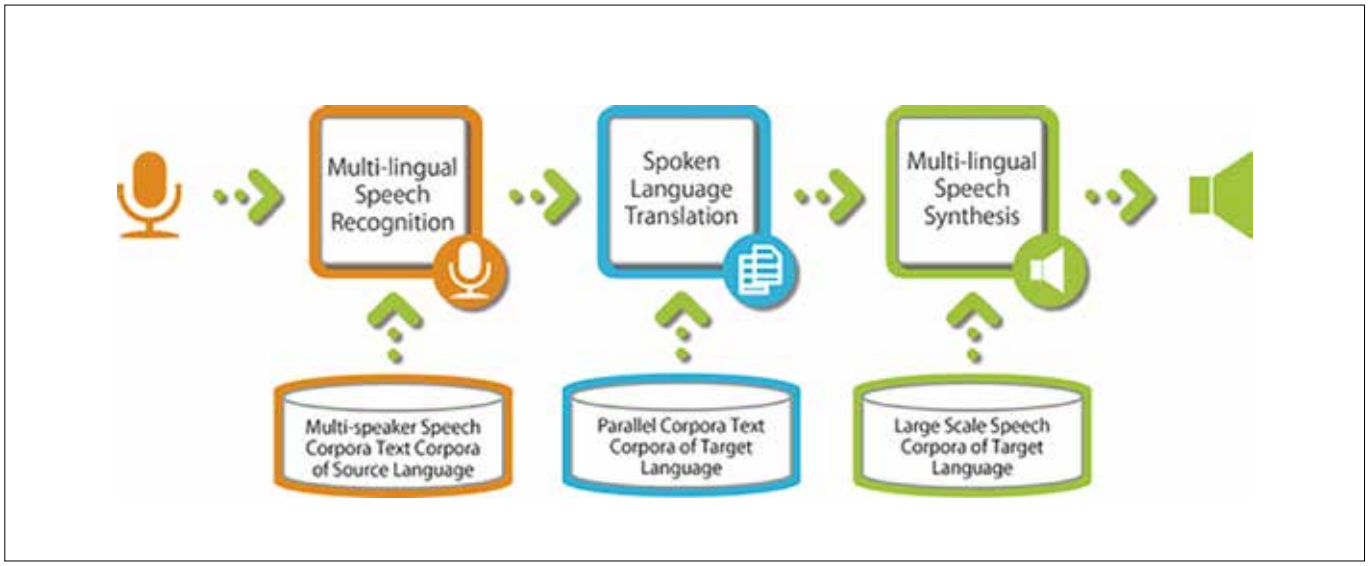
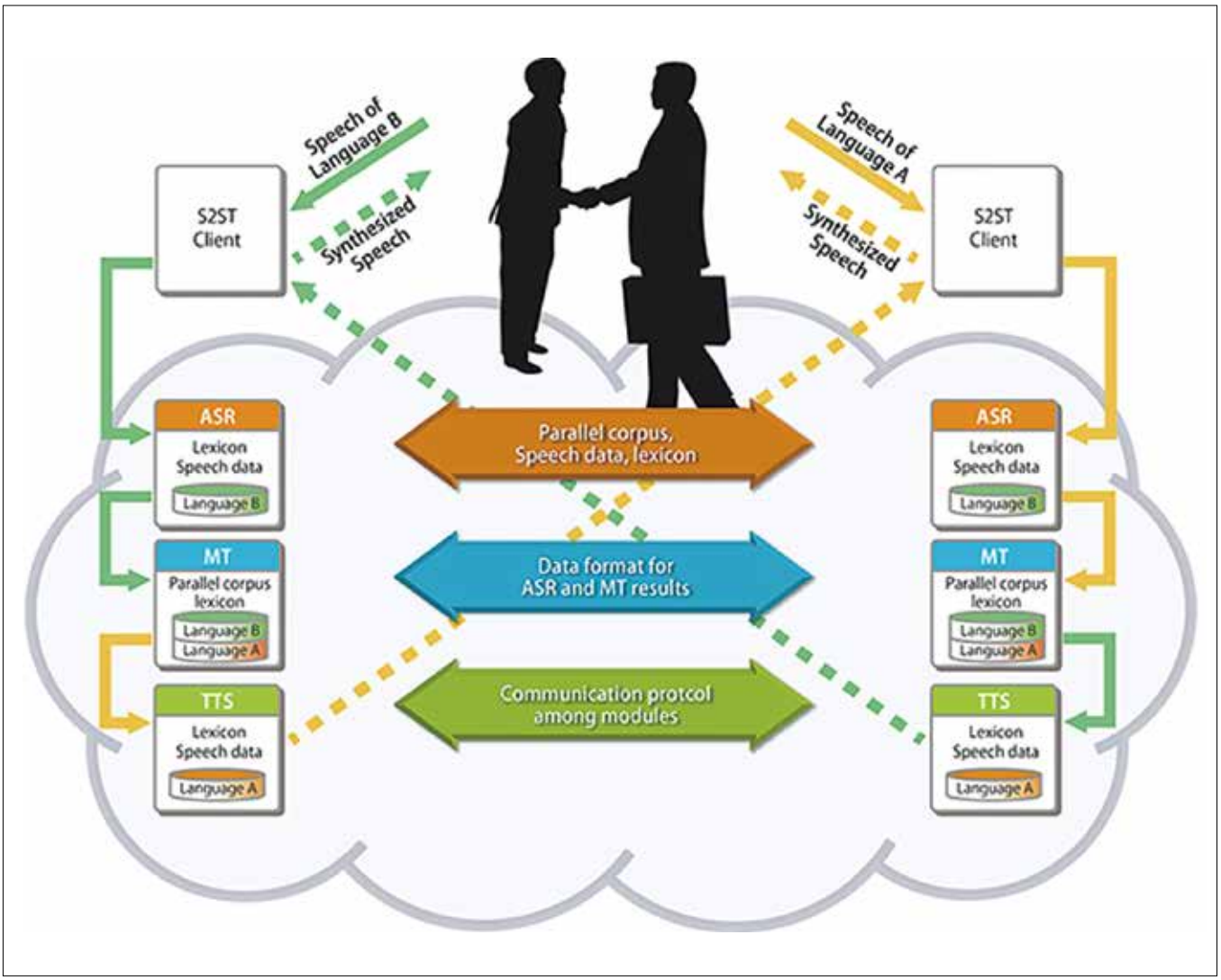


