Chapter 3

Realizing a Robust and Sound Data Distribution Society That Is Required for the New Age

With the advancement of telecommunications networks, the volume of data distribution has increased, and a variety of digital services utilizing data have spread throughout society. However, with regard to the distribution and utilization of data, there are concerns about a fair competitive environment due to the concentration of data on some major platform providers, the fairness and transparency in the handling of collected and accumulated data, and issues such as the spread of illegal harmful information, disinformation and misinformation, and information bias on social media and other platforms. Each country is responding to these issues.

Under such circumstances and with the realization of 5G networks that enable ultra-high-speed and large-capacity data distribution and the further advancement of XR (cross-reality) technology, AI, and other technologies, there are new movements in the concept of distribution and management of data and in services that utilize data.

This chapter provides an overview of the emerging trends in data distribution and utilization, and it analyzes and summarizes issues and initiatives for realizing a society in which everyone can enjoy the benefits of diverse digital services utilizing data.

Section 1 New Trends in Data Distribution and Utilization

This section summarizes Web3, which is attracting attention as a new trend in data management, distribution, and utilization and its applied technologies (non-fungible tokens (NFTs), etc.), metaverses and digital twins, examples of the use of generative AI, and measures taken by various countries related to these technologies and services.

1. Web3

(1) What is Web3?

The proliferation of smartphones and social media has made it possible to use and share data in both directions, but it has also led to an excessive concentration of data on platform providers that provide the infrastructure for services. Accordingly, issues such as the development of a competitive environment in the data market and the transparent and appropriate handling of data have become apparent, and a range of measures are being implemented by various countries. (See Section 2 in Chapter 2.) Under such circumstances, Web3 is attracting attention as a new way of managing and distributing data.

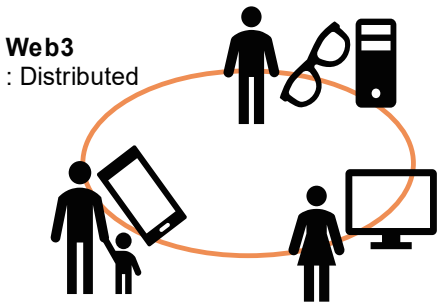
Web3 is a distributed network environment based on blockchain technology,[1] and it is expected that it will enable individuals to connect with other individuals without having to go through an intermediary, such as a platform provider, to perform data utilization and distribution management in both directions. Blockchain is used as the platform for data recording and data movement when users use internet services. Furthermore, by utilizing a smart contract, which is a program stored in a blockchain, it becomes possible to realize a mechanism that automatically executes the exchanging of a contract, etc. without human intervention.

Web3 has been described as decentralized because it creates a new digital economy in which independent users can directly connect with each other on a decentralized network that is based on blockchain without having to depend on a specific platform (**Figure 3-1-1-1**).

With Web3, the reduction in transaction costs and the capability to co-create, preserve, and exchange all kinds of value across borders and platforms is expected to have social impacts, such as building new business models in the cultural and economic fields, promoting investment and economic revitalization, and solving social issues.

[1] In this document, Web3 is considered a different concept to Web 3.0, which is proposed as a semantic web (technology that adds meaning [semantics] to information resources so that computers can process them autonomously without human intervention).

Figure 3-1-1-1 Features of Web3



	Web3
Flow of data and information	Distributed (information and rights are not biased by distribution management)
Core technology	Blockchain

(Source) Based on Document 1-2 from the 1st meeting of the MIC Study Group on the Utilization of Metaverse Towards Web3 Era

(2) An example of a Web3 application

a Non-fungible tokens (NFTs)

Non-fungible tokens (hereinafter referred to as NFTs) are unfalsifiable and tamper-proof digital data that can provide uniqueness to digital data on a blockchain to ensure its authenticity and can track transaction histories.[2] It is expected that NFTs will make it possible to prove the uniqueness and authenticity of original documents and enable designs that allow creators to earn revenue even during secondary distribution through programmability. Furthermore, initiatives for solving social problems and realizing a symbiotic society using NFTs are also underway.

For example, Social Art Lab, a general incorporated association that was established for the purpose of "creating an environment where people with disabilities can live in art," has been undertaking initiatives to convert the art of people with disabilities into NFTs so that they can be offered to a wide range of people, and it exhibits NFT art at events held at metaverse venues. It also sells art in the NFT marketplace and returns 74% of sales revenue to the artist or institution in the case of primary distribution.[3]

In August 2022, Chiba Institute of Technology began issuing academic certificates as NFTs. This is the first attempt in Japan to issue certificates as NFTs so that a person's academic history can be recorded on a blockchain, which prevents tampering. The certificate data can be managed using a virtual currency wallet, allowing users to connect to various platforms and showcase their qualifications in a one-stop shop.[4]

b Decentralized Autonomous Organizations (DAO)

A Decentralized Autonomous Organization (hereinafter referred to as DAO) is an organization that: utilizes blockchain technology and smart contracts, does not have a centralized management structure, and aims for autonomous management by participants.[5]

Some regions are now using DAOs to revitalize their communities and solve problems. For example, the Yamakoshi DAO was established in the Yamakoshi region of Niigata Prefecture with the aim of ensuring sustainable development of the region, and it uses the art of Nishikigoi, a symbol of Yamakoshi, as an NFT. Holders of this NFT art[6] can participate in the Yamakoshi DAO, and the proceeds from sales fund its activities.

In June 2022, Shiwa Town in Iwate Prefecture announced its Furusato DAO initiative, which aims to overcome physical constraints and bring together diverse human resources to solve local issues with new ideas. Local currency (tokens) will be issued to pay hometown taxes, etc., and it is currently working on several projects.[7]

c Trends in discussions and promotional measures in Japan and overseas

While it is expected that the Web3 environment will enable the building of new business models, revitalize investing and the economy, and promote the resolution of social issues, there is a need to collaborate globally to solve problems because the lack of an intermediary makes the location of responsibility and the targets of regulation ambiguous, and cross-border activities make it difficult to formulate rules on a country-by-country basis.

[2] https://www.meti.go.jp/shingikai/sankoshin/shin_kijiku/pdf/004_05_00.pdf
[3] https://prtimes.jp/main/html/rd/p/000000003.000091351.html
[4] Chiba Institute of Technology Press Release https://www.it-chiba.ac.jp/media/pr20220818.pdf
[5] Digital Agency: Web 3.0 Study Group Report (December 2022) https://www.digital.go.jp/councils/web3/#report
[6] As of September 14, 2022, 996 people had purchased NFTs. Note that these NFTs are distributed free of charge to residents of the Yamakoshi region.
[7] Presentational material presented by Shiwa Town, Iwate Prefecture, at the 4th meeting of the Digital Agency's Web 3.0 Study Group https://www.digital.go.jp/assets/contents/node/basic_page/field_ref_resources/495a2882-d9e4-4f25-b75f-acc6a5f38312/644f8005/20221025_meeting_web3_outline_01.pdf

In Japan, in response to the inclusion of the development of an environment for promoting Web 3.0, including the use of non-fungible tokens (NFTs) based on blockchain technology, in the Basic Policy on Economic and Fiscal Management and Reform 2022, which was approved by the Cabinet in June 2022, and the Priority Policy Program for Realizing Digital Society, each ministry and agency is examining issues and initiatives regarding its promotion. The Digital Agency created the Web 3.0 Study Group (chaired by Professor Jiro Kokuryo of the Faculty of Policy Management, Keio University), and in December 2022, it met and summarized future initiatives for the sound development of Web 3.0.[8]

Other countries are also examining promotional policies. In March 2022, the U.S. issued an executive order to examine strategies for utilizing digital assets and the underlying technologies that form their foundation, and initiatives are underway. In November 2022, the European Parliament passed a resolution to establish Digital Decade Policy Programme 2030, which includes plans for EU countries to jointly invest in Web3 and blockchain. In July 2022, the Shanghai Municipal People's Government in China released a draft of the 14th Five-Year Plan for the development of Shanghai's digital economy. This document includes plans to build an innovation system for blockchain technology, create a blockchain development ecology, and develop infrastructure for promoting Web3.

2. Metaverses and digital twins

(1) Metaverses

a What is metaverse?

XR (cross-reality) technologies such as virtual reality (VR), augmented reality (AR), mixed reality (MR), and substitutional reality (SR) have become more realistic due to the increasing capacity and speed of communications networks, improved computer rendering, and the evolution of devices and software (higher resolution and smaller sizes). During the COVID-19 pandemic, various economic and cultural activities were restricted, resulting in attention being focused on metaverses, where the real world and virtual space are linked and people can gather virtually from the comfort of their own homes and share the same experiences through events, etc. and transmit, experience, and share new value.

The global metaverse market is expected to grow from $65.51 billion in 2022 to $936.57 billion in 2030, and a number of companies are entering the market in anticipation of future growth.

