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Special Feature

Latest Trends in Metaverse Business

Introduction to the Digital Space

Toward Mass Adoption of web3

Utilizing the Metaverse in the Industrial Sector

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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.

Introduction to the Digital Space

Ryo Kato
Chief of the Secretariat
Japan Digital Space Economy Federation

1. Japan Digital Space Economy Federation

The Japan Digital Space Economy Federation (hereafter referred to as "the Federation") is an economic organization established in April 2022 with the goal of revitalizing economic activity in digital spaces and contributing to the sound development of the Japanese economy and the enrichment of people's lives.

The Federation's activities are broadly divided into two main committees:

1. The Policy Committee, which conducts policy proposals and public awareness initiatives, and
2. The Business Enhancement Committee, which carries out cross-company proof-of-concept (PoC) experiments among member organizations.

In 2022, the Policy Committee published a Report on Economic Development in Digital Spaces, and in 2024, released the Metaverse Literacy Guidebook to promote understanding and awareness of the metaverse. In 2023, the Business Enhancement Committee published two PoC reports: one on operating virtual stores in digital spaces, and another on implementing virtual offices. It is currently planning three additional PoC initiatives: virtual malls (e-commerce in digital spaces), metaverse university (education and training in digital spaces), and industrial metaverse (digital twins). All of these reports and outputs are available on the Federation's official website (in Japanese), and readers who are interested are encouraged to take a look.

As of January 6, 2025, the Federation has 134 member organizations. General members include companies from a wide range of industries, such as telecom, media, and technology (TMT), finance, real estate, manufacturing, retail, gaming, and entertainment. Supporting members also include local governments and industry associations.

2. What is digital space?

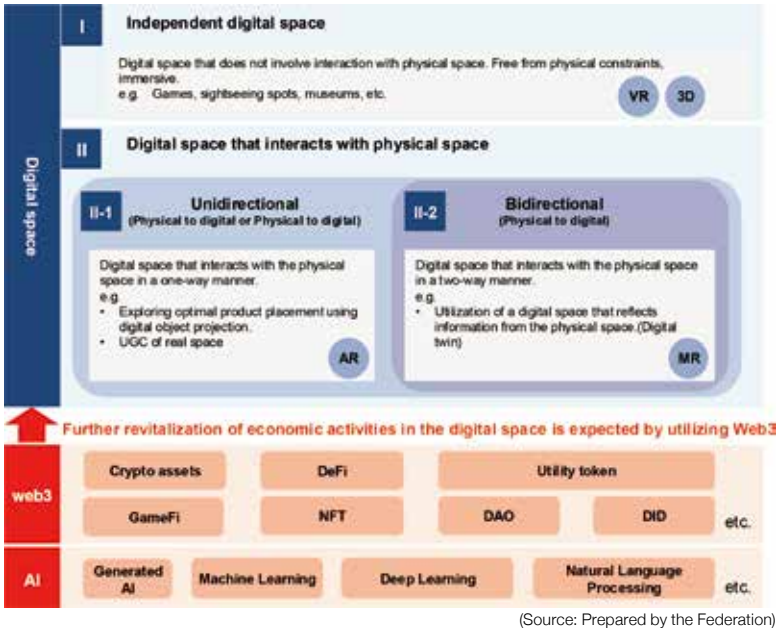
The author defines digital space as "a virtual three-dimensional environment constructed on the internet, where multiple participants can join, interact, and communicate with one another."

The clearest example of this concept is the so-called metaverse. However, because there is no universally accepted definition of the metaverse, the following classification system is used:

I. Independent digital spaces:

These are digital spaces that operate independently of the

Figure : What is digital space?



(Source: Prepared by the Federation)

physical world, without interaction between the two. Technically, this corresponds to virtual reality (VR). Examples include games and virtual museums created with 3D computer graphics (3DCG).

II. Digital spaces that interact with the physical world:

II-1. Unidirectional (physical → digital or physical ← digital):

These are digital spaces that incorporate unidirectional interaction with the physical world. This corresponds to augmented reality (AR).

For example, a physical sculpture could be represented as a digital item (such as an NFT) within a digital space for exhibition or sale.

II-2. Bidirectional (physical ↔ digital):

These digital spaces support bidirectional interaction with the physical world. This corresponds to mixed reality (MR). For instance, a digital space may faithfully replicate a physical environment, with real-world movements mirrored in the digital space (i.e., digital twins).

The Federation believes that utilizing Web3, a decentralized version of the internet built on blockchain technology and functioning without centralized administrators, can enhance user experiences in digital spaces. As such, Web3 is within the scope of the Federation's activities and areas of study. Similarly, the Federation sees strong potential for AI to complement interfaces within digital spaces and includes it within its scope of consideration as well.

3. The source of value in digital space

When it comes to utilizing digital space, its primary source of value lies in making possible what is difficult or impossible in the real world. For example, consider a history lesson on the pyramids of ancient Egypt. In the real world, students typically learn through textbook images or videos. But with digital space (imagine, in this case, a highly detailed reconstruction of the pyramids within the metaverse), students can explore a full-scale virtual pyramid, including areas that are inaccessible in real life. Moreover, as long as the technology supports it, students from all over the world can join the same lesson simultaneously.

Another example is the training of skilled welders. In the real world, this typically involves observing a master at work and learning by imitation, or gradually acquiring the skill while facing risks of injury. In digital space (think of a welding training program using VR), trainees can practice both theoretically and experientially, without any physical danger.

4. Case studies

Digital spaces can broadly be categorized into consumer-oriented applications, such as those for gaming, social media, exhibitions, and shopping, and those geared toward industrial use, such as in manufacturing and construction. Below are examples for each category.

(1) Roblox

Roblox is a metaverse platform where users can create and share their own games and experiences, and interact with others. With approximately 350 million monthly active users (MAUs), it is fair to say that Roblox is one of the most successful platforms globally. A major factor behind its success is that even users with little experience in programming or 3D modeling can easily create games and experiences using Roblox Studio. The platform empowers users to bring their ideas to life, *truly making possible what is difficult to achieve in the real world*. For example, users can design games that simulate zero-gravity environments and alternate dimensions, or let players explore fantastical worlds or futuristic cities in real time. Imagination thus becomes reality in digital space.

Moreover, Roblox features its own in-game currency, Robux, which users can use to buy and sell games and avatar items. This allows for ownership of digital content that cannot be obtained in the physical world.

(2) Hitachi, Ltd. – "Worksite-Augmenting Metaverse"

The use of digital spaces extends beyond consumer applications to industrial and B2B domains as well. One such example is the "Worksite-Augmenting Metaverse" being researched and developed by Hitachi, Ltd. According to Hitachi, the Worksite-Augmenting Metaverse is a system that "replicates workplaces in three dimensions (3D) and collects data in various forms to provide people with an intuitive sense of how things relate to one another in order to streamline operations."*1 They have conducted research applying this approach to plant construction management and railway vehicle maintenance. In the author's understanding, the Worksite-Augmenting Metaverse has the following key benefits:

1. Data accumulation via a metaverse interface

In the Worksite-Augmenting Metaverse, real-world objects such as plant structures or the exterior and interior of train cars are recreated using 3D Computer-Aided Design (CAD). Through the metaverse interface, users can access a wide range of data, such as blueprints, inspection reports, field notes, audio recordings, and more. This data is accessible not only to on-site workers but also to personnel at headquarters or branches and other remote locations. Moreover, the use of AI can help members more easily locate the appropriate data they need.

2. The metaverse as a shared "space" that enhances

*1 Quoted from https://www.hitachihyoron.com/jp/papers/2024/07/04/index.html [https://www.hitachihyoron.com/rev/papers/2024/09/01/index.html]

communication

Traditionally, communication between sites or between the field and headquarters was limited to either in-person visits or online meetings such as video conferences. By leveraging the Worksite-Augmenting Metaverse, both field workers and head office staff, including those with decision-making authority, can gather in the same virtual "space" and engage in more realistic, effective communication. This capability proves useful not only for day-to-day operations but also for incident response and accident investigations. For example, if an accident occurs at a factory, it could be faithfully reconstructed within the Worksite-Augmenting Metaverse, enabling experts in remote locations to participate in a virtual inspection. This could lead to quicker identification of the cause and, if members of an insurance company are involved, could also streamline the claims process.

In this way, the Worksite-Augmenting Metaverse enables data visualization and remote collaboration that would be difficult or impossible in the physical world. Going forward, such applications are likely to see increasing use in industrial and B2B settings.

5. Challenges

In this section, we discuss challenges that have not been successfully addressed or realized—yet are expected to be overcome in the future—as the use of digital spaces continues to expand (hereafter referred to collectively as "challenges").

5.1 Challenges in consumer-facing digital spaces

A straightforward way to describe the challenges in consumer-facing digital spaces (imagine the Roblox example from Section 4.1) is this: "not enough users" and "not financially viable." In other words, compared to social media services, video platforms, or even the physical world, these platforms often struggle to attract enough users. For commercial enterprises aiming to leverage digital spaces for profit, it is not uncommon for the cost of planning, development, and ongoing operations to outweigh revenues—leading to financial losses—or for anticipated effects in marketing or branding to fall short of expectations.

At the root of these challenges lies the fact that the market is still in its early stages. To give a relatable analogy: the number of "digital space natives"—i.e., those who grew up with VR/AR/XR or the metaverse ("metaverse natives")—is limited mainly to teenagers and perhaps those in their early twenties. In Japan, for example, this demographic makes up less than 15% of the population. Older generations typically come into contact with digital spaces through specific triggers and try them out of curiosity. At the Federation, we hypothesized that there are more people who prefer to first understand what the metaverse is and what to be mindful of (what you might call the "cautious" group) than those who would jump in just because it seems interesting. With this awareness, we felt there should be a kind of introductory guidebook tailored to such users. We therefore launched a special committee in FY2023 to create the Metaverse Literacy Guidebook (hereafter, "the Guidebook"), which was published in January 2024*2.

The Guidebook is available in two editions: one for general users and another for service providers, including platformers and business users. It is organized around ten themes, each providing easy-to-understand facts and advice—illustrated for clarity—that users should know before entering the metaverse. The business-focused edition offers suggestions on how service providers can create an environment in which users can confidently engage with the metaverse. The Guidebook aims to act as a kind of navigation tool for both users and businesses entering the metaverse economy, all while respecting the unique culture that has emerged within these digital spaces. We encourage all readers to take a look via the URL provided in the footnotes.