Figure 3: Architecture and its implementation protocol



To make it possible to implement multilingual speech translation with this sort of structure, the functionality of each functional element be standardized, as well as how each functional element is deployed, what and how they exchange information, including protocols and formats. Since the main functional elements of speech translation, namely ASR, MC, and TTS, require significant amounts of processing, the ITU-T SG16 has adopted a client-server model in which servers are placed on the network and users use server functionality through clients that are installed on their various terminals. As such, protocols between client and server, and between servers, are being standardized (Figure 3).

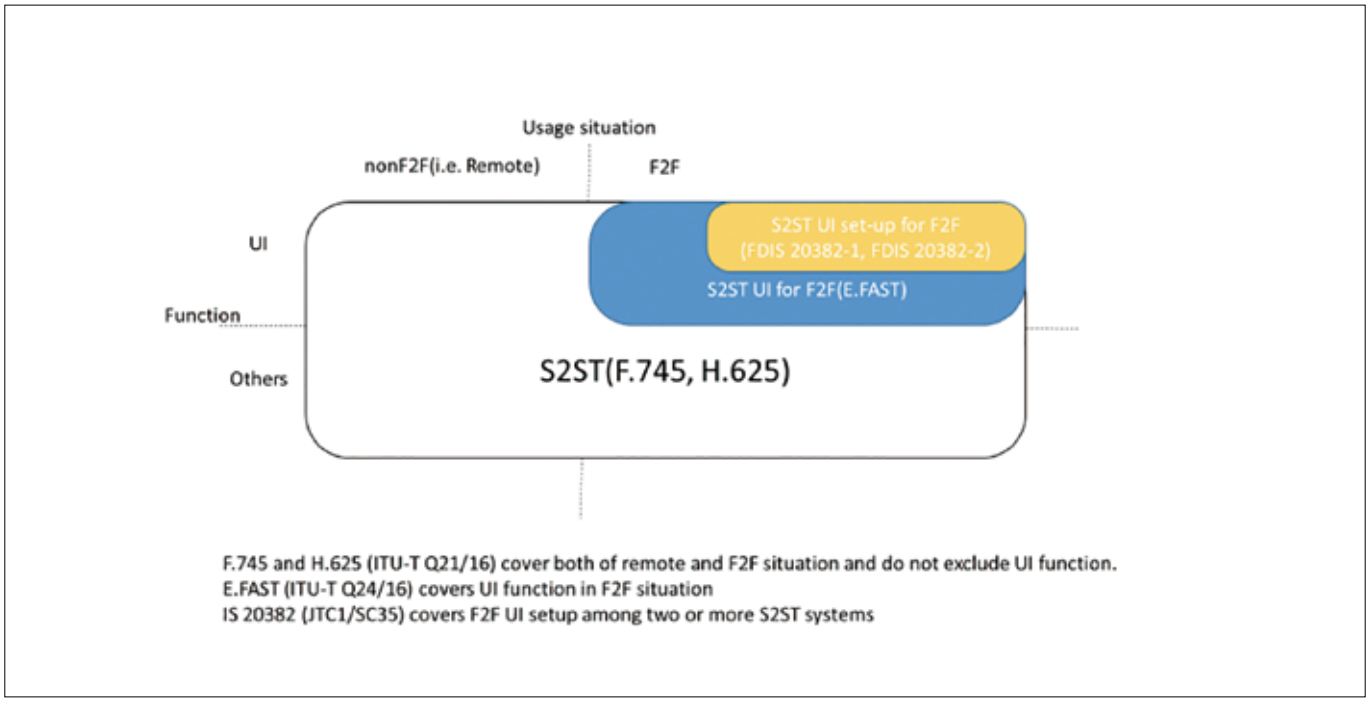
4. State of standardization in speech translation

Later in the speech translation field, in 2014, ITU-T SG2 Q4 and ISO/IEC JTC1/SC35 WG5 proposed that user interfaces be studied and standardized to improve service availability, independent of system functional and organizational requirements. These standardization proposals regulate user interfaces particularly for when speaker and listener are engaged in two-way communication with each other at a single location. S2ST has already been standardized and has moved to a maintenance and management phase, so the relation of these proposals to the completed recommendations, F.745 and H.625, as well as any particular requirements due to the face-to-face environment needed to be clarified. In this area, there were also proposals regarding the user interface for speech translation in face-to-face environments from ASTAP EG-SNLP in Q4/2 (which was later integrated into EG-MA), which was studying the E.FAST draft recommendation. It was agreed that more investigation was needed to understand various use cases and associated issues, and that work should move from SG2 to SG16, become Q24/16, and continue in collaboration with Q21. On the other hand, speech translation user interfaces being studied in ISO/IEC JTC1/SC35 WG5, IS20382-1 and -2

were standardized without necessarily coordinating sufficiently with ITU-T speech translation standardization activities, and ITU-T submitted comments identifying issues during DIS voting. The reply given to ITU-T SG16 by JTC1/SC35 was that these standards apply only to the user interface setup. In response, ITU-T SG16 reviewed and reorganized the interrelation among S2ST related standards (F.745, H.625, E.FAST, IS 20382-1 and -2) as shown in Figure 4, and intends to reaffirm this at the JTCI/SC35 meeting in February, 2018.