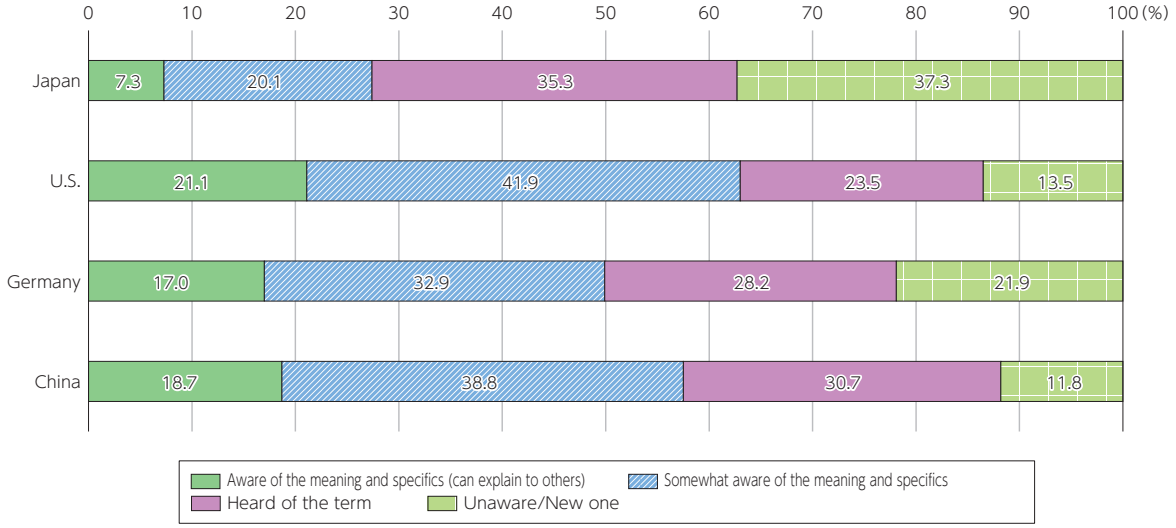
Although a clear definition of what a metaverse is has not yet been established, a report by the Ministry of Internal Affairs and Communications[9] defines it as "a virtual digital space accessible via a network, such as the Internet, that allows users to 'communicate' with each other," with characteristics such as (1) realism and reproducibility according to the intended use,[10] (2) self-projection and immersion, (3) interactivity (often in real time), and (4) the ability for anyone to participate in the virtual world (openness).

A questionnaire survey[11] that asked consumers in various countries about their awareness of the metaverse found that approximately 60% of respondents in Japan were aware of it (the sum of "Completely aware of meaning and specifics," "Somewhat aware of the meaning and specifics," and "Heard of the term") **(Figure 3-1-2-1)**, with the highest percentage of respondents being in their 30s (68.0%). Although awareness is lower than in other countries, the term "metaverse" is becoming increasingly better known by consumers in Japan.

However, only 2.8% of respondents in Japan answered "Currently using (have used in the past)" a metaverse, so the results show that there are very few consumers who have actually used one **(Figure 3-1-2-2)**.

[8] Digital Agency: Web 3.0 Study Group Report (December 2022) https://www.digital.go.jp/councils/web3/#report
[9] Interim Report of the MIC Study Group on the Utilization of Metaverse Toward the Web3 Era https://www.soumu.go.jp/main_content/000860618.pdf
[10] They may replicate the real world like digital twins, construct simplified models of the real world, or construct different worlds, including with respect to the laws of physics.
[11] Web survey of people living in Japan, the U.S., Germany, and China; age (20s, 30s, 40s, 50s, 60s, and over); sex (male and female); number of collected responses: 4,000 (Japan 1,000, U.S. 1,000, Germany 1,000, and China 1,000); implemented in February 2023

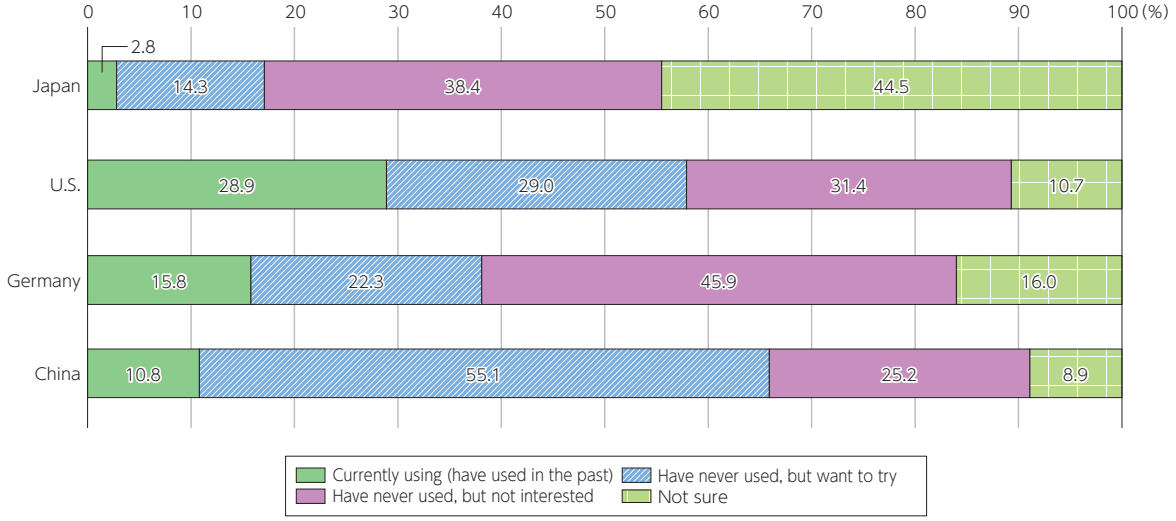
Figure 3-1-2-1 Awareness of metaverses by country



(Source) MIC (2023) "Survey Research on Advancement of ICT Infrastructure and Flow of Digital Data and Information"

Figure (related data) Awareness of metaverses by age
(Source) MIC (2023) "Survey Research on the Advancement of ICT Infrastructure and Distribution of Digital Data and Information"
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2023/data_collection.html#f00042
(Data collection)

Figure 3-1-2-2 Experience of using a metaverse (by country)



(Source) MIC (2023) "Survey Research on Advancement of ICT Infrastructure and Flow of Digital Data and Information"

b Examples of use

Awareness of metaverses is gradually increasing in Japan, and the provision of various services in the entertainment field, such as metaverse-based music events and shopping, is progressing. In addition, attempts to utilize metaverses to provide opportunities for learning and employment in the metaverse space, as well as for community development in which real cities and virtual spaces are linked, have also begun.

(a) Entertainment (NTT QONOQ)

NTT QONOQ offers XR World, a metaverse service where users can enjoy live music, walk around as their avatars, and chat with other users in a virtual space, Matrix Stream, a live streaming service in a metaverse space, and XR City, an AR city walking app. Matrix Stream is also used to distribute virtual YouTubers (VTubers) who perform video streaming and other activities on YouTube.

(b) Education (Metaverse School of Engineering, the University of Tokyo)

The University of Tokyo established the Metaverse School of Engineering in October 2022 as a place for education in the field of engineering using digital technology to create a society where all people can acquire the latest information and practical engineering skills to realize their dreams (**Figure 3-1-2-3**).

In fiscal 2022, with the aim of providing new learning

opportunities and information on engineering careers and based on the basic concept of diversity and inclusion in the field of engineering, the University of Tokyo launched the Junior Engineering Education Program for junior and senior high school students and the Reskilling Engineering Education Program, which are aimed at providing an opportunity for adults to relearn what they know, and the programs utilize metaverses.

Figure 3-1-2-3 Metaverse School of Engineering, the University of Tokyo

(Source) The University of Tokyo

(c) Creating jobs and realizing diverse working styles (PERSOL MARKETING CO., LTD.)

PERSOL MARKETING has started a business that provides workers that operate in a metaverse. In the current labor market, it is difficult to introduce suitable jobs to those that want to work but who are elderly, or are raising children, or who have certain physical characteristics, etc. By utilizing a metaverse to transcend distance, time, and physical characteristics, PERSOL MARKETING aims to realize a society in which more people can work in metaverse-based jobs, including information and hospitality services. In December 2022, at a metaverse-based job-hunting event organized by Toyota City, people who care for family members at home, etc. were employed as the information staff for the event. Going forward, PERSOL MARKETING aims to create a place where people can work in long-lasting jobs.

(d) Regional revitalization (KDDI Corporation)

Attempts to recreate real cities as metaverses in virtual space where events can be conducted that extend urban touchpoints and the urban experience are being developed.

For example, KDDI has been working on the Shibuya Ward Official Virtual Shibuya since 2020 as part of a project started in 2019 to revitalize the attractive real city of Shibuya using technologies such as 5G and XR. Virtual Shibuya recreates the city of Shibuya in a metaverse, and various events, such as Halloween festivals and live music performances, are held there (**Figure 3-1-2-4**). In 2023, with the aim of realizing open metaverses that connect to other platforms, the company began offering services that connect metaverses to Web3, digital twins, and other services, with a focus on city-linked metaverses, such as Virtual Shibuya.