Now, in addition to the issue of awareness and adoption, there are also several technical challenges, as outlined below.

(1) Device evolution

Currently, the devices used to access digital spaces can be broadly categorized into: (1) mobile or PC devices, (2) head-mounted goggles, (3) smart glasses, and (4) spatial displays.

Category (1) offers easy access but provides a lower level of immersion compared to (2) through (4). Category (2) offers a high degree of immersion but is not ideal for extended use and may not be comfortable for everyone. Category (3), which is typically associated with AR, has not yet seen widespread adoption, perhaps because wearing glasses for long periods is not comfortable for everyone.

Category (4) is more commonly used in industrial settings, such as for viewing large-scale structures or in medical applications.

Each device type has its pros and cons and is suited to different use cases. However, if a device were to emerge that anyone could use comfortably and naturally, there is little doubt that it would dramatically expand the user base of digital spaces.

(2) Handling increased concurrent connections

Depending on the platform, digital spaces often have limits on how many users can be connected at the same time. This is because more simultaneous connections lead to increased data traffic and higher server loads. To accommodate more users, platforms may lower the quality of 3DCG (visuals) or reduce functionality (e.g., disabling voice chat in favor of text chat). However, this trade-off represents the classic dilemma between

*2 Please refer to the special site: https://jdsef.or.jp/metaverse_literacy_guidebook [https://jdsef.or.jp/metaverse_literacy_guidebook_en]

quality and volume. Fortunately, new technologies are emerging to address this dilemma, with the goal of increasing simultaneous user capacity without significantly sacrificing quality.

(3) Interoperability

In digital spaces, interoperability refers to the ability to seamlessly move between different platforms. For example, if a user on platform A could instantly jump to platforms B or C without needing to log out, user convenience would improve—and with it, overall user numbers. Efforts are already underway to make this a reality. Organizations like the Metaverse Standards Forum are actively discussing the establishment of interoperability standards across platforms.

5.2 Challenges in industrial applications of digital spaces

When it comes to industrial use, such as in manufacturing or construction, digital spaces are not a new concept if we include technologies like 3D CAD. In that sense, it is a "long-established domain." However, concepts like the Worksite-Augmenting Metaverse, introduced earlier, represent a domain that is expected to evolve further. This section discusses the challenges involved in the continued development of such future-oriented applications.

(1) Designing incentives for user participation

As discussed previously, one of the key values of industrial digital spaces lies in the accumulation of data through digital interfaces. To build a richer dataset, field workers need to actively input data. However, from the workers' perspective, this can often mean added workload; and in some cases, they may feel as though their actions are being monitored. For example, if a skilled worker is asked to share their know-how within the system, they may perceive this as an act that could jeopardize their job security in the long term. This creates a clear disincentive.

To address this, it becomes necessary to design incentives that encourage field workers to contribute data. These incentives could be financial, such as reflecting participation in performance evaluations, salaries, or bonuses, or non-financial, such as public recognition or awards for proactive contributors. In any case, effective incentive design will be essential for the widespread adoption and utilization of such systems.

(2) Expanding use cases

In theory, industrial digital spaces have a wide range of potential use cases. For example, in a digital twin environment, when a part breaks down on-site, it could be possible to order a replacement part directly from the digital space by adding purchasing functionality. Moreover, if the assets being digitized, such as trains or factories, are of public interest, the digital content could be repurposed for consumer use by excluding any sensitive information. For instance, companies could offer virtual tours of train cars or factories. These virtual experiences could even allow users to explore areas that would typically be off-limits due to safety concerns in real-world site visits.

6. Conclusion

This paper has provided an overview of the current state and challenges of digital space utilization, based on the activities of the Federation. Digital spaces hold significant potential to contribute to economic activity and social progress. Moving forward, the Federation remains committed to advancing efforts that unlock and maximize this potential.

Cover Art

Fireworks at Ryôgoku Bridge (Ryôgoku hanabi) from A Hundred Views of Musashi Province

Woodblock prints depict famous landmarks in Tokyo.

Kobayashi Kiyochika
(1847-1915)

Source: National Diet Library, NDL Image Bank
(https://rnavi.ndl.go.jp/imagebank/)

Toward Mass Adoption of web3

Yasushi Teramura
Head of Blockchain Business
gumi Inc.

1. What blockchain brings

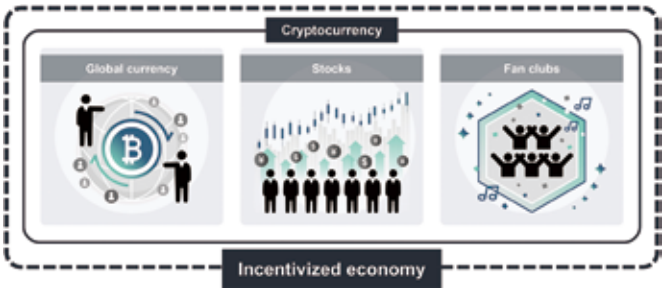
Before getting into the main topic, let's first clarify "what has blockchain, a new technology, brought to the table?" That question has no single answer, and it is important to answer it from multiple perspectives, such as technical, functional, and ideological. When conducting business using blockchain, if discussions take place without this awareness, the focus can easily shift, leading to misunderstandings; therefore, it is crucial to keep these perspectives in mind.

What I'm about to share is based on my personal experience in business. The potential of this innovative technology called "blockchain" is still largely unknown, and it may be used or interpreted in ways we haven't yet imagined. From a technical standpoint, blockchain is a technology that brings asset value to digital data and ensures the transparency and authenticity of peer-to-peer transactions. It will thus enable the ownership, trade, and mutual use of digital data as well as the expansion of the scope of use and mutual use of digital data. For example, crypto assets (payment currency) and non-fungible tokens (NFTs) (characters and items) linked to digital content such as games become users' assets and can become a user's own assets and be sold to other users. Depending on their design, it may also be possible to reuse them in other content. From the user's perspective, the money and time spent on content can serve as asset formation or investment behavior rather than consumption behavior (Figure 1).

Figure 1

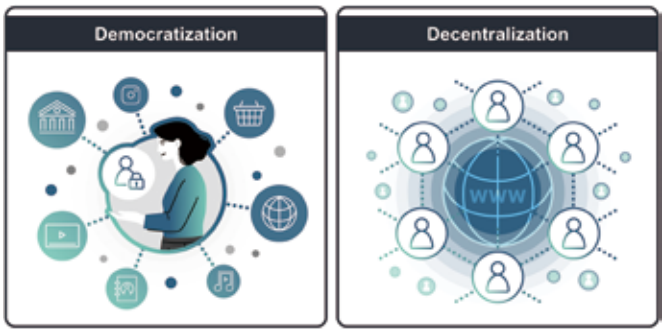
In terms of functionality, it is recognized that crypto assets combine the functions and elements of both financial aspects, such as a world currency (a global means of payment) and stocks (voting rights, price fluctuations, and funding), as well as a strong community aspect similar to a fan club. Utilizing these financial and community functions will make it possible to build a strong economic sphere that provides market participants with economic incentives (motivations that encourage autonomous behavior). In particular, the key point is that financial benefits are likely to be returned to early market participants—so-called "first fans" (Figure 2).

Figure 2



From an ideological perspective, blockchain (or perhaps the term "web3" is more appropriate) brings about a social movement that promotes "democratization" (individual sovereignty) and "decentralization" (personal responsibility). It is necessary to move away from the current centralized-management society, and although society will not swing dramatically to decentralization, a change in values is gradually spreading across society. In fact, it noteworthy that policies in countries around the world are increasingly focusing on web3 (Figure 3).

Figure 3



In this way, it is expected that blockchain and web3 will bring about social change and structural reform in terms of technology, functionality, and ideology. In particular, applying them as fundamental technologies, many new businesses and use cases will be created in the future.

2. Challenges facing mass adoption

Despite the above-described expectations, in terms of the extent to which blockchain and web3 are being used familiarly for business and personal consumption as well as investment activities, people's awareness of them is still low even on a global scale. In fact, according to a survey by an external organization, as of 2023, as for the number of cryptocurrency holders in the world, the US (which ranks first) and Japan account for around 27-million owners (8% of the population) and 5-million owners (4%), respectively. It can thus be said that the web3-related market has considerable room for growth, and many research companies expect its growth rate to increase in the future.

Nevertheless, why is it that—despite the fact that blockchain is an innovative technology—it has not been used in business and widely adopted around the world? It is thought that three major issues need to be addressed before blockchain can achieve mass adoption. The first problem is the psychological hurdles on the part of users (consumers); the second problem is failure of companies to provide quality content; and the third problem is establishing rules such as laws and regulations.

As for the first problem, the psychological hurdles for users, includes the complex and intimidating processes involved in opening accounts at cryptocurrency exchanges and choosing "crypto wallets" for managing crypto assets as well as a lack of trust in the market (as exemplified by the FTX incident) and a high level of caution against cyberattacks and fraud. This problem cannot be solved by a single business operator alone; it is considered necessary for media operators, who have a strong influence on consumers, and the businesses building the blockchain-infrastructure systems to work together to solve the problem. How information is communicated to consumers, including the clarity and tone of the communication, will be vital.

As for the second problem, a lack of quality content, for example, in the case of web3 games, many of them are monotonous and lack "gameplay" (fun), they are biased towards speculative games such as those typified by the phrase "Play to Earn," and almost no games use highly appealing intellectual property (IP). Under these circumstances, many content-development companies need an opportunity to enter this field and accelerate aggressive business investment.

As for the third problem, rulemaking, it is necessary to establish laws and regulations, accounting standards, tax systems, etc. in a comprehensive and integrated manner; accordingly, in Japan, the government and industry groups are making bold and rapid progress in solving this problem. Naturally, clarifying the rules is an advantage in regard to doing business, and it could be a major factor differentiating Japan from other countries.