Note that while F.745 and H.625 were standardized with the goal of realizing two-way speech translation, input and output signals are not necessarily limited to audio signals. By skipping the ASR and TTS functions of F.745 and H.625, and using only the MT function directly for input and output text data, these standards could be used for multilingual text translation systems. Or, by skipping the ASR function for communication in one direction, and the TTS function in the other direction, tools such as Koetra (http://www.koetra.jp/) can be created to support communication between deaf and hearing people. Still further, by applying recent advances in Big Data, AI and Deep Learning to video recognition, the ASR function could be replaced or extended, from simple speech recognition to recognition of sign-language video, so that multi-lingual speech translation could evolve into general translation, including sign language. Even if this will be difficult to realize by the time the Paralympics begin, continuing to work on implementing this sort of tool in support of disabled persons has the benefit of contributing to the hopes and dreams of many who live with such disabilities.

Figure 4: Interrelation among S2ST related standards



Accessibility Standardization

Masahito Kawamori
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1. Introduction

It is finally less than two years until the Tokyo Olympics and Paralympics begin in 2020. The Olympics and Paralympics also bring increased attention on measures supporting persons with disabilities (PwDs) and specific needs.

ITU-T works with external organizations such as the World Health Organization (WHO) and the World Federation of the Deaf (WFD) to create ICT standards promoting health and security in society. This article gives an overview of standardization toward creating a barrier-free society, for the Olympics and Paralympics and beyond, for example supporting the daily activities of elderly and PwD as well as communication in times of emergency.

Accessibility is a general term for technologies, policies and measures designed to make various information more accessible to PwDs, elderly, or others who have specific needs. ITU-T SG16 deals with standardization of technologies that make multimedia information, in particular, more accessible.

The increasing importance of accessibility is manifest in the United Nations' Convention on the Rights of Persons with Disabilities (UN-CRPD). This convention was adopted by the UN General Assembly on December 13, 2006, and it came into effect in 2007. It imposes a duty on signatory countries to preserve the right of persons with disabilities to be treated equally with persons without disabilities. UN-CRPD was ratified by Japan in January 2014 and has been in force since February that year. A result has been the "Act for Eliminating Discrimination against Persons with Disabilities", which was enacted in April 2016.

Articles 3, 9, and 21 of UN-CRPD in particular are provisions directly related to maintaining access to information. The gist of these articles is as follows:

- Article 3: General Principle: Respect for inherent dignity, individual autonomy including the freedom to make one's own choices, and independence of persons "
- Article 9: "Ability to use facilities and services (Accessibility)": to ensure to persons with disabilities access to information and communications, including information and communications technologies and systems
- Article 21: "Freedom of expression and opinion, and access to information"

Article 9 in particular states: "States Parties shall also take appropriate measures to promote access for persons with disabilities to new information and communications technologies and systems, including the Internet," stipulating that the UN and each country must endeavor to promote participation in the information society by PwDs.

These developments show that accessibility has become an important issue, especially at the ITU, which is the organization governing information and communications at the UN, and particularly the ITU-T, which recommends and promotes standardization of accessibility.

This standardization work is done mainly in ITU-T Q26/16. Below is a summary of the work items discussed in Q26/16.

2. H.702 "Accessibility profiles for IPTV systems" and related documents

This Recommendation was officially adopted on November 28, 2015, and it defines the basic accessibility functions for IPTV. Since then, further revisions have been made.