In November 2021, the company established the Virtual City Consortium to develop and implement guidelines for metaverses and city-linked metaverses. The consortium announced its Virtual City Guidelines in April, 2022. In the future, it aims to further strengthen cooperation with real cities and expand economic and residential areas.

Figure 3-1-2-4 Virtual Shibuya

(Source) Shibuya 5G Entertainment Project

(e) Examples of uses in other countries

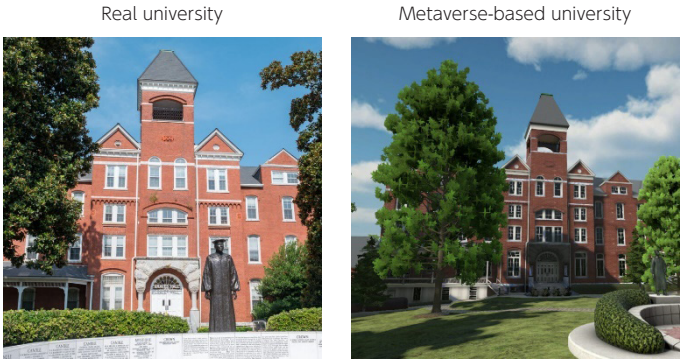
Uses for metaverses are advancing in a range of fields in various countries.

In the U.S., for example, VictoryXR, Inc. offers Metaversity, a platform that enables the creation of metaverse-based universities where classes are taught. As of March 2023, at least ten universities in the U.S. have adopted Metaversity, which offers classes in organic chemistry, anatomy, and physics and can display 3D models in its metaverse **(Figure 3-1-2-5)**.

As an example of regional revitalization, in October 2022, the Emirate of Sharjah in the United Arab Emirates announced plans to provide a metaverse called Sharjah Verse. The project aims to strengthen the local tourism industry and create jobs by recreating the country's tourist destinations and conducting sightseeing tours in its metaverse.

In January 2023, the city of Seoul in South Korea announced that it would launch a project called Metaverse Seoul, which recreates Seoul in a metaverse. The project is scheduled to be implemented in three stages by 2026. The first stage is to provide metaverse-based administrative services, such as the issuance of residence certificates and tax counseling. The second stage is to promote the development of the city by providing services related to real estate investment, and the third stage is to utilize AR technology for infrastructure management in Seoul City **(Figure 3-1-2-6)**.

Figure 3-1-2-5 Metaversity (U.S.)



(Source) Publicly available information provided by VictoryXR, Inc. and others

Figure 3-1-2-6 Metaverse Seoul (Korea)

(Source) Publicly available information provided by Seoul City and others

c Controversies surrounding metaverses

As metaverses are starting to be utilized, issues regarding their popularization are also being discussed.

In the current metaverse market, there are many domestic and foreign platform providers. The creators of these metaverse "worlds"[12] mainly identify target users, select a platform, and build a world on the platform. Also, platform providers sometimes create their own metaverse worlds.[13] However, there is no compatibility or interoperability between worlds, especially between worlds that exist on different platforms, and rules for generating identities and avatars, including prohibited acts and data handling that are applied within a particular metaverse, vary according to the rules set by each operator. Therefore, if data formats and data exchange formats differ between platforms, it may not be possible to carry data over from one metaverse to another on a different platform.

Going forward, as metaverses proliferate in Japan and overseas and as metaverses become new living spaces

[12] Each metaverse world is built and operated on a platform. https://www.soumu.go.jp/main_content/000860618.pdf
[13] Interim Report of the MIC Study Group on the Utilization of Metaverse Toward the Web3 Era https://www.soumu.go.jp/main_content/000860618.pdf

for users, it is important to have an environment that allows users to freely move between various platforms while retaining avatars and items, etc. that indicate their identity. For this reason, standardization efforts to ensure interoperability in which standards for multiple platforms are shared for user convenience have begun.

In a metaverse, as in the real world, problems such as an avatar's behavior, including obscene language, discriminatory language, slander, threats, and molestation or physical actions, including harassment and violence such as stalking and voyeurism, fraudulent transactions and impersonation as well as the problem of protecting the privacy of persons controlling avatars may arise across national borders. In the process of expanding the use of metaverses in all fields, consideration is now being given on how to form rules in the metaverse space, including from the viewpoint of whether existing laws can be applied.[14]

d Promotional measures for metaverses in Japan and overseas

Countries are now working on initiatives to promote metaverses and digital twins.

In Japan, the Basic Policy on Economic and Fiscal Management and Reform 2022,[15] approved by the Cabinet in June 2022, mentioned the expansion of the use of content including metaverses, and the Intellectual Property Promotion Plan 2022,[16] released in the same month, identified legal issues related to content on metaverses and clarified issues. In addition, the Study Group on the Utilization of Metaverse Toward the Web3 Era has been held at the Ministry of Internal Affairs and Communications to examine issues related to the utilization of metaverses, etc. in mainly the information and communications field.[17]

Looking at other regions, the U.S. and the EU have released reports on priority issues and policy issues to be discussed to promote the use of metaverses. In addition, Korea is actively developing metaverses as the new industry after smartphones, and in January 2022, the Ministry of Science and ICT announced the Korea Metaverse New Business Leading Strategy **(Figure 3-1-2-7)**.

Figure 3-1-2-7 Promotion measures for metaverses in other countries

Country	Overview, etc.
U.S.	In August 2022, the Congressional Research Service released a report titled "The Metaverse: Concepts and Issues for Congress" that summarizes the policy issues that should be considered by Congress, such as metaverse technologies and concepts. The report lists issues such as the appropriate use of content, the protection of personal information such as biometric information, the domination of platforms by major companies, and the disparity between those who have access to high-speed communications environments and those who do not.
EU	In March 2023, a policy paper title "Metaverse - Virtual World, Real Challenges" was published. The report provides an overview of metaverses (definition, history of metaverses, future fields of application, development time span, elements and related technologies, countries and companies considered to play a major role) and summarizes potential challenges and opportunities in the EU (why and how the EU should engage with metaverses).
South Korea	In January 2022, the Ministry of Science and ICT published the Korea Metaverse New Business Leading Strategy. In line with the development of metaverses, the strategy states that the Korean government will take measures such as the development of a sustainable metaverse ecosystem based on public-private cooperation, human resource development, development of industry-leading companies, and the establishment of sound and exemplary infrastructure, as well as undertake initiatives to support platform development, develop practical human resources, establish funds, and develop rules, etc.
China	In July 2022, the Shanghai Municipal People's Government in China released its 14th Five-Year Plan for the development of Shanghai's digital economy. In the metaverse field, the plan states that virtual reality technologies will be enhanced, platforms will be developed, and new digital entertainment such as virtual concerts will be fostered.

(Source) Based on Document 7-2 from the 7th meeting of the MIC Study Group on the Utilization of Metaverse Towards Web3 Era

(2) Digital twins

a What is "digital twin"?

A digital twin is where a real space is recreated in a virtual space, based on data collected from the real world and after performing various simulations.

While metaverses and digital twins are both virtual spaces, compared with metaverses, where it does not matter whether the worlds created in such spaces are real or not, digital twins are positioned as a solution for performing simulations. Therefore, they must reproduce the real world. Also, while metaverses are often used for communicating through avatars and playing games in spaces that are not real, digital twins are often used to perform simulations that are difficult to perform in the real world.

By reproducing cities, cars, people, products, and devices in a digital twin, tests that are difficult to repeatedly perform in real spaces, such as traffic congestion predictions, human behavior simulations, manufacturing site monitoring, and durability tests, can be simulated repeatedly in a virtual space. This can provide the following benefits:

○**Optimize production and improve operational efficiency:** Optimization can be performed by optimizing the placement of devices and personnel, and

[14] https://www.kantei.go.jp/jp/singi/titeki2/kanmin_renkei/dai3bunkakai/dai1/gijisidai.html
[15] Approved by the Cabinet on June 7, 2022 https://www5.cao.go.jp/keizai-shimon/kaigi/cabinet/honebuto/2022/2022_basicpolicies_ja.pdf
[16] https://www.kantei.go.jp/jp/singi/titeki2/220603/siryou2.pdf
[17] https://www.soumu.go.jp/main_sosiki/kenkyu/metaverse/index.html
For details on this study group, see Section 6, Promotion of ICT utilization in Chapter 5 of Part 2

processes can be improved to shorten lead times. In addition, the results can be visually confirmed by simulations in a virtual space, thereby contributing to improving safety and reducing risks.

○**Reduce time and costs:** Compared to physically testing and prototyping, simulations can be performed easily in a virtual space, significantly reducing the time spent on physical testing.