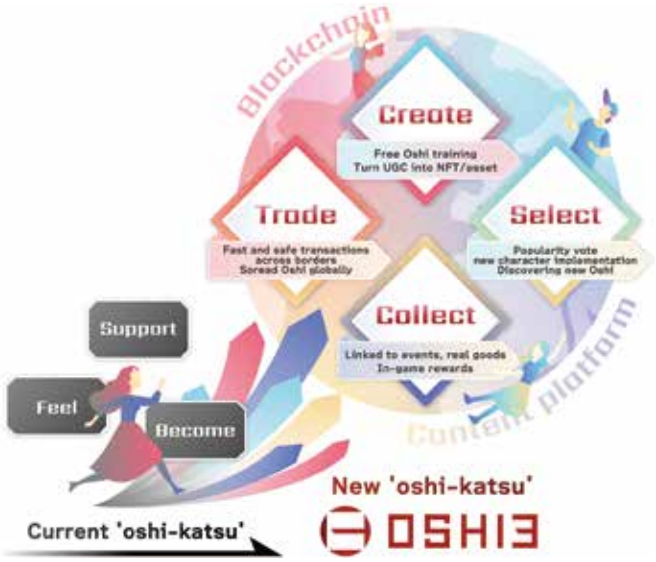
3. About the OSHI3 Project

The "OSHI3" project, which is being undertaken by gumi Inc., the company I work for, is a global initiative aimed at creating content and services that harness blockchain technology in the field of "*oshikatsu*" (fandom culture), offering users entirely new digital experiences. As discussed earlier, several barriers still hinder mass Web3 adoption. OSHI3 specifically targets one of the key issues: the lack of high-quality content.

First, I'd like to touch on the current state of the oshikatsu market in Japan. Having already grown to the level of 700 billion yen, the market size is expected to continue to grow. Until now, the term *oshikatsu* has been used—with a negative connotation—to describe nerds or nerdy activities, and the activity has been considered more of a subculture than a popular activity. In the past few years, however, the term *oshikatsu* has come to be used with the same positive connotation as "*kawaii*" (cute), and it is now considered to have been established not as a subculture but as a legitimate culture. The English words "fandom" and "stan" have become commonplace in other countries as well, and the Japanese *oshikatsu* culture is beginning to spread not only in Japan but around the world as well.

However, the sphere of *oshikatsu* activities is still mainly physical. For example, if fans have a favorite artist, their sphere of activity is limited to going to the artist's live shows as a fan to support them or buying merchandise such as figurines to display at home. If this behavior spreads further into the digital sphere and permeates the entire content market, which is said to be worth more than 190 trillion yen worldwide, it is likely to become an even stronger culture and lead to the formation of new industries and economic spheres (Figure 4).

Figure 4



To expand the practice of *oshikatsu* into the digital realm, it is useful to utilize blockchain technology, which can assign asset value to digital data. For example, if it becomes possible to develop digital characters in a game and own them as one's own assets, the act of "character *oshikatsu*" in the digital realm will become possible.

OSHI3 utilizes a unique cryptocurrency called "OSHI," which is designed to be usable in multiple contents in OSHI3,

and if the OSHI3 project as a whole gains momentum, the value of OSHI may rise. For users and investors who hold OSHI, contributing to OSHI3 in some way may generate economic benefits (profits from price appreciation), which makes it easier for them to participate in the OSHI economy with a sense of ownership. In the case of cryptocurrencies such as OSHI, the value fluctuates with the size of the economy, which is very different from previous points economies. Moreover, OSHI is listed on major cryptocurrency exchanges both in Japan and overseas and is distributed globally, so anyone can obtain it relatively easily (Figure 5).

Through its mobile online game business, gumi has a track record of developing and operating numerous game titles that utilize not only gumi's own original IP but also popular IPs from other companies, and we are well aware of the love and enthusiasm that users have for IP. Taking advantage of this knowledge, they are developing a service that combines "*oshikatsu* × blockchain technology × digital content." The first content created by OSHI3, released in March 2024, is a character-development game called "Phantom of the Kill - Alternative Imitation." Upon release, it ranked first in the download rankings on both the App Store and Google Play Store, and in doing so, it has achieved top-class results as a Japanese blockchain game and received a positive response from the market. Moreover, despite being content aimed at the Japanese market, it has also created an opportunity to attract a certain amount of attention globally (Figure 6).

With the goal of further development, OSHI3 also plans to form alliances with leading companies to receive non-game content from partner companies. I hope that the provision of multiple content related to the promotion of Japanese games, anime, and idols will serve as a catalyst for mass adoption on the web3.

Figure 5

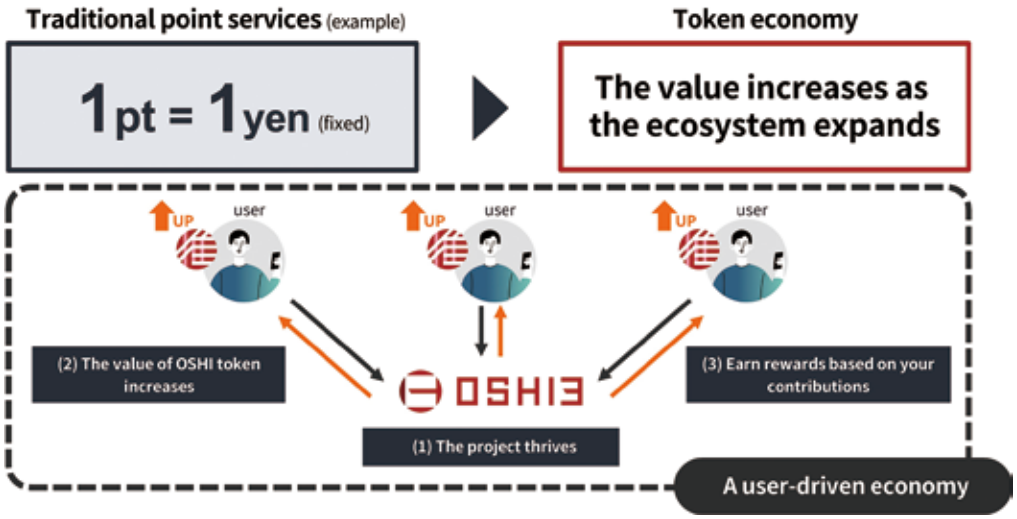


Figure 6

Utilizing the Metaverse in the Industrial Sector

— *The "Worksite-Augmenting Metaverse"*—

Yuki Inoue
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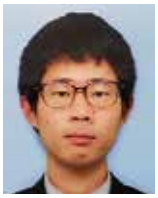

Takuto Sato
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1. Introduction

Advances in virtual reality (VR) technology, high-performance devices becoming prevalent, and the COVID-19 pandemic encouraging remote work and expanding stay-at-home demands have all contributed to the increasing use of the metaverse in various scenes over the past few years. However, when people hear the word "metaverse," they often think of its entertainment usages, such as VR games or virtually hosted events like music festivals. It may come as a surprise that behind the glamorous metaverse usages in the entertainment industry, the industrial applications of metaverse technology, referred to as the "industrial metaverse," are quietly gaining momentum. In this article, we introduce one of Hitachi's initiatives regarding the industrial metaverse—namely, the "Worksite-Augmenting Metaverse."

2. Difficulties with DX in the industrial sector

Japan's social infrastructure (including electricity, communications, and transportation) was developed between the 1960s and 1980s. In recent years, however, that infrastructure—across numerous industry sectors—has started to deteriorate, so its maintenance and repair is crucial. In the meantime, Japan has also been suffering a decline in the working-age population, which has led to a serious shortage of personnel to carry out the repairs and maintenance. Maintaining social infrastructure with a limited number of personnel requires efficiency, and it is hoped that digital technology will be the key to unlocking that efficiency. Transforming workplaces using digital technology—called "digital transformation" (DX for short)—is ongoing in many industry sectors. However, unlike the IT industry, in which digital technology is relatively easy to apply, the social-infrastructure sector often lacks mechanisms to digitize data from the field and systems to utilize the digitized data. As a result, worksite data are often locked inside the workfloor in a manner that makes it difficult for remote parties to comprehend the situation on the workfloor. This situation negatively affects efficiency, in forms such as miscommunication and unnecessary rework, and hinders DX.

3. Worksite-Augmenting Metaverse

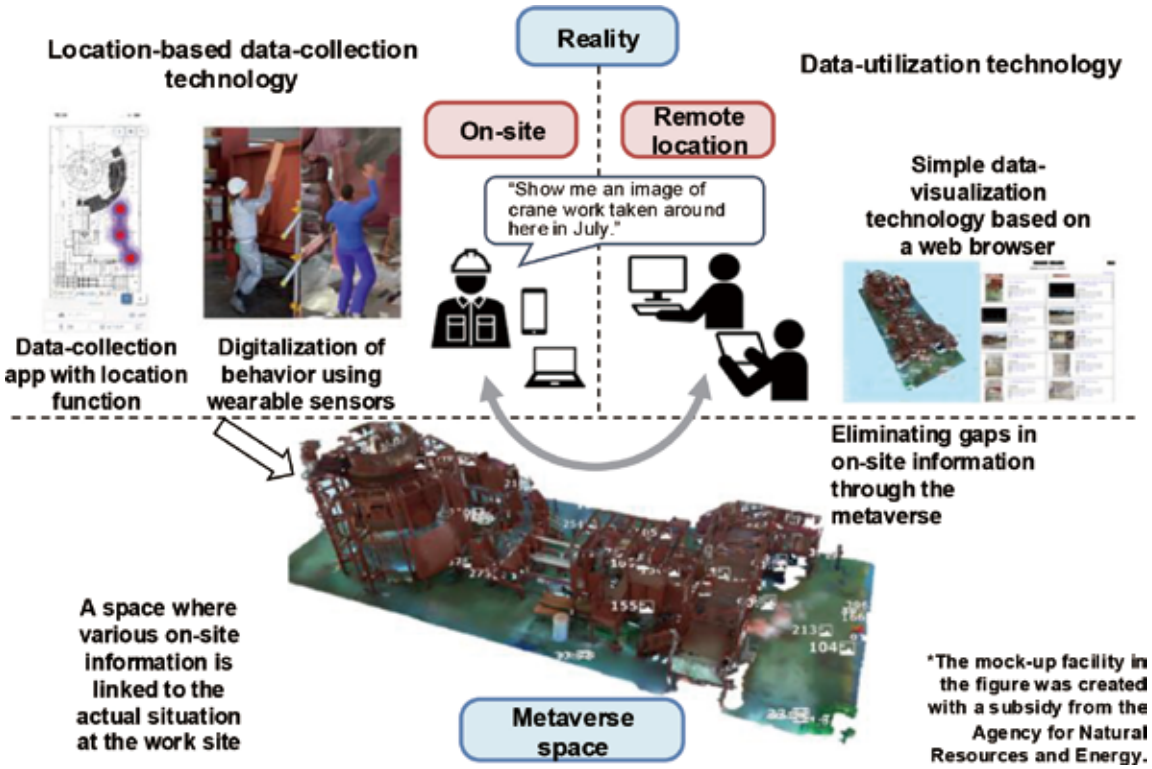
To solve the above-mentioned problems, since 2022, Hitachi has been researching and developing the "Worksite-Augmenting Metaverse" as a platform for efficiently collecting and utilizing data such as on-site work conditions and environmental information.*1 As shown in Figure 1, the Worksite-Augmenting Metaverse is composed of three elements: (i) the metaverse space (which is the core of the platform), (ii) data-collection technology, and (iii) data-utilization technology. It is composed of 3D scan data and/or computer-aided-design data (CAD, i.e., 3D models created for design, etc.) about the site, and it faithfully reproduces the appearance of the site. By virtually reproducing the site, the metaverse space enables people—even people who have never visited the site—to understand the current appearance of the site. This capability is especially beneficial for sites whose appearance changes frequently (such as construction sites).