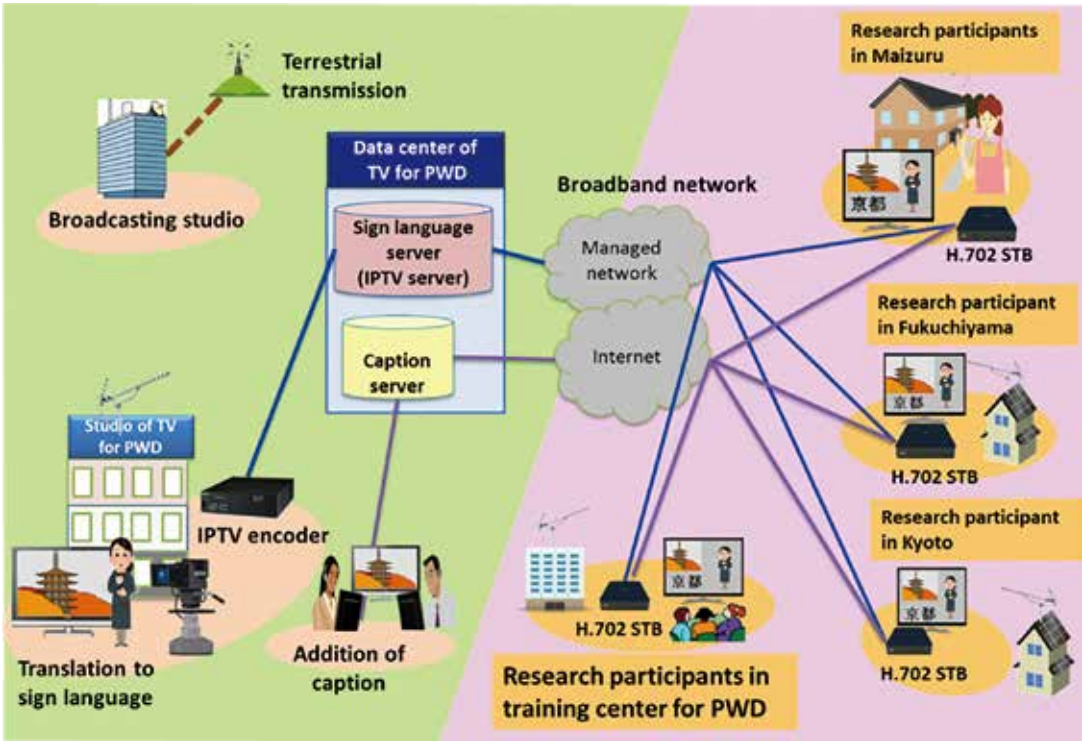
H.702 describes profiles of requirements on terminal devices for closed captioning, audio description (or descriptive audio), and display of sign language interpretation. It defines Basic Profile, Enhanced Profile, and Main Profile. It is hoped that ultimately, all televisions will implement Main Profile.

The Recommendation is the first ever international technical standard on IPTV accessibility and was initiated with a liaison statement from the Japan Federation of the Deaf and the All Japan Association of Hard of Hearing and Late-Deafened People (Zennancho), requesting ITU-T to standardize such profiles to meet their immediate needs. Contributions were created and proposed through industry-academic cooperation involving Waseda University, Keio University, Oki Electric Co. Ltd., ASTEM, and others.

Implementation according to this Recommendation has already been done in Japan, already recognized by the government as well as among PwDs both in Japan and overseas, and wider deployment is anticipated. Currently, work has also begun to adopt it for cable TV and regular broadcasts through organizations such as the European Broadcasting Union. In Japan, the Telecommunication Technology Committee (TTC) took global leadership in issuing the TTC standard JT.H702, "Accessibility Profiles for IPTV Systems" in 2016, making it a Japanese standard.

Accompanying H.702, Technical Paper HSTP.CONF-H702 "Conformance testing specification for ITU-T H.702" has also been approved, describing tests for conformance to the requirements of H.702. Conformance testing for H.702 has also been done according to this document, and the *Eye-dragon 4*, an IPTV set-top-box from ASTEM Co. Ltd., has passed this conformance testing.

Figure 1: Outline of the experiment of guaranteeing information accessibility for the disabled in digital terrestrial broadcasts using H.702



The technical paper, HSTP.ACC-UC "Use cases for inclusive media access services", is also currently being drafted, describing use-cases of H.702 implementations. This document describes examples of how systems implementing H.702 will be used, and how they provide accessibility, making it a reference for implementations. It describes the results of a joint experiment currently done with television broadcasters in Japan that provides information accessibility (specifically, signing video and closed captions) by using IPTV to complement digital terrestrial broadcasts (see Figure 1).

H.702 has become widely known among PwDs as an ITU international standard. As a result, it has also been adopted as a national standard by governments in several countries due to demand from PwDs. Besides Japan, Mongolia is planning to adopt H.702, and translation of the documents to Mongolian is currently in progress. Adoption in the legal system is expected within FY2018.

The Japan International Cooperation Agency (JICA) is conducting the "Project for Promoting Social Participation of Persons with Disabilities in Ulaanbaatar City," in Ulaanbaatar, the capital of Mongolia, and H.702 is expected to be a powerful tool for the project. A group of PwDs in Mongolia have obtained a broadcasting license, are preparing a broadcasting service, and are expecting to start a local pilot service using H.702 during 2018.

Interest in H.702 is also increasing in the United Nations. December 3 has been designated International Day of Persons with Disabilities (IDPD) by the UN to commemorate adoption of the World Programme of Action concerning Disabled Persons on December 3, 1982, with various events held around the world each year. In 2017, the United Nations Headquarters held an IDPD event on December 1, where a panel was held to discuss and promote the importance of the H.702 standard for access to information for PwDs, accompanied by an H.702 demo session.

Events to promote H.702 are also planned at general meetings of other organizations including the UN, the World Federation of the Deaf, the International Federation of Hard of Hearing People, and the European Federation of Hard of Hearing People.

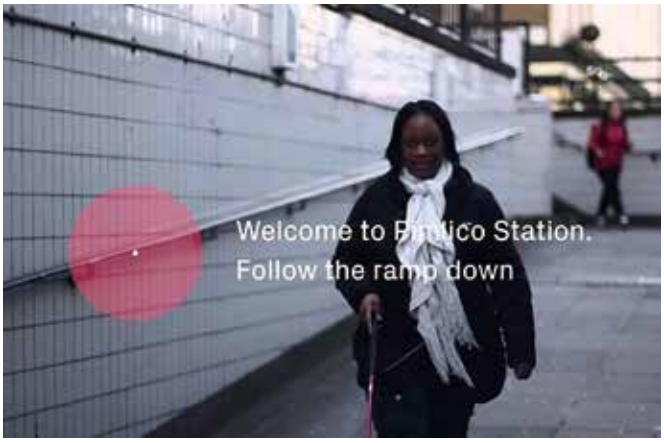
Figure 2: A TV screen in Mongolia implementing H.702

3. ITU-T Rec. F.921 "Audio-based network navigation system for persons with vision impairment"

This Recommendation was approved in May 2017. This work item was based on a proposal from the WayFindr organization in the UK. It specifies a framework for providing audio-based navigation directions for persons with visual impairments.