○**Perform simulations that are not possible in the real world:** Phenomena that do not occur often in the real world can be easily generated and used to prepare for the future, such as major earthquakes and other events.

b Examples of uses

The use of digital twins began mainly with manufacturers, such as in the aviation industry and for manufacturing lines in general, but they are now used in a wide range of fields, including national and urban planning and disaster prevention.

As an example of their use in urban planning, since fiscal 2020, the Ministry of Land, Infrastructure, Transport and Tourism has been promoting the PLATEAU project,[18] which develops, utilizes, and creates open data for 3D city models. Up to August 2021, it had completed open data conversion of 3D city models of 56 cities nationwide. In order to promote the digital transformation of town planning, digital twins of real cities have been constructed and released as open data, enabling anyone to freely utilize this data.

In the field of disaster prevention, since 2019, Shizuoka Prefecture has been working on the VIRTUAL SHIZUOKA project in which the topography and buildings throughout the prefecture are acquired as three-dimensional information called point cloud data, which is also being released as open data. Information, including VIRTUAL SHIZUOKA information and aerial photographs taken in the past, was compared with data measured in 3D by drones, etc. at the locations where landslides occurred. It was then analyzed and utilized for the landslide disaster that occurred in Atami City, Shizuoka Prefecture, in July 2021 to grasp the damage situation as early as possible and to prevent secondary disasters (**Figure 3-1-2-8**).

Figure 3-1-2-8 VIRTUAL SHIZUOKA

(Source) Shizuoka Prefecture

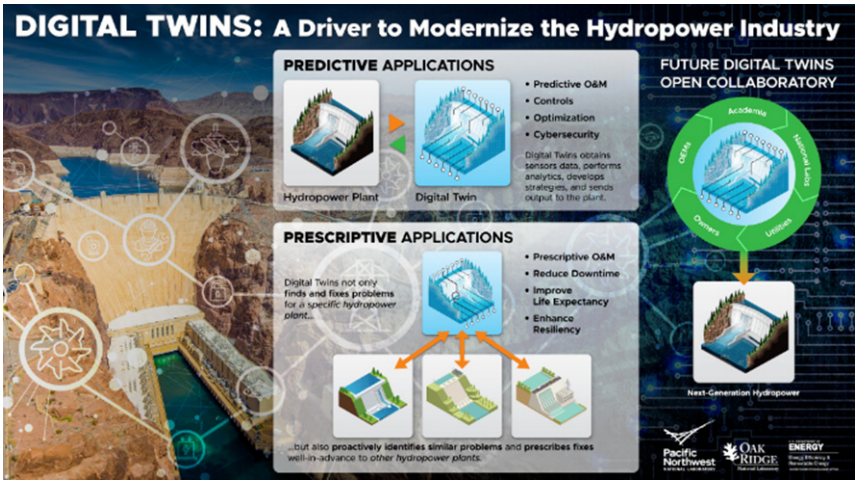
In the field of agriculture, initiatives for realizing agricultural platforms using digital twins are underway. Happy Quality Co., Ltd. offers a digital twin virtual platform that reproduces the cultivation environment in a virtual space, and it can be customized for individual farms. Utilizing this platform makes it possible to perform a range of monitoring activities and simulations. It is expected that smart agriculture will be realized through simulations of cultivation environments and remote cultivation guidance, enabling the agricultural industry to solve the problem of future labor shortages.

Outside Japan, digital twins are being used in various fields, including infrastructure management and urban planning.

For example, Oak Ridge National Laboratory and Pacific Northwest National Laboratory in the U.S. are working to develop an open platform for hydropower systems using digital twins. Monitoring an actual facility and comparing it to a digital twin will enable robust control and optimization of the facility, which is expected to reduce operating costs, improve reliability, and address increased operational complexity. Oak Ridge National Laboratory has also created digital twins for 129 million buildings across the United States, providing power companies and businesses with a way to make simulation-based decisions about how best to improve energy efficiency (**Figure 3-1-2-9**).

[18] https://www.mlit.go.jp/plateau/

Figure 3-1-2-9 Digital twin for hydroelectric systems (U.S.)



(Source) Oak Ridge National Laboratory HP

Shanghai is also using digital twin technology to run and manage the city.[19] It has developed a digital platform that reflects actual objects and information about the objects, such as buildings, street lamps, pipes, plants, etc., and it has demonstrated efficiency for managing social issues, such as garbage disposal and electric bicycle charging. During the COVID-19 pandemic, it was used for pandemic control and prevention, including providing accurate information on nearby residents to local centers for disease control and for future epidemiological studies.

3. Generative AI

(1) Generative AI trends

AI can analyze a massive amount of data to detect signs of failure or scam/spam information, to predict the future, or even to determine which video to show a website visitor next. AI that is used for data analysis is called analytical AI. This type of AI is already used widely throughout society.

However, a new type of AI called generative AI has made rapid progress recently. This type of AI is used to generate and create information—something that has conventionally been seen as a human specialty.

Open AI released GPT-3, a large language model that uses 175 billion parameters, in May 2020. The company followed this up with ChatGPT, a dialog-based AI chatbot based on GPT-3.5, in November 2022 and then GPT-4 in March 2023.

In the same month the following also happened: Microsoft announced that it would include AI based on GPT-4 in its search engine Bing and its internet browser Edge.[20] Google released Bard, an experimental dialog-based AI service using LaMDA (Language Model for Dialogue Applications) for public use, and Baidu, a Chinese search engine, released Ernie Bot, a dialog-based AI service similar to ChatGPT.

There have been developments in Japan as well. LINE Corporation and Naver Corporation collaborated to develop HyperCLOVA, a large language model (LLM) for the Japanese language. HyperCLOVA does not use a chat-based interface, but it can be used to create or summarize text.On April 1, 2023, Works Mobile Japan integrated with and absorbed LINE CLOVA (LINE's AI business that is responsible for HyperCLOVA). The company is now looking into using HyperCLOVA to provide support functions on its LINE WORKS service.[21]

2022 saw the introduction of prompt-based image-generation AI (also called text-to-image) in which users enter text to generate images. This makes it possible for AI to draw images similar to those that humans draw. Operating this technology initially required a high-performance PC capable of processing advanced calculations and storing a large amount of data. However, volunteers began developing applications that could be run on websites, allowing anyone to easily provide prompts for AI to create images.

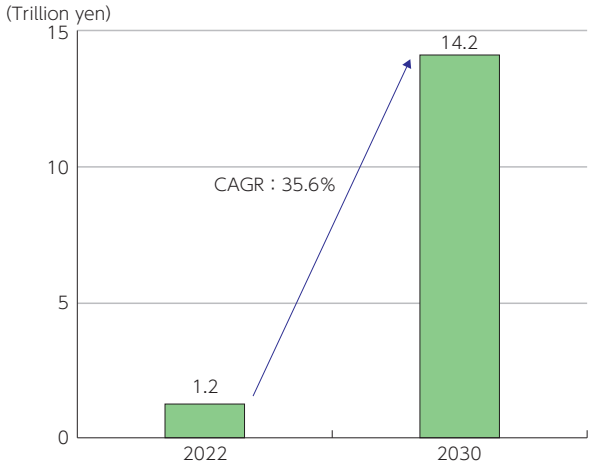
Generative AI is now available for use in many other applications. For example, AI can be used to provide answers or summarize text in response to typed questions, create source code for programs in response to prompts from the user, or even create music from text prompts.

According to SEQUOIA and GPT-3's "Prediction of Generative AI Deployment by the 2030s" published in September 2022, it is expected that the use of generative AI will continue to make progress in the order of text, coding, image, and video/3D/game fields.[22]

The global market for generative AI is expected to expand to approximately 14 trillion yen by 2030, with a compound annual growth rate (CAGR) of 35.6% from 2022 to 2030[23] (**Figure 3-1-3-1**). North America has the largest share of the market (40.2%), based on 2021 data.

[19] https://english.shanghai.gov.cn/nw48081/20220216/d4de492067ca497991823b9758001192.html
[20] https://blogs.bing.com/search/march_2023/Confirmed-the-new-Bing-runs-on-OpenAI's-GPT-4
[21] On April 1, 2023, Works Mobile Japan integrated with and absorbed LINE CLOVA (LINE's AI business that is responsible for HyperCLOVA). The company is now looking into using HyperCLOVA to provide support functions on its LINE WORKS service.
[22] Source: https://www.sequoiacap.com/article/generative-ai-a-creative-new-world/
[23] Based on predictions by the research firm Grand View Research, Inc. (at a conversion rate of 1 USD = 130.3715 JPY as of Jan. 25, 2023)

Figure 3-1-3-1 Global market size of generative AI



(Source) Survey by Grand View Research Inc.

(2) Controversies regarding generative AI

While the use of generative AI has been spreading all over the world, some issues with the technology have been raised, for example, the handling of confidential information, personal information protection, and the accuracy of answers it provides.