Moreover, when multiple users log in to the metaverse space simultaneously, an avatar of each user is displayed, so it becomes possible to communicate through demonstratives words (e.g., "this," "that," "here") and body language such as finger pointing. In the industrial field, many conversations are about specific locations or equipment, so it is advantageous to be able to clearly indicate the subject of a conversation using non-verbal signs.

However, the metaverse space can only provide external information, so it is difficult to fully understand the situation on the workfloor from the metaverse space alone. To overcome that difficulty, in the Worksite-Augmenting Metaverse, information is

*1 Hitachi Review, "Hitachi Group's Progress on Worksite Augmenting Metaverse for Industry "

Figure 1: Conceptual diagram of the Worksite-Augmenting Metaverse. The mock-up facility in the figure was built with a subsidy from the Agency for Natural Resources and Energy



supplemented by storing data collected from the field and linking it to the corresponding coordinates in the metaverse space. For many industrial worksites, the data collected from the workfloor carries an important "spatial" meaning, so it is important to store the data in a form that can retain such spatial information. For example, by linking the sound of a pump recorded during maintenance work to the physical coordinates of the pump, it becomes possible to link the pump's 3D information to its operating status as inferred from the sound data.

As for the data-collection technology, we developed a smartphone app that enables field workers and others to collect data. The app incorporates indoor-positioning technology that allows location information to be tracked within the site. By using this app, a worker who wants to record a particular matter while working can take a photo or write a note on the spot and save that data linked to the location at which it was collected.

The final element of the Worksite-Augmenting Metaverse is data-utilization technology, including image analysis, voice recognition, text summarization, and other recognition technologies, which are applied to the collected data in a manner that allows the desired data to be accessed quickly.

In conclusion, the Worksite-Augmenting Metaverse represents a significant step forward in industrial DX by redefining the traditional concept of "on-site" presence. It extends physical workspaces into virtual ones and thereby allows stakeholders to access and share on-site data from anywhere in the world. In the following sections, two specific applications of the Worksite-Augmenting Metaverse are described to illustrate its potential in real-world scenarios.

4. Case study: management of plant construction

4.1 Issues at construction sites

During plant construction, information about the progress of construction is shared among many stakeholders, including designers, site supervisors, on-site workers, and executive management, and they discuss how to deal with problems and revise plans as necessary. In such cases, it is essential that the relevant parties have an accurate understanding of the situation; however, due to geographical and time constraints, it is not possible for all involved parties to physically inspect the worksite before every discussion. As such, discussions are often based on photographs and written reports. However, understanding such materials also requires a certain level of on-site knowledge, and often the knowledge gap between the on- and offsite parties is so large that they have difficulty having smooth discussions. Although it is in theory possible to avoid such a situation by sharing very detailed documentations, doing so requires considerable effort. For promoting worksite efficiency, it is therefore necessary to provide a way for the offsite (remote)

parties to grasp the on-site information easily, and satisfying that necessity motivated us to develop the Worksite-Augmenting Metaverse as a platform.

4.2 Worksite-Augmenting Metaverse at construction sites

Hitachi, Ltd., Hitachi-GE Nuclear Energy, Ltd., and Hitachi Plant Construction, Ltd. jointly used—for approximately two months from July 2023—the Worksite-Augmenting Metaverse in a project concerning the relocation of a nuclear-plant mockup. This relocation project required sharing information about the on-site situation and reaching consensus between multiple worksites and head-office departments; it was therefore chosen as a case study to measure the effectiveness of the Worksite-Augmenting Metaverse. The specific operations carried out were (i) daily on-site 3D-point-cloud measurements, (ii) collection of work data via a smartphone app, and (iii) evening meetings in the metaverse. The images shown in Figure 1 represent some of the data collected during this period.

One event that we put particular effort into on-site was the metaverse evening meeting [operation (iii) above]. Daily evening meetings, which were previously held on-site, were instead held in the metaverse, where stakeholders in remote locations reported and discussed the latest situation by utilizing the measured on-site 3D-point-cloud data and work data acquired on the day. It thus became possible for different, remote departments to reach agreement on, for example, drawing up logistics plans for the next day based on the dismantling status or revising drawings and arranging parts in a timely manner according to the on-site status. We also found that this type of smooth consensus building prevents inefficiencies, such as unnecessary rework due to misunderstandings or waiting for the completion of other tasks, and has a positive effect on carrying out work as planned. Over the course of two months, we confirmed the effectiveness of the Worksite-Augmenting Metaverse in promoting consensus building and improving work efficiency.

5. Case study: maintenance of rolling stock

5.1 Issues at railway sites

Responding to emergencies such as accidents and breakdowns concerning railway rolling stock requires rapid information sharing among different organizations, such as the railway company performing maintenance and the manufacturer responsible for vehicle design and manufacturing. However, in the case of traditional information-management methods, technical and know-how information tend to get disorganized in a manner that makes it difficult to retrieve the information and understand the worksite situation.

5.2 Worksite-Augmenting Metaverse at railway sites

In cooperation of Tobu Railway Co., Ltd., we developed a prototype of the Worksite-Augmenting Metaverse (called the "rolling-stock metaverse") for the company's Spacia X*2 train and examined its use in maintenance scenarios. In contrast to the construction site example presented in the previous section, where the site appearance changes significantly as work progresses, in this rolling-stock-maintenance scenario, it is necessary to manage each individual part. To meet that need, we utilized the CAD information synthesized during the vehicle design as the basis of the metaverse space, instead of the 3D scan data. Information such as design changes and operation incidents were then registered alongside the 3D information. By centrally managing various types of information that may be required during maintenance, the rolling stock metaverse aims to promote intuitive communication and acquisition of information across organizations in a manner that supports the safe operation of rolling stock.

An example of how the rolling-stock metaverse can be used is shown in Figure 2. The image to the right shows a sample scene from the rolling-stock metaverse, where precautionary information about automatic-door inspection is presented in the metaverse space. This intuitive visualization allows design drawings to

Figure 2: Using the rolling-stock metaverse for maintenance. Stakeholders from various departments can participate in the metaverse space and check information linked to work content and location

*2 Spacia X is a registered trademark of Tobu Railway Co., Ltd.

be understood in three dimensions in a way that promotes the sharing of on-site know-how and other technical information. Furthermore, by centrally managing a wide variety of data in the metaverse, it becomes easier to search and utilize data by using generative AI. As a result, the users can interact with the accumulated information more intuitively, in a dialogue format using natural language.

6. Future developments

Nearly two years have passed since Hitachi began researching and developing the industrial metaverse, and we have made significant progress through actual testing of the metaverse as a digital copy of the industrial worksite and as a forum for fostering discussion between various stakeholders. The introduction of the Worksite-Augmenting Metaverse has been a major success since it has made it possible to understand—remotely—**what** is happening at work sites, **where** it is happening, and **when** it is happening—which were previously obscure remotely. However, visualization of the worksite is just one milestone, as our ultimate goal is to provide feedback based on the collected data, and thereby improve worksite operations, as summarized in the roadmap shown in Figure 3. We are currently on the far left in the roadmap, in which the Worksite-Augmenting Metaverse is mainly used for collecting and visualizing on-site data. Feedback to workers is limited to visualizing and organizing data and training in the metaverse space.

The next step on the roadmap is developing an AI agent that can give advice to workers. Unlike ordinary AI agents that only have general common knowledge, our AI agent will be able to provide more detailed support by utilizing the data accumulated in the Worksite-Augmenting Metaverse, which is rich with "what," "when," and "where" information about the worksite. Using the data accumulated in the metaverse, the AI agent will be able to answer questions that previously could only be answered by experts.

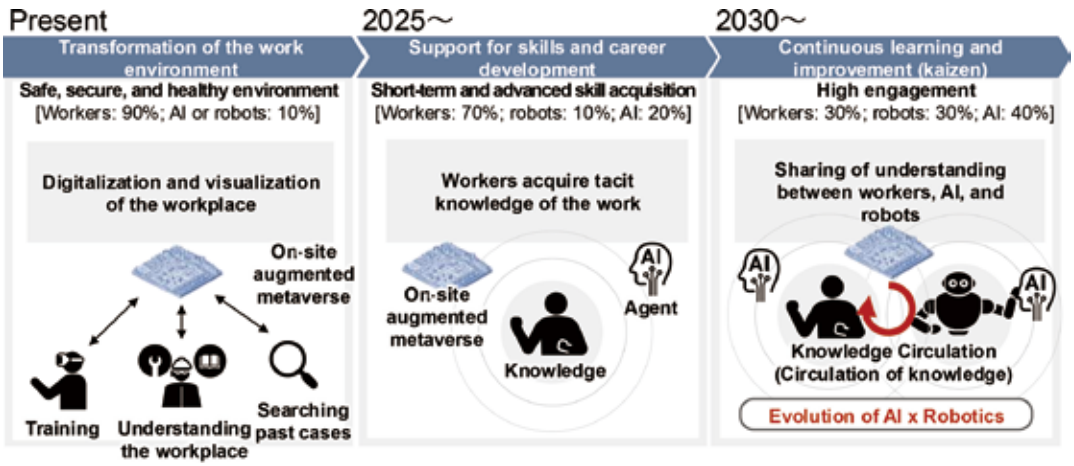
We believe that one of the goals of the Worksite-Augmenting Metaverse is to become a collaboration platform between human workers and robot agents. For example, the use of robots on construction sites is currently dominated by simple tasks such as assembly work; therefore, considering the evolution of AI and robotics research, as well as the needs of a declining productive population, it is highly likely that in the near future humanoid robots will take on the same jobs as construction-site workers. In this regard, we envision that the Worksite-Augmenting Metaverse, which is a virtual copy of the worksite, will serve as (i) a simulator for virtual trial and error when customizing robots for each site and (ii) a knowledge base that is updated sequentially after the robots are deployed in the field.