The Recommendation is intended for use, not outdoors, but in spaces like large buildings and underground train stations, where GPS signals do not reach. It describes requirements for methods such as installing beacons and other devices that are able to give appropriate audible guidance to persons with visual disabilities.

Figure 3: A video of the experiment taken place in London



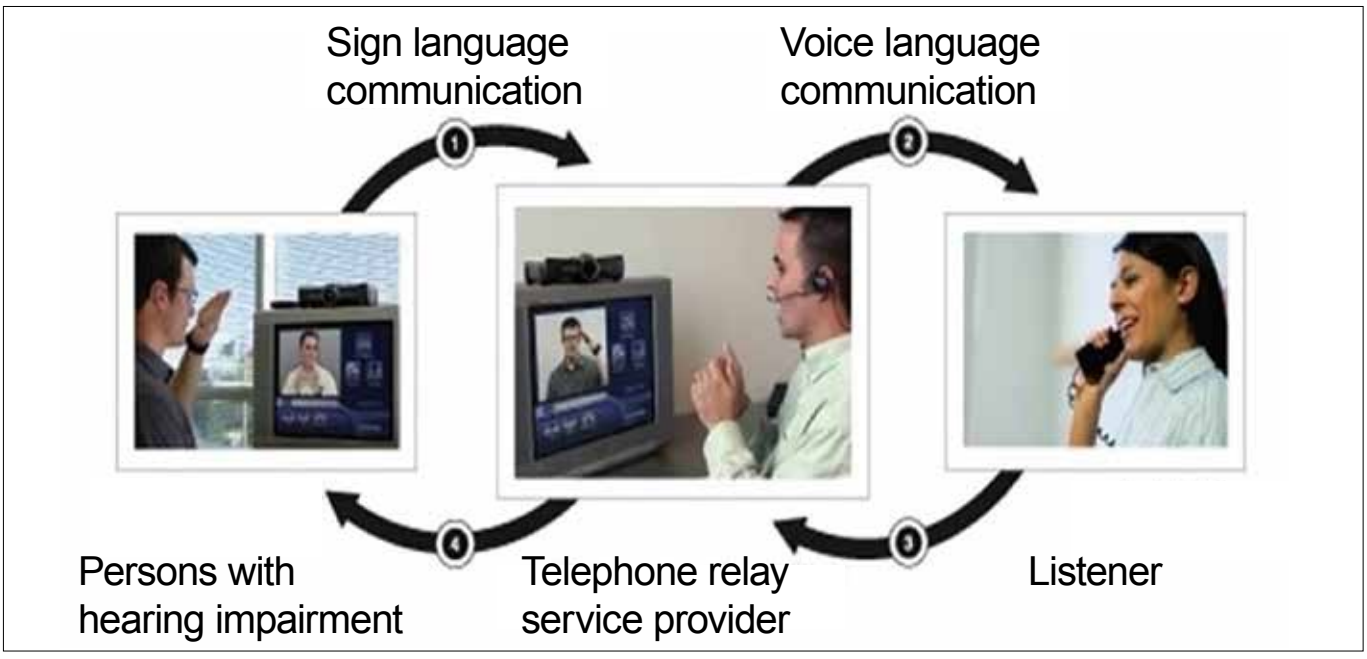
F.921 is a Recommendation regarding a framework and describes requirements. Detailed descriptions and compliance are described in "Compliance Protocol and Indicators for Audio-Based Network Navigation System for Persons with Vision Impairment" (FSTP. ANS-Checklist). F.921 and the WayFindr framework on which it is based are already being used in the London Underground, and demonstrations are about to begin in areas including Los Angeles and Sydney.

Demonstrations are also planned in Asia, including Japan, the Philippines, and Mongolia. It is anticipated that further technical Recommendations and conformance test documents will be created in the future, mainly by WayFindr, and will become international standards for audio guidance. An accessibility advisor to the President of the US has also shown interest in adopting it as a standard in the USA, as it is attracting attention from many governments as a global standard. Also related to this, the Zero Project decided to recognize F.921 as an excellent technology policy providing audio guidance to persons with visual disabilities at the 2018 Zero Project Conference. The Zero Project is an effort, headquartered in Vienna, to find and introduce the most advanced initiatives, from around the world that will improve the lives of PwDs, through collaboration with over 3,000 experts on issues of PwDs from around the world.

In Japan, the TTC plans to begin efforts toward localizing the standard quickly.

This Recommendation is very significant for ensuring safe freedom-of-mobility for persons with visual impairment, and the Tokyo Olympics and Paralympics, in particular, is a good opportunity for it to be deployed widely.

Figure 4: Mechanism of telephone relay services



4. F.Relay Telecommunication Relay Services

Telephone relay services are a mechanism for Deaf and hard-of-hearing people to use the telephone. They provide support for real-time two-way communication between hearing and non-hearing persons by having a Communication Assistant (CA) mediating between spoken voice language and sign language or text.