As discussed in more detail in Section 3 of Chapter 2, generative AI also has the possibility for misuse. It can be used to create fake images or videos that if spread, either intentionally or unintentionally, could infringe the rights of others or even cause social turmoil. For example, a prompt-based image-generation AI called Stable Diffusion was used in September 2022 to create fake images of flooding in Shizuoka Prefecture in Japan. These images were then spread through social media. Investigations revealed that it took only 14 seconds to create the images.[24] It is now possible for anyone to use image-generation AI to easily create and spread fake images of very high quality.

The technology can also be used to infringe upon intellectual property rights, which could have a negative economic impact on artists, illustrators, and other content creators. In January 2023, a number of artists in San Francisco sued two companies developing image-generation AI technology (Stability AI Ltd, Midjourney Inc. and DeviantArt, Inc.), claiming copyright infringement. The plaintiffs claimed that the companies had created copies of artwork protected under copyright and generated images mimicking the styles of millions of artists, infringing the rights of those artists. They requested monetary damages and a court order as a means to prevent copyright infringement by AI companies. In Japan, a company called RADIUS5 released "mimic," an AI trained on human-generated images that was capable of automatically generating images mimicking the style of the original artist. However, the service was terminated after only one day due to the many concerns voiced over the possibility of the technology being misused.

Although companies providing AI services have established rules for using their technologies, these companies must do more to ensure that users are made aware of their rules. Users must also strive to use these technologies in an ethical manner.

The use of generative AI is already being discussed at both national and international levels.

In March 2023, the Italian Data Protection Authority[25] temporarily prohibited the use of ChatGPT, claiming that sufficient information was not provided to data owners, that the company had a legal obligation to justify its collecting and processing of large volumes of personal data for machine learning, and that the mechanism in place for verifying the age of users was insufficient. In April of the same year, authorities in the UK[26] released eight points of consideration in developing and using generative AI that makes use of personal data, such as the requirement to clarify the legal basis of such technologies, the obligations of organizations managing the data, and the need to perform risk assessment. In the U.S., the National Telecommunications and Information Administration (NTIA) sent out a request for comments on the topic of a system for auditing, evaluating, and certifying AI.[27] Finally, in May of the same year, the Biden administration announced a new policy for promoting responsible AI innovation,[28] consisting of guidelines for investing in responsible artificial intelligence (AI) research and development, evaluating generative AI developed by private companies, and the use of AI by the federal government in order to stress the fact that companies are responsible for confirming safety prior to

[24] https://spectee.co.jp/report/202209_shizuoka_typhoon15_fake/
[25] Garante per la protezione dei dati personali
[26] Information provided by the Commissioner's Office
[27] https://ntia.gov/issues/artificial-intelligence/request-for-comments
[28] https://www.jetro.go.jp/biznews/2023/05/7c5bc3a8bf11f2ff.html

developing and releasing AI products.

In the EU, a decision was reached to establish a task force to investigate concerns over privacy protection with regard to ChatGPT.[29]

Cooperation between countries has also seen some progress in this area. During the G7 Digital and Tech Ministers' Meeting held in Takasaki, Gunma Prefecture, in April 2023, participants discussed the topic "Responsible AI and Promoting of AI Governance" and adopted "The G7 Digital and Tech Ministers' Declaration"[30] in which a decision was reached to convene for discussions on generative AI and to create an action plan for the promotion of global interoperability of AI governance as soon as possible.

During the G7 Summit held in Hiroshima in May2023, participants expressed a common understanding of the importance of engaging in international discussions on the topic of AI governance at the top level, as well as the importance of ensuring the interoperability of AI governance. Participants also agreed to establish the Hiroshima AI Process by the end of the year to discuss generative AI.[31]

[29] https://edpb.europa.eu/news/news/2023/edpb-resolves-dispute-transfers-meta-and-creates-task-force-chat-gpt_en
[30] https://www.soumu.go.jp/main_content/000879099.pdf
[31] https://www.mofa.go.jp/mofaj/files/100506875.pdf

Section 2 Toward Realizing an Abundant Data Distribution Society

As communications infrastructures become more advanced and the use of smartphones more common, diverse digital services that make use of data are becoming crucial parts of our lives. New forms of data usage, such as the metaverse and digital twin technology, have also been the subject of much recent attention. It is hoped that these technologies will contribute toward solving the various social/economic issues facing Japan, such as regional revitalization, disaster prevention, and the realization of diverse working styles.

This section summarizes issues and efforts involved in realizing a society where the safe and appropriate distribution of data is promoted and where anyone and everyone can benefit from the use of data.

1. Safe and robust communications networks supporting data distribution

There have been several recent incidents in Japan and elsewhere where communications infrastructures have been disabled due to large-scale natural disasters, abnormal weather, or even human errors. With an increasing amount of activity now conducted over the Internet, the impact of such incidents is much higher than it was in the past (**Figure 3-2-1-1**).

Figure 3-2-1-1 Examples of recent telecommunications services outages

Area	Date occurred	Details
Global	June 2022	Cloudflare: An outage occurred in 19 data centers throughout the world.
UK	July 2022	Google, Oracle: An outage occurred in cloud services due to a heatwave.
Japan	July 2022	KDDI: A communications outage occurred due to human error.
Japan	Aug. 2022	NTT West: A communications outage occurred in the FLET'S Hikari Internet service due to equipment failure.
Japan	Sept. 2022	Rakuten Mobile: A communications outage occurred due to an equipment error.
Japan	Sept. 2022	Softbank: A communications outage occurred due to human error.
South Korea	Oct. 2022	Naver, Kakao: A service outage occurred due to a fire at an SK C&C data center. Service was restored in South Korea on the day of the outage for Naver, and then five days later for Kakao.
Japan	Dec. 2022	NTT Docomo: A communications outage occurred due to an equipment error and human error.
U.S.	Feb. 2023	T-Mobile: A communications outage occurred.
Japan	April 2023	NTT East, NTT West: A communications outage occurred in services such as "HIKARI DENWA."

(Source) Created by MIC based on publicly available documents released by various companies

As the international situation becomes more complicated, ensuring the reliability and safety of communications infrastructures has become an extremely important issue from the perspective of guaranteeing economic security. Cyberattacks are growing more complex and sophisticated as digital technology advances, making security risks a widespread and critical issue. There have been many cases of cyberattacks targeting key infrastructures in countries all over the world, causing social turmoil. This is true even in Japan, where cyberattacks targeting private companies, including key infrastructure operators, have occurred. There have even been cases where investigations have determined that foreign governments were likely involved in these incidents.[1] Furthermore, as ICT devices continue to become more advanced and supply chains more complex and global, security risks in supply chains have also become apparent, as seen in the fact that unauthorized software installed in communications devices and systems used in information and communications infrastructures and unauthorized software, such as malware, being introduced through supply chains related to maintenance and operations.

There are also growing concerns about ensuring economic security and problems that could prevent devices and parts from being procured that are required for the provision of digital services. Factors such as antagonism between the U.S. and China have even changed the structure of global supply chains, and even in Japan, ensuring reliable access to ICT-related devices and parts is now directly related to ensuring economic security. The ratio of companies exporting ICT-related devices and parts to Japan in 2021 reveals the tendency of Japan to rely on certain countries, with China and Taiwan accounting for a large ratio of the semiconductors, mobile phones, portable automatic data processing machines, and parts, such as processors, that Japan imports.[2]

Amid concerns of natural disasters becoming more frequent and intense and the international situation becoming more complicated, it will be crucial to build more robust communications infrastructures (including arranging alternate means), decentralize data centers and submarine cables, enhance cybersecurity and supply chains, and implement other measures to ensure

[1] https://www.cas.go.jp/jp/seisaku/keizai_anzen_hosyohousei/dai3/siryou4.pdf
[2] MIC (2022), "Ensuring the Economic Security of the Digital Society"

that data can be distributed reliably and safely and that digital services remain available even during an emergency.

(1) Building resilient communications infrastructures

Robust communications infrastructures are crucial to maintain access to digital services even during a natural disaster or other emergency. There are currently a number of initiatives underway in Japan to create more robust communications networks, based on lessons learned during large-scale natural disasters, such as the Great East Japan Earthquake.

Telecom operators have implemented measures to prevent power outages and transmission line disconnections, based on experience during the Great East Japan Earthquake, where such failures occurred due to mobile phone base stations being switched off. Some measures being implemented to prevent power outages include deploying more vehicle-mounted power supplies and power generators and enhancing base station batteries. Meanwhile, measures being implemented to prevent transmission line disconnections include adding new transmission line routes and expanding emergency restoration measures that make use of satellite entrance lines and micro-entrance lines.