As mentioned at the beginning of this article, the word "metaverse" is typically associated with the entertainment industry. However, anticipating that the metaverse will drive the much-needed DX, we firmly believe in potential applications of the metaverse within the industrial sector. Though hardships such as differing statuses and laws regarding various worksites will make it difficult for us to make huge leaps at once, we remain committed to advancing the technologies of the Worksite-Augmenting Metaverse and its commercialization one step at a time. Guided by our vision, we aim to enhance labor productivity, foster human growth, and promote happiness for all workers.

Acknowledgements

The plant mock-up facility mentioned in the article was developed as part of the "Subsidy for Decommissioning and Contaminated Water Countermeasures Projects Starting in 2021 (Development of Detailed Investigation Technology for the Inside of Reactor Containment Vessels)," a subsidized project by the Agency for Natural Resources and Energy. Tobu Railway Co., Ltd. gave us permission to use their Spacia X train in the development of the prototype for the rolling-stock metaverse. We would like to express our deepest gratitude to all those involved.

Figure 3: Roadmap for using the metaverse to support field workers



Report on the ITU-T CxO Roundtable 2024

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1. Introduction

The CxO Roundtable, hosted by Mr. Seizo Onoe, Director of the Telecommunication Standardization Bureau (TSB) of ITU-T, was held on December 9, 2024, in Dubai, United Arab Emirates (UAE). The event was co-hosted by Telecom Review (a publishing company), Telecommunications and Digital Government Regulatory Authority (TDRA) (UAE's regulatory body), du (a UAE-based telecom operator), and Huawei (a Chinese telecommunications equipment vendor). The term CxO refers to senior executives such as CTOs (Chief Technology Officers) and CEOs (Chief Executive Officers), and the Roundtable is designed to facilitate exchanges of views not only from a technical standpoint but also from broader perspectives such as business management and information governance. The focus is on industry priorities and related standardization efforts.

The CxO Roundtable was established under Resolution 68 of the World Telecommunication Standardization Assembly (WTSA) 2016 as a forum led by the TSB Director to discuss the outlook and priorities for standardization, as well as the needs and involvement of private-sector companies. As in 2023, the

Table: Session Topics

	Panel discussion on the business impact of standards Moderators: Bilel, TSB Deputy-Director, ITU, Charlyne Restivo, ITU Regulator: TDRA, Saif Bin Ghelaita Operator: Du, Saleem Alblooshi Vendors: -Ericsson, Per Beming -Huawei, Ahmed Riad Ismail
1.	Opening remarks and welcome 1. Seizo Onoe, Director of the Telecommunication Standardization Bureau (TSB), ITU 2. Toni Eid, Founder, Telecom Review Group, CEO, UAE–host 3. Xiao Ran, Chief Strategy Officer, President of Standardization and Industry Development, Huawei, China–Co-host 4. Roundtable of introductions
2.	Adoption of Agenda
3.	ITU debrief on key outcomes of the World Telecommunication Standardization Assembly (WTSA-24), October 2024
4.	Standards and applications for optical, quantum, terrestrial and non-terrestrial communication networks (part I) 1. Towards Sustainable ICT Infrastructure Fostering Future AI Systems-NTT, Japan 2. Insights into optical networks towards 2030 for the AI age–Huawei, China 3. Quantum information networks–CAS Quantum Network Co. Ltd., China 4. QoS assessment for satellite networks-Rohde & Schwarz, Germany 5. NTN for IoT-LoRa Alliance, USA 6. Seamless affordable 5G IoT connectivity everywhere–Sateliot, Spain 7. The future of public safety communications–GuardianSafetyNet, Canada
5.	Standards for AI-native networking 1. AI in networks-Nokia, Finland 2. AI for Networks and Networks for AI–Turkcell, Türkiye
6.	Standards for fraud mitigation and call validation 1. Real-time call validation framework–AB Handshake, USA 2. International do not originate for fraud mitigation–Somos, USA
7.	Standards for data processing and management 1. Overview of China data factor market construction-Shanghai Data Exchange, China
8.	Adoption of Communiqué and Closing

2024 meeting was held exclusively in person and limited to CxO-level participants, with representatives from 20 companies and organizations in attendance, in accordance with Director Onoe's intent.

2. Discussion Topics

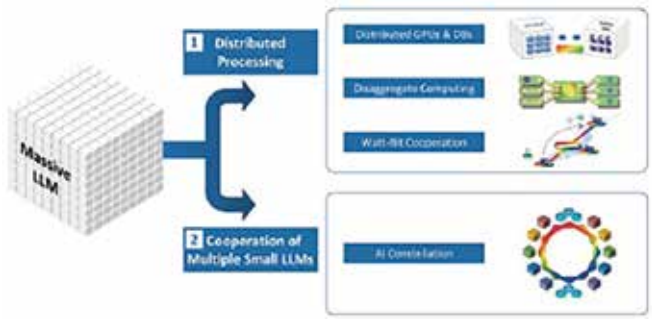
The main themes were determined in advance based on proposals from each CxO during five preparatory meetings, and the sessions were organized according to the topics and speakers listed in the program. This year's Roundtable focused on areas such as optical technologies, quantum, Non-Terrestrial Networks (NTN), AI-native systems, and fraud prevention. The key issues shared among the CxO participants were compiled into a joint statement (communiqué).

3. Proposal from Japan

From Japan, Mr. Shingo Kinoshita, Senior Vice President and Head of the Research and Development Planning Department at NTT, participated in the meeting. He addressed challenges arising from the recent scale-up of AI, introducing the benefits of IOWN*1 and the lightweight LLM "tsuzumi"*2. He emphasized the need for a flexible, optimally functioning, distributed ICT infrastructure that delivers ultra-high performance (high speed, low latency, and low power consumption). He also proposed the formulation and revision of relevant ITU-T standards to enable its realization (see Figure 1).

The proposal received several supportive comments from participating CxOs, and the key points were adopted almost entirely and incorporated into the joint communiqué as a significant outcome of the meeting.

Figure 1: Proposal from NTT (Necessity of a distributed ICT infrastructure based on IOWN)



4. Looking Ahead

Although the CxO Roundtable is not a venue for direct discussions on standardization recommendations themselves, its joint communiqué often serves as a reference point to initiate discussions within ITU-T Study Groups. For example, the 2023 CxO Roundtable included a statement in the communiqué highlighting the need for ITU-T to study IOWN concept and its activities. Based on that recommendation, the July 2024 ITU-T SG13 (Future Networks Study Group) meeting reached an agreement to initiate the work item on the IOWN framework (Y.L2E2net-frm). Following the consensus reached at this year's Roundtable, it is anticipated that discussions within ITU-T on establishing and revising standards will advance—particularly in support of realizing a distributed ICT infrastructure that operates flexibly and optimally with the exceptionally high performance that characterizes IOWN.

Figure 2: Group photo of CxO Roundtable 2024 participants

*1 IOWN: A term coined from the initials of "Innovative Optical and Wireless Network," representing a next-generation information and communications infrastructure based on optical technologies. The initiative aims to create a well-being-oriented society where individuals can live more smartly and authentically.
(Reference: https://group.ntt/jp/group/iown/vision.html)

*2 tsuzumi: A lightweight Large Language Model (LLM) under development by NTT that delivers world-class processing performance despite its compact design.
(Reference: https://www.rd.ntt/research/LLM_tsuzumi.html)

Toward Stable Wireless Communications in Manufacturing Sites

—Verification Experiment for SRF Wireless Platform Ver. 2—

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1. Introduction

In addition to the spread of Wi-Fi and Bluetooth, the introduction of new wireless communication technologies such as 5G and local 5G (L5G) are raising expectations of wireless communication in manufacturing sites and other fields including medical care and logistics. Examples of applications using wireless communication in manufacturing sites include the automation of parts conveyance by automated guided vehicles (AGVs) and the collection and management of information related to tools such as torque wrenches. The introduction of manufacturing-oriented applications using wireless communication to improve productivity is progressing annually and is expected to increase even more in the years to come.

On the other hand, the quality of wireless communication can become unstable due to interference and shielding effects causing delays and throughput to deteriorate. If communication performance should worsen in this manner, AGVs may come to a stop or tool-related information may become unavailable causing the manufacturing line to shut down and productivity to drop. This article introduces the Flexible Factory Project (FFPJ) established by the National Institute of Information and Communications Technology (NICT) in 2015 to promote cross-barrier collaboration among a variety of companies and work sites with the aim of achieving the stable use of wireless communication in manufacturing sites. It also introduces the Smart Resource Flow (SRF) wireless platform as technology developed for the coordinated control of heterogeneous radio systems using the knowledge gained at FFPJ. Finally, it reports on the development of a wireless communication system supporting technical specifications Ver. 2 of the SRF wireless platform and on an experiment to verify the effectiveness of this system in an actual manufacturing site, all in collaboration with NEC Corporation, Tohoku University, and Toyota Motor East Japan.

2. FFPJ and FFPA

To promote the use of the Internet of Things (IoT) in manufacturing sites, NICT established FFPJ to achieve smart factories using wireless communication and it has been conducting a variety of wireless-communication performance evaluation experiments at working factories (Figure 1). The goal here is to achieve adaptive wireless control systems according to environment and application in manufacturing sites.