Deaf and hard-of-hearing people cannot make use of audio-only telephone services. This presents various obstacles that limit freedom in daily life for Deaf and hard-of-hearing people. One particular issue is the inability to make emergency calls (like 911 in the USA) in the event of disasters or crime.

During the 2020 Olympics and Paralympics, Japan expects to receive many PwDs from foreign countries, and the question of how to provide emergency services to these guests will be an extremely important one.

Telephone relay services can support such circumstances by enabling telephone conversation between persons with and without hearing disabilities.

In a telephone relay service, the service provider puts a person as a Communication Assistant between the callers, as shown in Figure 4. The Communication Assistant converts spoken words to sign language or text, and sign language or text to spoken words so the two parties can understand each other.

Telephone relay services have already been in operation in many countries. However, since there has been no standard, policies and technologies in each country are different and the resulting lack of interoperability has posed a great inconvenience for users, particularly with current advances in globalization. This applies especially during international events such as the Olympics.

This draft Recommendation is expected to change the situation by specifying a framework for such telephone relay services. It has been progressing based on proposals from Gallaudet University in the USA, which is well known for education for the Deaf and hard of hearing, and companies like Sprint, who are actually offering telephone relay services.

For these and other reasons, this draft Recommendation is much anticipated by Deaf and hard-of-hearing communities, receiving active contribution from them.

The draft Recommendation is expected to be completed and to enter the approval process during 2018. A telephone relay service utilizing IPTV is also described in an appendix.

In parallel with F.Relay, a service similar to, but different from, telephone relay services are dealt with in the draft Recommendation in the next section, regarding accessibility to public services.

5. F.ACC-TCPS: Total Conversation System for Public Services

Recently, more and more companies are providing customer service to PwDs using telephone relay services or remote video sign-language interpretation (VRI). For example, Barclays Bank in the UK are providing reception services in British Sign Language (BSL) to BarclayCard customers.

Reception services like this, using remote video, are technically quite similar to video telephone relay services (VRS), but differ in that they do not connect the person with hearing disability to any customer, but only to the reception of the party providing the service. These services are currently provided according to the needs of each enterprise.

However, unlike services by private enterprises, services by the public sector, such as fire brigade and policing, should be made available equally to all citizens, so the public sector has a duty to make their services accessible to all, including PwDs.

In light of this, F.ACC-TCPS describes technical background and requirements for public service reception guidance.

At international events like the Tokyo Olympics and Paralympics, where many PwDs are expected to attend, handling of emergency information is extremely important, so it is desirable that this draft Recommendation be approved and disseminated quickly.

6. H.ACC-MMSIGN: "Abstract language for multimedia signing"

This draft Recommendation was originally a work item arising from a proposal by Tunisia University in 2014, but there were no contributions after that. The work has now been restarted, because topics related to sign language have begun to be treated as part of natural language translation.

In the past, there have been many proposals for languages that describe sign language to be used for computer graphics (CG), but none of them were really able to describe it adequately. A language for describing sign language is needed not just for

generating sign language using CG and animation; use with captured video as well as for machine learning databases for sign-language recognition is also important. As such, a standard language for encoding sign language is needed.

This draft Recommendation uses the term "Multimedia Sign". While it does not provide a clear definition for this term, simply put, it refers broadly to "sign language expressed using multimedia," which includes sign language using a CG avatar, but also captured video.

There are many conflicting opinions on whether real communication is possible using sign language generated with CG avatars, but since Deaf people that have real experience with CG in particular have expressed strong concerns and opposition, this draft Recommendation avoids any mention of CG as much as possible.

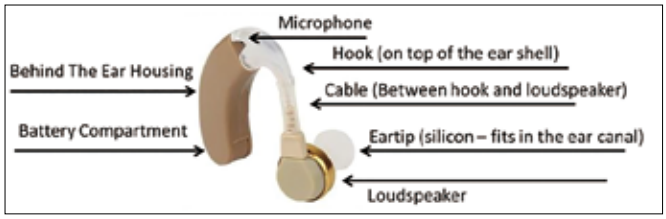
7. F.WAAD: "Safety requirements for wearable audio augmenting devices"

Recently, devices generally referred to as Personal Sound Amplifier Products (PSAPs), which are different from hearing aids used for medical purposes, are becoming widely available on the market. Prices are not high, in the range from 10 to 1,000 US dollars, and they can be purchased on Amazon and other Web sites, so they are rather easy to use.

PSAPs are intended to be used to help people with healthy hearing hear better, but it has recently been found that these products are actually often promoted and purchased as an inexpensive alternative to hearing aids (See Figure 5). The problem with this situation is that since these products are not intended to be used as hearing aids, they do not provide functions that hearing aids are required to have, such as mechanisms to suppress feedback and limit volume. If they are used by people with poor hearing, there is a danger that they could cause further hearing damage.

This draft Recommendation describes safety requirements for PSAP devices based on proposals for the EU by members of the European Association of Hearing Aid Professionals.

Figure 5: Example of PSAP



8. HSTP.AEHH: Audio enhancement for the hard-of-hearing

This Technical Paper describes various technologies for helping people who are hard of hearing to hear better. It was created based on a proposal originally from Japan Broadcasting Corporation (NHK). It describes technologies that make hearing easier for those that are hard of hearing, using methods that augment sound without increasing the volume, or change the speed of sound playback.