The National Institute of Information and Communications Technology (NICT) Resilient ICT Research Center is now working with Tohoku University and other industry, academia, and government organizations to research, develop, and verify resilient ICT infrastructures that can cope with environmental changes, such as large-scale disasters and communications outages.[3]

(2) Ensuring diverse communications infrastructures and measures

Intercarrier roaming allows mobile phone users to temporarily access other carrier networks. This technology is one means of providing continuous access to digital services even during natural disasters, communications outages, or other emergencies. One example of the use of this can be seen in Ukraine, where telecom operators[4] allow users to roam between networks at no charge to ensure continuous communication while the country is under attack from Russia. In the U.S., the Federal Communications Commission (FCC) in July 2022 implemented the Mandatory Disaster Response Initiative (MDRI), which requires providers to allow roaming between mobile carriers during disasters, such as hurricanes, wildfires, and long-term power outages.[5]

In Japan, the Ministry of Internal Affairs and Communications has been holding meetings for the "Study Group on Intercarrier Roaming in Emergency Situations" since September 2022. It has investigated a wide range of measures, including intercarrier roaming for mobile phones, to ensure that communication is available during emergencies. In December of the same year, the organization released the "First Report on Intercarrier Roaming in Emergency in JAPAN,"[6] a basic policy on introducing intercarrier roaming as quickly as possible and in a manner that allows for full roaming for data communications in addition to general calls and call backs from emergency agencies. In response, telecom operators have begun investigating policies for using and operating technologies in order to implement intercarrier roaming.

However, because there is always the possibility of a communications outage preventing the use of intercarrier roaming, it will be important to continue to promote comprehensive solutions, including utilizing other means of communication. Since March 2023, mobile carriers have begun providing auxiliary line services that allow users to switch to other carriers to maintain connectivity.[7] This provides a useful alternative for situations where users cannot access their carrier network due to a communications outage or disaster. In response to demands from mobile carriers belonging to the Telecommunications Carriers Association to continue to use the "00000JAPAN" SSID for disasters even if a communications outage occurs, the Wireless LAN Business Promotion Association (Wi-Biz) revised its "Guidelines on Providing Free Access to Public Wireless LAN during a Large-Scale Disaster" in May 2023 to allow access to "00000JAPAN" during a communications outage. Wi-Biz continues to investigate situations where alternate operations could be required during a natural disaster.

One other effective means of ensuring communication is to use non-terrestrial communications networks, such as satellites. The Starlink broadband internet service is being used to maintain communications in war-torn Ukraine. This service, provided by SpaceX (U.S.), utilizes a satellite constellation for communications. Even in Japan, telecom operators are engaged in efforts to utilize and introduce satellites, etc. for use during emergencies **(Figure 3-2-1-2)**. Authorities in Tokyo are also investigating the use of satellite communications to maintain access to the Internet even if a communications outage or disaster occurs.[8]

[3] https://www.nict.go.jp/resil/
[4] The three largest telecom operators in Ukraine (Kyivstar, Lifecell, and Vodafone Ukraine)
[5] https://www.soumu.go.jp/main_content/000838215.pdf
[6] https://www.soumu.go.jp/main_content/000852036.pdf
[7] https://news.kddi.com/kddi/corporate/newsrelease/2023/03/27/6618.html
[8] https://note.com/smart_tokyo/n/n51c567aefe31

Figure 3-2-1-2 Efforts by Japanese telecom operators to utilize and introduce satellites, etc.

	Overview
NTT	Established Space Compass, jointly funded by SKY Perfect JSAT. Aims to begin providing low-delay communications services within Japan using High Altitude Platform Station (HAPS) in fiscal 2025.
KDDI	Signed contract with SpaceX (U.S.) to use Starlink as the backhaul link to au base stations. Began operating in Hastushima (Atami, Shizuoka Prefecture) in December 2022, and plans to expand service to approximately 1,200 locations throughout Japan.
SoftBank	Currently developing an NTN solution to provide communications networks from outer space and the stratosphere, using three services: (1) satellite phone service provided by THURAYA, (2) LEO satellite communications service provided by OneWeb, and (3) HAPS provided by HAPSMobile (a subsidiary of SoftBank).
Rakuten Mobile	Working with AST SpaceMobile (U.S.) on the "SpaceMobile" project to build mobile broadband networks utilizing LEO satellites. Aims to allow smartphones to communicate directly with satellites.

(Source) Created by MIC based on publicly available documents released by various companies

(3) Strengthening data centers, submarine cable functions, and safety measures

Data centers serve to store and process data and are the foundation for a variety of internet services, including data communications. Japan also relies on submarine cables for about 99% of its international communications, which are becoming even more important as the volume of cross-border data flows increases. In addition, as tensions between the United States and China continue to rise and the international situation, such as the invasion of Ukraine, becomes more complex, it is increasingly important to strengthen security measures for data centers and submarine cables from the viewpoint of economic security.

In Japan, currently about 60% of data centers are located in the Tokyo metropolitan area.[9] In addition, domestic submarine cables are mainly laid on the Pacific Ocean side, while the Sea of Japan side is undeveloped (this condition is called "missing link"), and the landing bases of submarine cables are concentrated in the Boso Peninsula and the Shima Peninsula. With data centers and submarine cable landing stations concentrated in specific areas, a large-scale disaster in the Tokyo metropolitan area could have a significant impact on the communications environment on a nationwide scale. In fact, the Great East Japan Earthquake caused damage to KDDI's submarine cables in ten locations off the coast of Ibaraki Prefecture and Choshi in Chiba Prefecture, both of which are located on the Pacific side, and connections to at least ten countries were affected.[10] In January 2022, an eruption of an underwater volcano off the coast of Tonga severed a submarine cable, and it took five weeks to restore communications.[11]

Given the importance of data centers and submarine cables, Japan is currently decentralizing their locations. As part of the Digital Garden City Nation Infrastructure Development Plan (Revised) announced in April 2023, the Ministry of Internal Affairs and Communications, in cooperation with the Ministry of Economy, Trade and Industry, plans to develop over ten regional data centers in about five years. And in light of the fact that the Tokyo and Osaka areas are increasingly becoming data center hubs, it also plans to promote the development of third and fourth core data center hubs to complement and replace Tokyo and Osaka for the time being. In addition, while paying close attention to trends in infrastructure development that are in line with internet traffic conditions, initiatives toward greening, and collaborations using Multi-access Edge Computing (MEC) and AI, based on the discussions at the Expert Meeting on Digital Infrastructure Development (DCs, etc.) and in cooperation with the Ministry of Economy, Trade and Industry and other relevant ministries and agencies, the Ministry of Internal Affairs and Communications will proceed with considering how data centers and other infrastructure should be distributed and the necessary support for site development. With regard to submarine cables, the Ministry of Internal Affairs and Communications plans to start operation of submarine cables on the Sea of Japan side by the end of fiscal 2026 and to promote distribution of landing stations and efforts to strengthen Japan's functions as a hub for international data distribution, such as multi-routing of international submarine cables and the laying of branch lines for landing stations, in conjunction with efforts to develop data center sites and strengthen safety measures for international submarine cables and landing stations **(Figure 3-2-1-3)**.

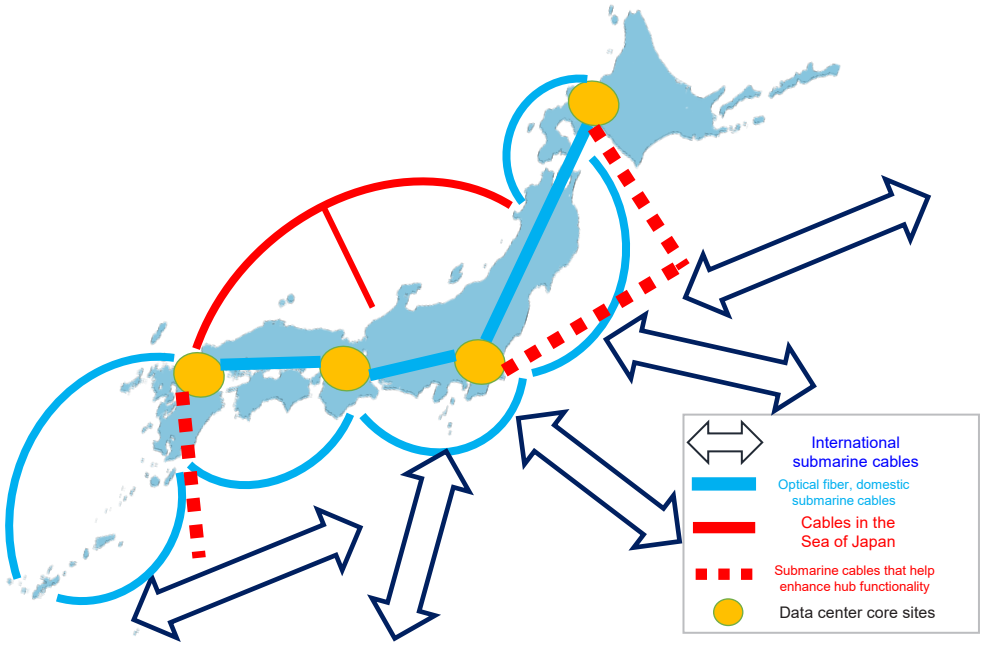
As a concrete measure, the Ministry of Internal Affairs and Communications has been providing subsidies to private businesses for digital infrastructure development using the Fiscal 2021 Supplementary Budget Digital Infrastructure Development Fund (Specified Telecommunications Facilities Development Promotion Fund) as a source of funding. As of June 2022, seven local data center projects have been adopted.