Launched in June 2015, the FFPJ currently consists of 23 participating companies, namely, NICT, OMRON Corporation, the Advanced Telecommunications Research Institute International (ATR), NEC Corporation, Fujitsu Limited, Sanritz Automation Co., Ltd., Murata Machinery, Ltd., Mobile Techno Corp., Panasonic System Networks R&D Lab. Co., Ltd., Internet Initiative Japan Inc., KOZO KEIKAKU ENGINEERING Inc., Silex Technology, Inc., Toyota Technical Development Corporation, PwC Consulting LLC, NTT Communications Corporation, Takenaka Corporation, KYOCERA Corporation, AK Radio Design Inc., FUKUDA DENSHI , Microwave Factory Co., Ltd., ANRITSU CORPORATION, Sekisui Chemical Company, Limited, and Nippon Telegraph and Telephone East Corporation. These companies have been involved in the development of new wireless platforms, the formulation of specifications for wireless communication standards, the publishing of various types of white papers on diverse topics including communication security in manufacturing sites, etc. These projects continue to this date, but to expand to other fields such as medical care, logistics, and infrastructure that have issues similar to those of manufacturing sites, activities expanded in 2020 to the Flexible Society Project (FSPJ) that aims to support society overall through wireless communication. Specifically, activities have been divided into the Flexible Care Project (FCPJ) targeting issues in medical care, Flexible Logistics Project (FLPJ) targeting issues in logistics, Flexible Infrastructure Project (FIPJ) targeting infrastructure, and Flexible Data Trading Project (FDTPJ) that aims to enable the use of data measured in locations and environments that differ from field to field. What has not changed in these activities since the launch of FFPJ is

Figure 1: Scene from an experiment in the Flexible Factory Project

how we proactively promote feedback from on-site personnel to research and development and conduct all sorts of surveys and experiments in relation to wireless communication in accordance with on-site needs.

In addition, the Flexible Factory Partner Alliance (FFPA), a non-profit voluntary organization, was established in July 2017 by a group of FFPJ volunteers to promote adoption of the Internet of Things (IoT) in manufacturing sites. The plan is to achieve this through the formulation, standardization, and spread of the SRF wireless platform as coordination control technology for achieving stable communications in environments having multiple wireless systems. As of March 2025, member companies consisted of OMRON Corporation, Advanced Telecommunications Research Institute International (ATR), Sanritz Automation Co., Ltd., NICT, NEC Corporation, Fujitsu Limited, Murata Machinery, Ltd., Siemens K.K., and Telecom Engineering Center. Andreas Dengel (German Research Center for Artificial Intelligence) is chairperson of FFPA.

3. SRF wireless platform

SRF is a system engineering strategy that uses multilayer system analysis proposed by NICT to smoothly manage the flow of manufacturing-related resources (such as people, facilities, equipment, materials, energy, and communications). The wireless control platform for implementing this system engineering strategy is the SRF wireless platform, which is a mechanism for connecting a wide variety of wireless devices and facilities and operating them in a stable manner. For example, the SRF wireless platform can be used to avoid interference in the radio interval and minimize communication delay by monitoring communication conditions of other applications running in the same space and adaptively controlling the communication channels and data speeds they are using. The technical specifications of the SRF wireless platform are formulated by FFPA, which released Ver. 1 in October 2021 and Ver. 2 in January 2023.

Within the SRF wireless platform, the Field Manager (management server) performs global control to coordinate resources among multiple wireless systems, and an SRF Gateway/Device (wireless equipment) performs local control to optimize communications within a single wireless system (Figure 2). Based on information obtained from the wireless environment sensor, this platform avoids interference in the radio interval and minimizes communication delay by coordinating global control and local control and adaptively controlling communication channels and data speeds according to the communication conditions of other applications. Technical specifications Ver. 2 of the SRF wireless platform used in system development enables the use of hybrid networks using LTE and 5G circuits in addition to wireless LAN targeted by Ver. 1. In this way, wireless communication quality can be stabilized even further by combining LTE and 5G, which can provide wireless communications over a wide area, with local 5G, which can provide wireless communications locally in places like factory buildings whose metallic frame might make it difficult for radio waves to arrive from the outside. NICT and NEC developed a wireless communication system supporting technical specifications Ver. 2 of this SRF wireless platform. Additionally, to verify the effectiveness of this system in an actual manufacturing site, we conducted an experiment at the Miyagi Ohira plant of Toyota Motor East Japan in the environment shown in Figure 3. Specifically, we tested for the first time in the Tohoku region the stability of wireless communication quality with a mobile vehicle by switching between the carrier network (LTE/5G) and local 5G.

Figure 2: Functional configuration of the SRF wireless platform

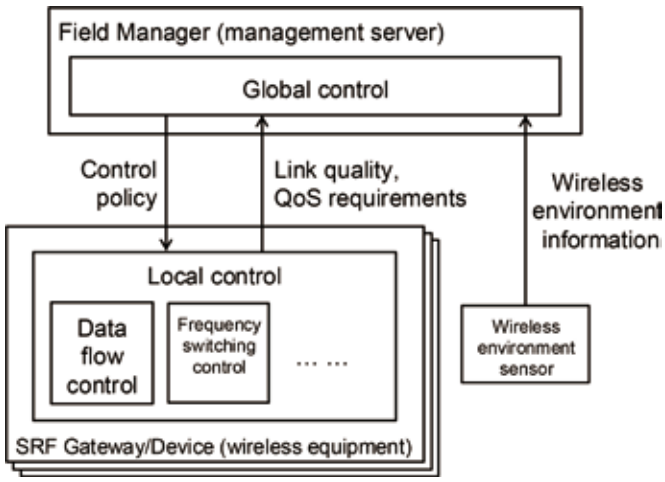


Figure 3: Experimental system using the developed SRF wireless platform Ver. 2

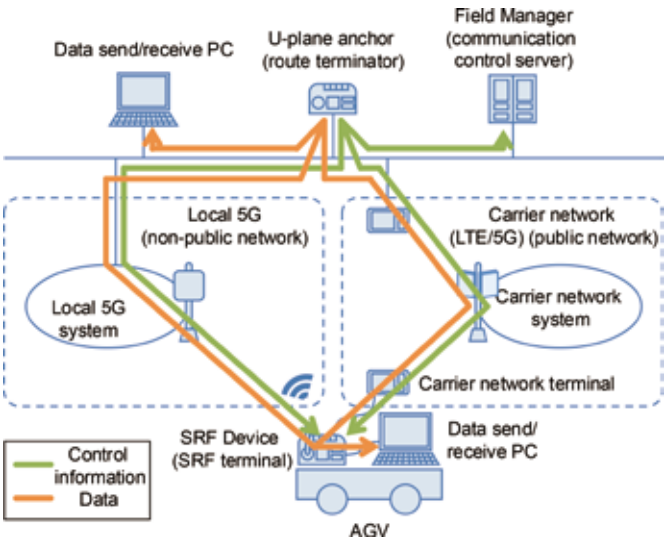


Figure 4: Mobile vehicle (AGV) mounting an SRF Device

4. Verification experiment in a working manufacturing site

To verify the effectiveness of this wireless communication system in a working manufacturing site, we conducted an experiment at the Miyagi Ohira plant of Toyota Motor East Japan to evaluate wireless communication quality with a mobile vehicle by switching between the carrier network and local 5G in the environment shown in Figure 3. In the experiment, we mounted an SRF Device on a mobile vehicle (AGV) operating in a manufacturing site as shown in Figure 4 and had the vehicle make a round trip between Plant-A and Plant-B situated approximately 163 m from each other. The local 5G frequency band used radio waves in the 4.8 GHz – 4.9 GHz range.

We performed this experiment in the environment shown in Figure 5. Here, Plant-A has a local 5G base station installed and the AGV mounting an SRF Device makes round trips between Plant-A and Plant-B. The shutters in these plants (AGV entrances/exits) were approximately 163 m away from each other connected by an outdoor passageway. The AGV moved in the direction indicated by the arrows in Figure 5. Waiting areas for passing each other were situated at three locations along the passageway to avoid congestion. Until bidirectional AGVs become available, the AGV that arrives first will wait in that waiting area.

While transmitting data by local 5G as indicated by the blue line in Figure 3, the AGV starts to move from Plant-A equipped with a local 5G base station toward Plant-B. At this time, local 5G communication quality deteriorates as the AGV moves away from Plant-A. However, the SRF wireless platform provides a backup path on the carrier network side as shown by the blue broken line on the right in Figure 3. Accordingly, if the SRF Device should determine that the carrier network is more suitable than local 5G for data transmission based on wireless quality information (receive signal strength, etc.), communication quality can be maintained by switching the data transmission path to the carrier network as shown by the green line in Figure 3. In this experiment, we tested whether switching between local 5G and the carrier network could be performed seamlessly and whether communications could continue in a stable manner.

Experimental results are shown in Figure 6. For the case of not using the SRF wireless platform as shown in Figure 6 (a), the AGV becomes out of range from local 5G immediately after entering Plant-B. As a result, communications are disconnected. Then, on searching for another transmission path, the AGV is switched to the carrier network and communications are reopened, but only after a communication cutoff of approximately 9.75 s. In addition, round-trip time (RTT) deteriorated significantly just before the local 5G communication cutoff reaching a maximum of approximately 1.01 s (see the enlarged view in Figure 6 (c) left).

However, for the case of using the SRF wireless platform as shown in Figure 6 (b), it was found that switching the data