9. FSTP-RCSO: Overview of remote captioning services

Remote captioning services use a remote operator to provide caption text for, for example, a meeting as it progresses. This sort of services is extremely useful for Deaf and hard-of-hearing persons and also for foreigners, and offering it remotely helps to improve efficiency. This document gives a technical overview and requirements for these sorts of remote captioning services. This work is being done by the European Federation of the Hard-of-Hearing People and includes quite practical content such as educational methods and operations. It also refers to an important type of captioning service, which uses automatic speech recognition technology.

As captioning services are expected to be needed in many situations at the Tokyo Olympics and Paralympics, this document should be a valuable reference providing guidance for services that provide captions remotely.

10. Conclusion

This article has described the standardization work on accessibility at ITU-T Q26/16. This standardization of accessibility in cooperation with other UN related organizations is becoming a mainstream activity around the world, and standards that have been made into Recommendations are already being adopted in many countries. We hope that they will also come into general use in Japan as the Tokyo Olympics and Paralympics approach.

= A Serial Introduction Part 3= Winners of ITU-AJ Encouragement Awards 2017

In May every year, The ITU Association of Japan (ITU-AJ) proudly presents ITU-AJ Encouragement Awards to people who have made outstanding contributions in the field of international standardization and have helped in the ongoing development of ICT.
These Awards are also an embodiment of our sincere desire to encourage further contributions from these individuals in the future.
If you happen to run into these winners at another meeting in the future, please say hello to them.
But first, as part of the introductory series of Award Winners, allow us to introduce some of those remarkable winners.

Yoshihiro Nakayama
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Fields of activity: ICT projects in rural area

A Desire to Contribute to Society in Rural Area through ICT

I am very honored to receive the ITU-AJ Encouragement Award. Since engaging in international cooperation activities, I have been involved in projects in various countries including Vietnam, Mongolia, Myanmar, Bangladesh, and Thailand. I would like to express my deepest appreciation to my colleagues in Japan and overseas for their support in these projects.

I have greatly enjoyed traveling to different parts of Asia and meeting all sorts of people from different cultures. I find it very rewarding being able to use my ICT skills to improve the lives of others.

In a project in Mongolia in 2015, we set up a parabolic antenna to bring Internet access to a village called Khalkhgol along the border of the eastern steppe area, about 1,000 kilometers away from the capital Ulaanbaatar. We also connected the village hall, school and hospital by Wi-Fi. As a result, the local children are now able to access online teaching materials. It takes two whole days to drive from Ulaanbaatar to Khalkhgol. After the installation work, there was an opening ceremony where it was possible to see the happiness and excitement on the faces of everyone including the village head, doctor and teacher, and where many children gathered to sing a song. Khalkhgol is located near Nomonhan, which is the site of a battle between Russia and Japan over 70 years ago. There are still many monuments marking this event. At the welcome party, we had a good time singing and dancing together. Some of my Mongolian colleagues even sang a famous Japanese song, Kitaguni-no-haru, accompanied by an electronic piano. Although this project lasted just one year, its benefits were recognized and the running costs for at least the following year were included in the village budget.

After this experience, I am keen to make further contributions to local communities. I am proud of the way Japan has supported and encouraged these people, but I hope we can do even more to accelerate and promote projects that will help people not only in other countries but also here in Japan.

Yoshikazu Narikiyo
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Fields of activity: Digital terrestrial broadcasting

International standardization of current and future digital terrestrial broadcasting

It is a great honor to receive the ITU-AJ International Activity Encouragement Award. I am deeply indebted to The ITU Association of Japan and everyone who has offered me their guidance.

Since 2014, I have been involved with Working Party 6A of ITU-R Study Group 6, where we are working on the revision and formulation of documents concerning terrestrial digital broadcasting. This included revising Recommendation ITU-R BT.1368, which relates to planning criteria, including protection ratios, for digital terrestrial television services in the VHF/UHF bands, and creating ITU-R BT.2343, which relates to field trials of 4K and 8K transmission for the next generation of terrestrial digital broadcasting.

My first job in ITU-R standardization was to revise the ITU-R BT.1368 Recommendation. This started at a meeting in the spring of 2014, where I worked on interference protection ratios for DVB-T2 and ISDB-T in Colombia, which is one of the countries in South America that has adopted the DVB-T2 standard. At the fall 2014 meeting, we revised the recommendation to make some corrections based on experimental results obtained in Japan. With the support of Brazil, which is another member of the ISDB-T family, the issues were resolved not only at the meeting but also in preliminary behind-the-scenes discussions in Colombia. We eventually became good friends and often went out to dinner together.

I have also spent a good part of my career working on the ITU-R BT.2343 report on field trials of 4K and 8K television via terrestrial digital broadcasts. At the fall 2014 meeting, we proposed the creation of a report by Japan, and the first version of this report was published at the spring 2015 meeting. Also, for public viewings using 8K UHDTV transmissions in Brazil during the 2016 Rio Olympics, we revised the report into the form of a joint proposal by Japan and Brazil with the cooperation of the Brazilian supervisory authorities.

Through our international standardization activities at the ITU, I hope that Japan's broadcasting technology will lead the world, and that the world's broadcasting industry will continue to evolve.

Yoshitaka Hakamada

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Fields of activity: Digital broadcasting

International standardization of channel bonding for 4K and 8K cable TV transmission

I am honored to receive the ITU-AJ International Activity Encouragement Award. My sincere gratitude goes out to The ITU Association of Japan and to all my colleagues.