[9] The reason behind the concentration of data centers in the Tokyo metropolitan area is that constructing data centers close to Tokyo, which is where there is the largest demand for data, reduces the latency time of communications and improves the quality of services. In addition, from the viewpoint of operations and maintenance, it is desirable to locate data centers in the Tokyo metropolitan area for easy access by maintenance personnel. So locating data centers in Tokyo metropolitan area has been very advantageous for operators.

[10] The cable is believed to have been severed by the earthquake, which caused the ground beneath the sea to shift, placing excessive load on the cable.

[11] https://www.technologyreview.jp/s/266975/tongas-volcano-blast-cut-it-off-from-the-world-heres-what-it-will-take-to-get-it-reconnected/

Figure 3-2-1-3 Image of data center and submarine cables maintenance



(4) Responding to cybersecurity and supply chain risks

It is necessary not only to prepare for large-scale natural disasters but also to address cybersecurity risks (including those in the supply chain) and procurement risks.[12]

In light of the increasing importance of preventing acts that harm the security of the nation and its citizens from taking place in relation to economic activities in the face of the increasing complexity of the international situation and changes in the socioeconomic structure, the Act on the Promotion of Ensuring National Security through Integrated Implementation of Economic Measures (Act No. 43 of 2022) was enacted in May 2022.

In order to prevent important facilities that are part of Japan's core infrastructure from being used as a means for acts (including cyberattacks) that obstruct the stable provision of services performed outside Japan and to ensure the stable provision of core infrastructure services, this act stipulates a system for "ensuring the stable provision of specified social infrastructure services" in which the government reviews plans in advance when core infrastructure operators introduce important equipment, etc. Telecommunications is stipulated as one of the industries that may be subject to the regulations.

In addition to working on the steady implementation of the system from the perspective of procurement risks, it is important to be able to secure telecommunications infrastructure autonomously without being overly dependent on specific countries. To this end, it is necessary to consider ways to procure reliable devices and parts, including promoting research and development in Japan and diversifying suppliers.

Furthermore, in light of the global importance placed on ensuring the safety and reliability of communications infrastructure, it is necessary for the public and private sectors to promote overseas expansion of 5G and submarine cables while strengthening cooperation with other countries as economic security measures, including measures with respect to supply chain risks.

2. Development of advanced ICT infrastructure that supports ultra-high-speed, high-capacity data distribution

As new technologies and services, such as blockchain-based NFTs, DAOs, metaverses, and digital twins, begin to be utilized, it will be necessary to transmit huge amounts of data at a very high speed and without delay in order for these technologies and services to penetrate society in the future.[13]

In addition, it is expected that in the 2030s, the integration of cyberspace and physical space (Cyber Physical Systems [CPS]) will advance, and physical communications in physical spaces will be reproduced in the form of digital data in cyberspace. By using AI, it is also expected that it will be possible to ascertain the status of

[12] For details on the MIC's cybersecurity policy, see Section 5, Cybersecurity policy trends in Chapter 5 of Part 2.
[13] According to Manabu Tsukada, Associate Professor at the Graduate School of Information Science and Technology at the University of Tokyo, delays, scale, and data transfer speeds are major points in the popularization of metaverses. For example, to achieve one of the goals for metaverses of unlimited numbers of users who can synchronize events and experience them satisfactorily, delays should be kept to within 150 milliseconds, and in more demanding environments, such as games, delays should be kept to within 20 milliseconds.

physical spaces at any time and make decisions on subsequent actions based on such information. Thus, it will be necessary to meet a wide variety of requirements, including performance beyond 5G.

Therefore, Beyond 5G (6G), which is a more advanced information and communications infrastructure than 5G, is essential for realizing the data-driven Society 5.0, which makes the most of CPS for socioeconomic activities **(Figure 3-2-2-1)**.

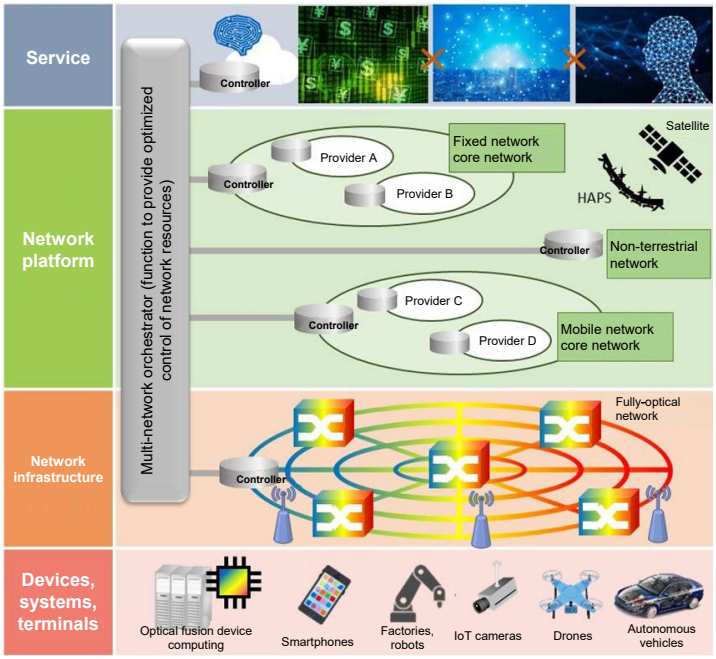
As well as further advancing the functions of 5G, which are high speed and high capacity, low latency, and multiple simultaneous connections, Beyond 5G (6G) is also expected to realize new functions, such as reduced power consumption due to recent advances in remote and online communication traffic in response to increases in network power consumption, scalability to expand communication coverage, and network safety, reliability, and autonomy.

In particular, as environmental problems, such as global warming, become more serious, reducing the power consumption of information and communications infrastructure has become an issue, and attention is being paid to fully optical network technology,[14] which utilizes photoelectric fusion technology to achieve higher network speeds and significantly lower power consumption by combining telecommunications and optical communications.

In the interim report of the Information and Communications Technology Strategy Beyond 5G- With the aim of building a robust and vibrant society in the 2030s- issued by the Information and Communications Council (June 30, 2022), the concept of capturing Beyond 5G (6G) as an entire network that includes wired, wireless, land, sea, air, space, etc. rather than as an extension of current wireless communications, the ideal network for Japan, the key technology areas that Japan should focus on, including all-optical network technology, non-terrestrial network (NTN) technology, and secure virtualization and integrated network technology, and the direction of strategically promoting research and development, social implementation, intellectual property and standardization, and overseas expansion. Based on this, the Ministry of Internal Affairs and Communications is devising new policies, including legal amendments and the creation of a permanent fund, that are based on budgetary measures.[15]

In addition, activities, such as the examination of use cases and technical challenges, international cooperation, and the promotion of intellectual property and standardization through industry-academia-government cooperation organizations (the Beyond 5G Promotion Consortium and Beyond 5G New Business Strategy Center), are also progressing in industry.

Figure 3-2-2-1 The ideal Beyond 5G network



(Source) Summary of the Information and Communications Council's interim report on the "Information and Communications Technology Strategy Beyond 5G"

[14] This is one of the major technology areas in NTT's IOWN Initiative.
[15] For details, see [Policy focus] Toward the realization of Beyond 5G (6G), and Section 7, ICT Technology Policy Trends in Chapter 5 of Part 2, etc.

3. Formation of international rules, including standardization

In order for new services and products to proliferate, it is important to disseminate rules for services and products.

Since digital spaces, such as metaverses, do not have the concept of borders and people from all over the world can participate and use them via the Internet, it is necessary to form and disseminate international rules, including standardization, in cooperation with the international community.

With regard to metaverses, there is already a growing movement toward the formation of international rules led by the private sector, with many companies and organizations participating in international forum organizations aimed at realizing interoperability. At its annual meeting in May 2022, the World Economic Forum announced the launch of the New Initiative to Build an Equitable, Interoperable and Safe Metaverse[16] as a public-private framework for international cooperation on metaverses. In June 2022, The Khronos Group Inc. in the U.S. led the establishment[17] of the Metaverse Standards Forum, an industry group that promotes the development of interoperability standards for metaverses, and it is working on developing open standards for metaverses, such as avatar identity management, privacy, and human interfaces, such as XR.

In addition, ITU-T Study Groups is examining security, wired content transmission, encoding, distribution of digital media, etc. in anticipation of ensuring the mutual compatibility of metaverses. Regarding standardization of transmission lines, it has also set delay tolerances, jitter as an indicator of dispersion, and packet loss requirements, etc. Furthermore, the metaverse focus group (FG-MV)[18] was established to collect information on the standardization of metaverses in a wide range of areas, and it is promoting examination of items that should be standardized in the future and how cooperation with other standardization organizations should be conducted.