Figure 5: Factory environment for this experiment

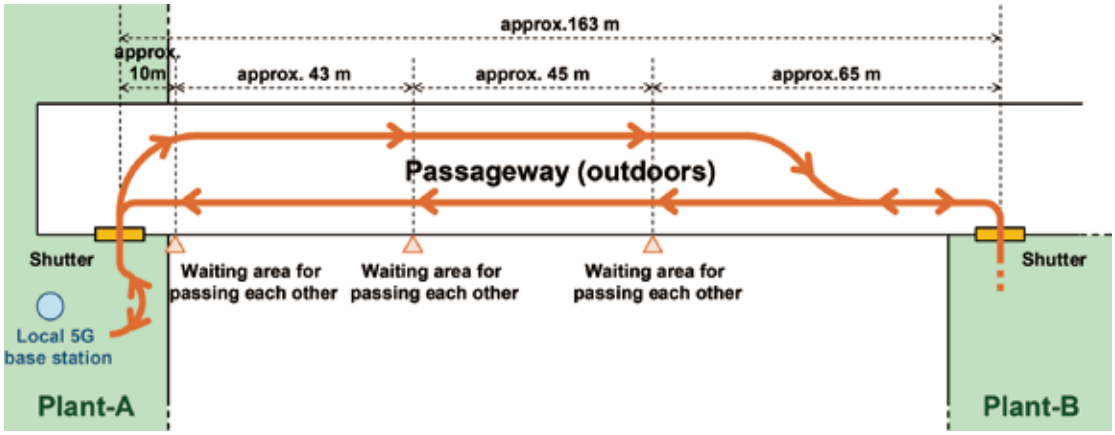


Figure 6: Experimental results

Figure 6(a): Case of not using the SRF wireless platform

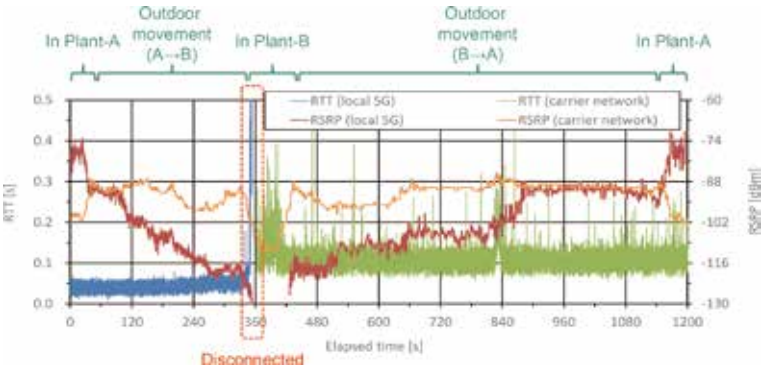


Figure 6(b): Case of using the SRF wireless platform

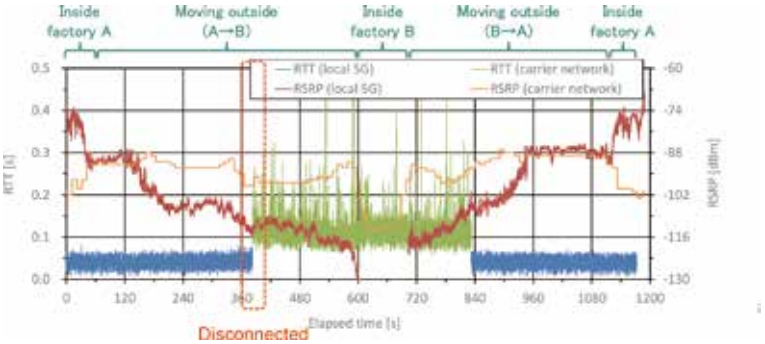
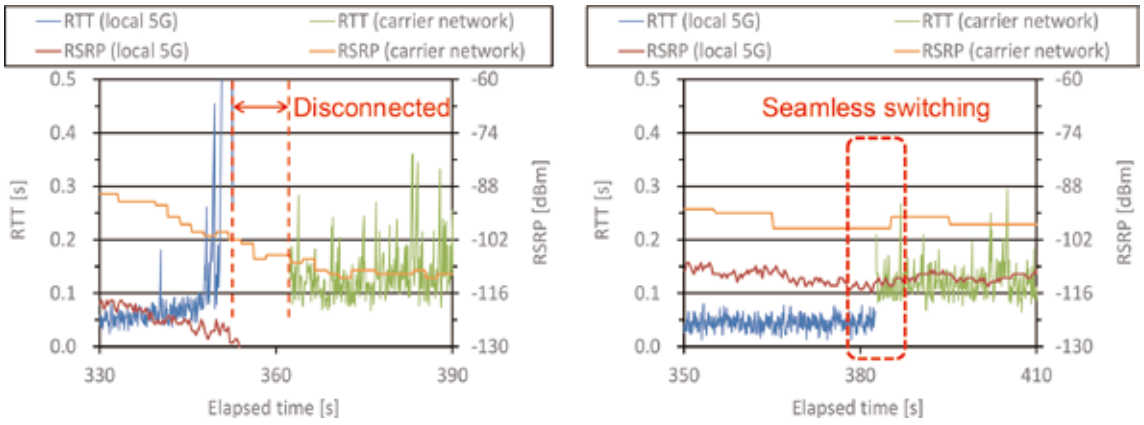


Figure 6(c): Enlarged views at switching time (left: SRF not used; right: SRF used)

Blue line: round-trip time (RTT) via local 5G; green line: round-trip time (RTT) via carrier network; red line: receive signal strength via local 5G; orange line: receive signal strength via carrier network



transmission path to the carrier network slightly before entering Plant-B shortened the communication cutoff time at the time of path switching to approximately 0.14 s. This result confirmed that application communications could continue in a stable manner through seamless switching (see the enlarged view in Figure 6 (c) right). Additionally, once the AGV leaves Plant-B and approaches Plant-A and the receive signal strength of local 5G improves, it was found that the SRF Device could switch back to local 5G and continue communications. In this way, we demonstrated as a world's first the effectiveness of the SRF wireless platform in achieving stable communications without interruption by using a hybrid network consisting of a carrier network and local 5G having different characteristics such as size of service area.

5. Conclusion

Going forward, we aim to apply the results of this verification experiment to the practical use of the SRF wireless platform to achieve stable wireless communication in factories. Finally, we would like to express our sincere appreciation to Toru Osuga of NEC and to all concerned at Toyota Motor East Japan and Tohoku University for their gracious assistance. This research and development work was commissioned in part by the SCOPE (International Standard Acquisition Type) JPJ000595 project of the Ministry of Internal Affairs and Communications (MIC).

Strengthening Disaster Resilience Through Digital Transformation: ITU and Japan's Collaboration in Sub-Saharan Africa

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In the past decade, Africa has experienced a significant increase in the frequency and intensity of natural and climate-related hazards that lead to disasters. These events, including droughts, floods, cyclones, and epidemics, have devastating impacts on communities, livelihoods, and infrastructure across the continent*1. Recognizing the urgent need to mitigate these risks, it is evident that early warning systems (EWS) and National Emergency Telecommunication Plans (NETP) are vital for disaster management and emergency response*2, particularly in the face of climate change and increasing extreme weather events. African countries are increasingly adopting NETP and EW4All as a proactive approach to disaster management.

Launched in 2022 by United Nations (UN) Secretary-General, António Guterres, Early Warnings for All (EW4All) is a groundbreaking initiative to ensure that everyone on earth is protected from hazardous weather, water, or climate events through life-saving early warning systems by the end of 2027. Indeed, early warning systems (EWS) play a crucial role in reducing vulnerability and increasing the resilience of communities to potential hazards*3.

For an EWS to be truly effective, it must be accessible and inclusive for all segments of society, leaving no one behind. Certainly, universal access to EWS is critical for inclusive disaster management and emergency response*4. However, financing is needed for universal access to EWS, and such investment is critical to the achievements of the 2027 target of ensuring that every person on Earth to be protected by EWS. Similarly, in Africa, the need to raise awareness through workshops and trainings cannot be overstated.

Partnerships with international organizations, donors, and the private sector have proven to be an effective and valuable approach in terms of funding, expertise, and technological innovations. By leveraging these partnerships, Africa has managed to tap into global knowledge and good practices while tailoring EWS and NETP solutions to its unique needs and challenges.

Through initiatives like Connect2Recover, the Telecommunication Development Bureau (BDT) of the International Telecommunication Union (ITU) has been working with Japan's Ministry of Internal Affairs and Communications (MIC) to enhance among others, digital infrastructure resilience in Africa. Connect2Recover has received three financial contributions from MIC Japan in 2020 (Phase 1), 2022 (Phase 2) and 2023 (Phase 3).

Making sure alerts reach the last mile

In subsequent engagements, MIC Japan reiterated that the focus of Phase 3 contribution to ITU is to support early warning systems and implementation of NETPs, which is in alignment with the purpose and scope of Connect2Recover. The statement underscores a shared commitment between MIC Japan and the ITU to advance warning dissemination and communication across Africa. Through MIC Japan's contribution, ITU has assisted various countries in the implementation of NETPs and strengthening EW4All by supporting among others, an assessment of the country's warning dissemination and communication, providing technical assistance, and capacity building.

Africa is not a 'one size fits all continent' as country contexts differ, and every country's digital transformation journey is unique. Some countries are already deploying digital infrastructure (4G and 5G) at incredible speed and scale, while others are dominated by 2G and 3G coverage, with 4G network coverage reaching less than 50% of the population. Regardless of what stage they are in their journey, the necessary mechanisms ought to be in place to ensure that **alerts reach the last mile**.

Moreover, collaboration plays a critical role in building and strengthening capacity at national level considering the diverse political, economic, social, legal, cultural, and environmental factors. Collaborations like the one of ITU and MIC Japan, has been a significant step forward in the implementation of NETPs and accelerating the EW4All initiative and is contributing to its success in Africa. Albeit, considering the growing demand for support from the Member States, there is a need to bring on board more partners and identify various financing opportunities, including domestic resource mobilization (DRM) to meet the EW4All ambition.

Key Achievements of the Collaboration between ITU and Japan on NETPs and EW4All

ITU developed the Southern African Development

*1 Union, African. "Multi-hazard Early Warning for All Action Plan for Africa (2023-2027)." (2023).
*2 ITU, Digital transformation and early warning systems for saving lives – Background paper
*3 United Nations Office for Disaster Risk Reduction and World Meteorological Organization. "Global Status of Multi-Hazard Early Warning Systems." (2023).
*4 ITU, Digital transformation and early warning systems for saving lives – Background paper

Figure 1: SADC Model National Emergency Telecommunication Plan (NETP) Implementation and Early Warning for All (EW4All) Awareness Workshop in Bingu International Conference Centre (BICC), Lilongwe, Malawi

Figure 2: NETP workshop in the Gambia: The event, held from November 20 to 21, 2024, marks a significant step forward in enhancing the country's disaster preparedness and response framework. The workshop in the Gambia drew participants from diverse sectors, including the Public Utilities Regulatory Authority (PURA), the National Disaster Management Agency (NDMA), the Gambia Cybersecurity Alliance (GCSA), and the National Early Warning and Response Mechanism Coordinating Centre (NCCRM)

Figure 3: NETP workshop in Guinea Bissau

Community (SADC) NETP Model to assist 16 members of the Southern African Development Community (SADC) region in identifying their priorities and actions for the use of ICTs for disaster risk management and coordination mechanisms. Subsequently, Connect2Recover provided fellowships to Member States to participate in the ITU-SADC Workshop on the SADC NETP Model Implementation and EW4ALL Awareness which was held in Lilongwe, Malawi from 9 - 11 October 2024. This workshop was attended by more than 40 participants from 12 SADC member states. The workshop aimed to raise awareness and build the capacity of Member States as they transpose and operationalize the SADC Model NETP. It also provided Member States with a regional platform to assess their readiness in operationalizing and implementing the SADC Model NETP and preparing for a harmonized Early Warning System (EWS) approach in line with Common Alerting Protocol (CAP).