In Japan, we are making steady progress towards the start of 4K and 8K satellite broadcasting in December 2018. From 2014, I participated in Study Group 9 (SG9), which is concerned with cable TV research, and I became involved with the standardization of channel bonding technology that was developed for cable TV transmissions of 4K and 8K satellite broadcasts. Channel bonding technology is covered by three Recommendations (ITU-T Recommendations J.183, J.288 and J.94).

With the aim of fast-tracking the international standardization of channel bonding technology, I took part in the ITU-R SG9 meeting of September 2014, even though the system was still in the middle of being studied here in Japan. At this meeting, in order to complete the international standardization without making it inconsistent with the details of Japan's domestic standardization, I introduced a contributory document proposing revisions to existing Recommendations J.183 (multiplexing frames) and J.94 (service information; SI), for which it was known that standardization efforts were required in Japan, and I started working on standardization at ITU-T SG9.

Then, at the ITU-T SG9 meeting in June 2015, based on the progress that Japan had made in standardization, we proposed a method for dealing with the variable-length packet format adopted for 4K and 8K satellite broadcasting, and began drafting the new Recommendation J.288.

At the ITU-T SG9 meeting in January 2016, we prepared revised drafts of the existing Recommendations J.183 and J.94 and a draft of a new Recommendation J.288 aimed at achieving consistency with the contents of the Japanese standard issued in November 2015. Following discussions at this meeting, all three draft recommendations were approved and in March 2016 they were all issued as Recommendations.

This award has encouraged me to continue working on standardization activities aimed at the development of broadcasting technology in the future.

Katsumasa Hirose

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Fields of activity: ISDB-T, EWBS

Promoting ISDB-T in Peru — our neighbor across the Pacific Ocean

It is a great privilege to receive the ITU-AJ International Activity Encouragement Award. I would like to express my sincere gratitude to The ITU Association of Japan and all my colleagues. Starting in October 2012, I spent two years working as a technical cooperation expert for the Japan International Cooperation Agency (JICA), and spent time working in Peru to promote the spread of terrestrial digital broadcasting (ISDB-T). Like Japan, Peru is located on the Pacific "Ring of Fire", where major earthquakes and tsunamis occur periodically, and also experiences abnormal weather events that can cause flooding and other problems. I worked on the introduction of an emergency warning broadcast system (EWBS), which is one of the features of ISDB-T. Our plan was to set up terrestrial digital transmission facilities in seven cities, and to multiplex the terrestrial digital signals with EWBS from the capital city Lima so that emergency information can be received via broadcasts in rural areas. The project was officially started in 2012, and a little over four years later, we were able to start operating the system in Peru in June 2016. When an earthquake struck off the coast of Mexico (M8.1) in September 2017, EWBS was used to inform people of the arrival of a tsunami. This made Peru the first country outside Japan to make practical use of this system. In the future, I hope that Peru's EWBS will continue to protect as many people as possible.

Peru may be a long way from Japan, but we are both neighbors of the Pacific Ocean, and there are strong expectations that Peru will import terrestrial digital broadcasting and other technologies from Japan. In the meantime, I am proud to have spent two years promoting the spread of terrestrial digital broadcasting in Peru, and my contribution, however small, is something I will always remember fondly. I hope that Peru and all the other countries that have adopted ISDB-T will continue to enjoy the benefits of this technology in the future. With the encouragement of this award, I hope to continue working on the international development of ISDB-T, and perhaps contribute to the spread of next-generation 4K and 8K broadcasting systems.

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“For the ideal use of radio spectrum in new wireless era”

— Nomination for ITU RRB Member —

In the 110-year history of the Radio Regulations (RR), wireless applications have been increasing in number and in categories and the structure of the RR have become more and more complicated. The Radio Regulations Board (RRB) has an important role to avoid unnecessary conflicts in applying the RR. Dr. Hashimoto’s outstanding and significant accomplishments in the ITU-R make him an ideal candidate for a Member of the RRB. Here, the Government of Japan nominates him for a Member of the RRB and would like to seek your support to him.

ITU Experience

1995	Chairman, WP9B, SG9
2000	Vice-Chairman SG9
2003	Chairman, WG5D, WRC-03
2007	Chairman, COM5, WRC-07
2007–2015	Chairman, SG5
2015	Chairman, RA-15

Professional Career within the Company

1970	Joined Nippon Telegraph & Telephone Public Cooperation (NTT)
1995 – 1997	Executive Manager of Wireless Systems Lab, NTT
1997 – 1998	Moving to NTT DOCOMO, Senior Manager of Plant Department
1998 – 2001	Vice President, Executive Manager of Wireless Link Development Department
2001 – 2015	Managing Director of Wireless Technology Standardization Department
2016 –	Counsellor for Wireless Technology Standardization

General Information

Name	Dr. Akira HASHIMOTO
Present title	Counsellor for Wireless Technology Standardization, NTT DOCOMO Inc.
Date of birth	October 30, 1947
Official address	2-11-1 Nagata-cho, Chiyoda-ku, Tokyo, 100-6150, Japan

Awards

June 2015	Minister’s Award from Ministry of Internal affairs and Communications (MIC) for Radiowave Achievement Award
October 2015	ITU Silver Medal for contributions to the ITU-R activities
June 2016	Minister’s Award from the MIC for Radio Day 2016

Education and Academic Achievement

1970	Bachelor’s degree of Electrical Engineering, The University of Tokyo
1999	Ph.D. degree, The University of Tokyo
1999	Achievement Award from the Institute of Electronics, Information & Communication Engineering, Japan

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Candidate for RRB Member

Akira HASHIMOTO

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