Moreover, through Connect2Recover, ITU supported Rwanda, the Gambia, Cabo Verde and Guinea Bissau in their efforts to strengthen capacity to use ICTs for disaster management through the development of their NETPs based on their own needs and priorities. The initiative also supported the development of NETP implementation plans for Zambia and Malawi to strengthen emergency telecommunication preparedness. Furthermore, preliminary assessments on early warning systems based on Cell Broadcast (CB) have been developed in Rwanda, Malawi, Zambia, Botswana and Seychelles in line with the EW4All initiative.

Furthermore, ITU assessed Zimbabwe's digital infrastructure resilience, focusing on fixed and mobile broadband connectivity, network resilience, policy, regulation, and digital strategies. The recommendations from the assessment would be useful to shape Zimbabwe's digital future, include effectively implementing a national broadband strategy, bridging the urban-rural connectivity gap, setting affordability targets, and expanding fiber infrastructure to ensure widespread high-speed broadband access across Zimbabwe, particularly in underserved areas as well as strengthening emergency preparedness.

Scaling up Early Warning in Africa

While Africa is making significant strides in enhancing the quality and coverage of its early warning systems, the continent still lags behind the global average. The implementation of the EW4All and NETP initiatives hinges on the ability to mobilize sufficient and timely financial resources. Addressing the financial needs to scale up EWS remains an intricate challenge, underscoring the need for attracting more partners to effectively tackle the pressing need for disaster preparedness and response. This calls for fostering innovative partnerships among stakeholders to achieve better outcomes. In addition to international partnerships, scaling up domestic resource mobilization (DRM) will be key to achieving that objective.

On 12th September 2024, ITU in collaboration with the Africa Telecommunication Union (ATU) held an online workshop on the Early Warnings for All Initiative(EW4ALL); the workshop provided an in-depth understanding of Pillar 3 of the EW4All initiative, and equipped participants from more than 30 Member States, with the knowledge and necessary tools to implement effective early warning systems and provided them with a detailed understanding of the role of telecommunication/ ICT players in this initiative. The workshop has been a catalyst for more requests for assistance from Member States in developing their national EWS.

In addition, within the framework of the EW4All initiative, ITU in collaboration with national focal points for Pillar 3 of the initiative supported the gap analysis and development of national roadmaps during the national workshops conducted in Liberia, Seychelles, Mozambique and South Africa, among others.

Conclusion

Through sustained efforts, collaboration, and a shared commitment, Africa can build a resilient future where early warning truly becomes a reality for all. The Japan and the ITU strategic partnership have demonstrated a shared commitment to creating a more sustainable and prosperous future for Africa. By combining resources and expertise, this partnership is delivering impactful solutions that promote inclusive early warning coverage on the continent, to ensure everyone is protected by early warning systems by 2027.

= A Serial Introduction Part 4 = Winners of ITU-AJ Encouragement Awards 2024

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.

Masashi Fushiki
FUJITSU LIMITED
fushiki.masashi@fujitsu.com https://global.fujitsu/en-global
Fields of activity: 3GPP RAN WG4

Contribution to the standardization of radio performance in 3GPP

I am deeply honored and grateful to receive the ITU Association of Japan Encouragement Award, and I would like to express my sincere appreciation to all those involved for their invaluable support.

The decision to grant this award was based on my work as Rapporteur for the specification of radio performance requirements for millimeter-wave-supporting fixed wireless access terminals in 3GPP RAN working group 4. Despite the challenges of online meetings due to the COVID-19 pandemic, I persevered in coordinating with various companies, carefully understanding their respective positions. We were able to gradually build consensus. The successful development of this specification was a deeply rewarding experience.

I am currently continuing my standardization activities in 3GPP RAN working group 4. I am committed to using my past experiences to promote smoother discussions and contribute to efficient standardization.

3GPP will be intensifying discussions on the development of 6G. I hope to leverage my experience and knowledge to contribute to the development of wireless communications.

Hiroto Yamazaki
Japan International Cooperation Agency (JICA)
yamazaki.hiroto3@jica.go.jp https://www.jica.go.jp/english/index.html
Fields of activity: International cooperation on digital transformation (DX), ICT infrastructure, and cybersecurity

Contribution to International Cooperation in ICT and Cybersecurity

I am deeply honored to receive the distinguished ITU Association of Japan Encouragement Award. I would like to express my sincere gratitude to everyone at the association and all those involved.

I believe that ICT and digital technologies have the potential to greatly change people's lives and promote economic development, even in developing countries. In collaboration with numerous stakeholders, I have had the privilege to contribute to a diverse array of projects related to the promotion of ICT and digitalization. These projects have included initiatives such as promoting the spread of terrestrial digital broadcasting in Africa, examining the development of a data exchange platform, and strengthening disaster prevention communication capabilities in Oceania.

In the same vein, it is important to acknowledge the growing concern regarding cyberattacks in developing countries. These attacks pose a significant challenge, not only to national security but also to personal privacy. In this regard, it is essential to explore avenues for international cooperation, with the aim of leveraging the immense benefits that technology offers while addressing its potential risks. However, many countries face the challenge of a shortage of human resources. In light of this, I have been dedicating my efforts to the development of human resources in developing countries. Specifically, I have had the privilege of conducting cybersecurity training and awareness-raising activities in Viet Nam, Cambodia, the Philippines, and other countries.

ICT and digital technologies have the potential to bridge gaps and positively impact society. I hope to continue contributing to the field of international cooperation and the sustainable development of developing countries. In particular, in the field of cybersecurity, I would like to focus on human resource development. I will seek to further strengthen cybersecurity human-resource development in developing countries and cultivate each country's capacity to address cyber challenges.

Junji Watanabe

NTT, Inc.
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Fields of activity: Haptics, Well-being

Rules for communicating haptic sensations remotely

The spread of COVID-19, during which direct skin contact was discouraged, was a crossroads in haptic research. Prior to the pandemic, I had been working to create new experiences by transmitting haptic information in addition to visual and auditory information. For example, there is a system called the "Public Booth for Vibrotactile Communication," which was added to the use cases for standardization. The system allows users at two remote locations to share vibrations on desks in addition to video and audio. When a person taps on one desk, the vibration is sent to the remote location, causing the remote desk to vibrate. Communications using the sense of touch expand the possibilities of dialogue and foster a sense of intimacy between remote users.

To enable many people to enjoy such experiences, rules for transmitting haptic information are necessary. This is a major motivation for me to engage in standardization activities for haptic information transmission. Among the several types of haptic information, such as pressure, vibration, and temperature, vibration information can use existing audio transmission formats. This has been a significant advantage in promoting the standardization of haptic information transmission, though there are distinct aspects as follows. The frequency bandwidth of vibration information is biased toward the low-frequency side, and the information must be transmitted using uncompressed or lossless compression. It is also necessary to determine the allocation of channel signals to bodily parts for suitable presentation of haptic information.

Modern society is said to be in an age of complexity and unpredictability, where people with diverse values must engage in sustained dialogue to realize ideas and actions that cannot be done alone. In the future, the importance of haptic communication will increase, and the transmission of haptic information based on standards will bring more choices in the way people connect and communicate with each other.

57th Celebration of World Telecommunication and Information Society Day

16 May 2025 at the KEIO PLAZA HOTEL

The ITU Association of Japan

Award winners and Honorable guests

MIC Minister's Award Winner
YOSHINO Hitoshi
(Proxy Attendance: SAKATA Kentaro(Right))

ITU-AJ Special Achievement Award Winner
HARAYAMA Yuko(Right)

Anniversary Lecture
Ten years of reflecion on
"Artificial Intelligence and Human Society"

ITU-AJ Accomplishment Award Winners

ITU-AJ Encouragement Award Winners

The List of the Award Winners (Affiliation is at the time of nomination) (Title omitted)

MIC Minister's Award

YOSHINO Hitoshi (SoftBank Corp.)

ITU-AJ Special Achievement Award

HARAYAMA Yuko (Global Partnership on AI (GPAI) Tokyo Expert Support Center National Institute of Information and Communications Technology (NICT))

ITU-AJ Accomplishment Awards

IWATANI Junichi (NIPPON TELEGRAPH AND TELEPHONE CORPORATION)
IWAMURA Shunsuke (Japan Broadcasting Corporation)
KAWAMURA Kei (KDDI Research, Inc.)
SAKAKIBARA Morihiro (KDDI Foundation)
SAWADA Masahiro (DOCOMO Technology, Inc.)
TAKADA Fujio (BHN Association)
NAGAO Jiro (NIPPON TELEGRAPH AND TELEPHONE CORPORATION)
FUKUI Yusuke (KDDI CORPORATION)
HORIUCHI Shingo (NIPPON TELEGRAPH AND TELEPHONE CORPORATION)
MANO Masatoshi (Oki Electric Industry Co., Ltd.)
YAMADA Toru (NEC Corporation)
YAMAMOTO Hideki (Oki Electric Industry Co., Ltd.)

ITU-AJ Encouragement Awards

ISHIKAWA Yoshimitsu (Japan Development Service, Co., Ltd.)
KOGURE Yoichi (Japan Development Service, Co., Ltd.)
OU Hiroshi (NIPPON TELEGRAPH AND TELEPHONE CORPORATION)
KIDANI Yoshitaka (KDDI Research, Inc.)
KOISHIKAWA Toshifumi (NTT COMWARE CORP.)
KOIWAI Kosuke (KDDI CORPORATION)
SHIMIZU Kazuto (NTT DOCOMO, INC.)
SUENAGA Yasutaka (Japan Broadcasting Corporation)
NAKAMURA Kazuki (Railway Technical Research Institute)
HARASAWA Masamitsu (Japan Broadcasting Corporation)
HIRAYAMA Haruhisa (KDDI CORPORATION)
MIN Tianyang (NTT DOCOMO, INC.)
MATSUI Takashi (NIPPON TELEGRAPH AND TELEPHONE CORPORATION)
MIYATAKE Yukinobu (KDDI Foundation)
YAMAMOTO Kanta (Fujitsu Limited)
YOSHIOKA Shohei (NTT DOCOMO, INC.)

通巻百四十七号
定価 一冊 一、六五〇円（本体価格 一、五〇〇円、消費税 一五〇円） 年間購読料 六、六〇〇円（本体価格 六、〇〇〇円、消費税 六〇〇円）