The VRM Consortium is taking the lead in developing the VRM format, a standard for 3D avatars developed in Japan. And relevant organizations in Japan, such as the VRM Consortium and private companies, are actively working on international standardization, including participating in the Metaverse Standards Forum.[19]

In this way, in addition to ensuring interoperability between multiple platforms, Japan is also moving toward standardization of advanced data compression technologies and standards for 3D avatars, so it is necessary for Japan to actively and proactively address and promote these initiatives in cooperation with the international community.

With regard to AI, which is becoming increasingly advanced and more widely adopted, it is important for each country to cooperate in examining which measures should be promoted and the form of regulations, etc.

The promotion of development, utilization and appropriate regulation of AI are all important. Based on these ideas, at the G7 Digital and Technology Ministers' Meeting held in April 2023, which Japan presided over, discussions were held on measures for realizing the common vision of each country to promote the adoption of "trustworthy AI." As a result, an action plan was agreed on to promote interoperability of AI governance, such as a basic framework for AI management and operation, which varies by country and region, and an agreement was also reached to quickly establish a forum for discussing generative AI, such as ChatGPT. In addition, at the G7 Hiroshima Summit in May of the same year, it was agreed to create the Hiroshima AI Process to discuss generative AI. Going forward, it is necessary to continue to promote development of the environment for utilizing AI in cooperation with other countries, based on action plans.

4. Creation of abundant and sound information spaces

As described in Chapter 2, Section 3, the spread of social media has made it possible for all parties to disseminate information on the Internet and easily obtain various kinds of information. On the other hand, numerous problems have arisen regarding the distribution and utilization of data, such as the spread of illegal harmful information, disinformation and misinformation, and information bias. These issues are not confined to cyberspace or any particular age bracket but to society as a whole, including in the real world.

However, at present there is no magic solution for these problems, and no solution has been found for one of the causes of these problems, the "attention economy" on the Internet. In addition, the spread of generative AI and deepfake technologies has made it possible for anyone to easily create fake text and images, and the Japanese public is increasingly exposed to information that the human eye has difficulty discerning whether it is real or not. The problem of disinformation and misinformation is expected to become more complicated in the future due to the misuse of these technologies.

In order to realize a sound information space where everyone can use digital services with peace of mind, further initiatives are required by a variety of stakehold-

[16] https://initiatives.weforum.org/defining-and-building-the-metaverse/home
[17] As of March 2023, more than 2,300 organizations are participating, including Meta, Microsoft, Alibaba, Deutsche Telekom, Sony Entertainment, and NTT QONOQ.
[18] Focus group: a fixed-term organization that is open to non-ITU members with the purpose of collecting a wide range of information for examining the development of recommendations
[19] Interim Report of the MIC Study Group on the Utilization of Metaverse Toward the Web3 Era https://www.soumu.go.jp/main_content/000860618.pdf

ers, including operators of platforms that serve as a place for distributing, sharing, and utilizing data.

In the second report published by MIC's Study Group on Platform Services (chaired by Professor George Shishido of the Graduate School for Law and Politics, University of Tokyo) in August 2022, the direction of initiatives regarding disinformation and misinformation going forward is to comprehensively promote voluntary initiatives by a wide range of stakeholders, including platform operators, by, for example, promoting fact-checking initiatives in cooperation with platform operators, fact-checkers, fact-checking promotion organizations, and existing media, etc. and ascertaining the status of initiatives for improving ICT literacy and the problem of disinformation in Japan from the perspective of ensuring freedom of expression, based on voluntary initiatives by the private sector.

In this context, platform operators are required to appropriately set and operate disinformation policies that are based on risk analysis and assessment and promote transparency and accountability in these initiatives. Therefore, it is necessary for the government to continuously conduct monitoring and verification of these initiatives.

It is also necessary to improve the literacy of users of digital services.

In Japan up to now, measures for improving ICT literacy have mainly targeted young people, with the main aim of encouraging them to avoid risks associated with ICT use, such as how to avoid internet-related problems. With the use of ICT and digital services becoming commonplace, it is becoming increasingly important for all generations to learn the characteristics of digital services, the responsibilities associated with their behavior when using those services, and how to accept, utilize, and disseminate information in an independent and interactive manner while using ICT, etc.

The Ministry of Internal Affairs and Communications held the Working Group on Improving Literacy for ICT Use (chaired by Professor Tatsuhiko Yamamoto of the Graduate School of Law, Keio University) to discuss and examine measures to promote improving the literacy required for the digital society in the future while taking into account the concept of "digital citizenship" in which people voluntarily engage with the digital society. Based on the discussions of this committee, etc., the MIC plans to prepare and publish in the summer of 2023 a roadmap that summarizes future issues to be addressed. Going forward, it is necessary to proceed with examining the formulation of indicators for literary proficiency and the development of content for improving literacy, based on this roadmap.

New digital technologies and services, such as generative AI and metaverses, which have evolved and spread rapidly in recent years, will make the lives of ordinary citizens more convenient and bring various benefits, but this depends on these technologies being used properly. Incorrect use of these technologies may create problems not only for the user but may also violate the interests and rights of others.

In order for everyone to enjoy the convenience of using AI, etc., it is necessary to acquire the skills and literacy needed to properly use it.

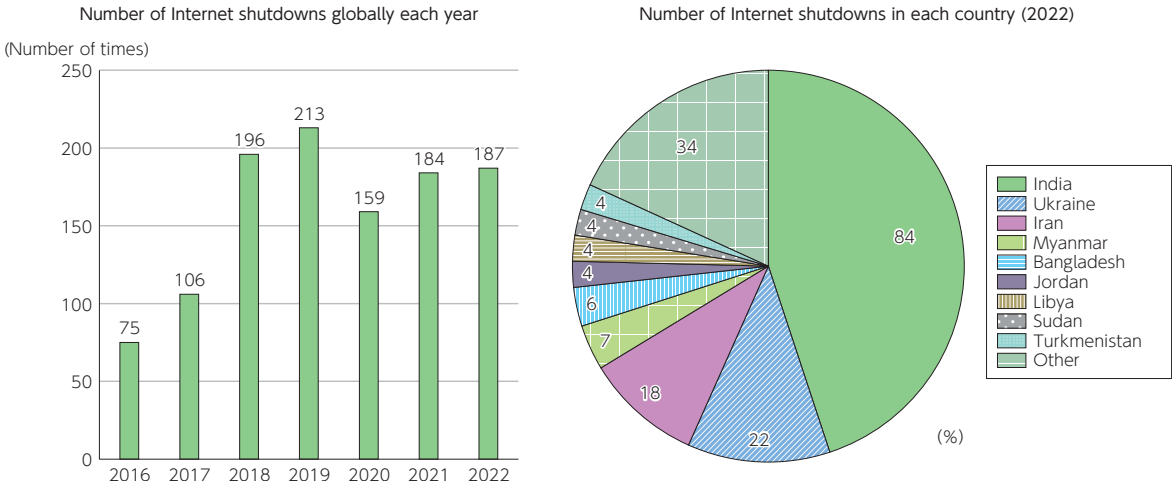
Column Maintaining and promoting a free and open Internet

The Internet originated as a communications network between universities and research institutes under the ARPANET program[1] in the U.S., and it started to be used commercially in the 1990s. With the widespread adoption of personal computers and the development of broadband networks, it has expanded worldwide. The Internet has developed into a free and open space accessible to all in accordance with the basic principles of autonomy, dispersion, and cooperation, and it has become the foundation that supports our socioeconomic activities, where all kinds of people share knowledge and information, and a range of digital services and businesses are created by various stakeholders.

As a governance framework supporting a free and open Internet, the Internet Corporation for Assigned Names and Numbers (ICANN) has played a major role in the management and coordination of resources, such as domain names and IP addresses, and the Internet Engineering Task Force (IETF) has played a major role in the standardization of internet-related technologies. ICANN and the IETF operate according to the principle that governments are just one of the parties involved in decision-making and that democratic decision-making involves multiple stakeholders, including researchers, companies, engineers, and civil society. In addition, the Internet Governance Forum (IGF) was established in 2006, following the consensus statement of the United Nations-sponsored World Summit on the Information Society (WSIS). The IGF also adopts a multi-stakeholder approach in which various parties, including industry, government, academia, and the public, participate in discussions, based on the idea that a wide range of participants share their wisdom to solve problems.[2]

As a threat to this kind of free and open Internet, the movement towards a "splinternet" has become apparent. The term splinternet is a combination of "splinter" and "Internet," and it refers to a situation in which the Internet becomes fragmented due to government regulations and interventions, technological factors, and business activities.[3] According to a report by Access Now, an international NPO, 35 countries experienced at least 187 internet shutdowns in 2022, with both figures up from the previous year **(Figure 1)**.

Figure 1 Internet shutdowns in the world



(Source) Created based on "WEAPONS OF CONTROL, SHIELDS OF IMPUNIT"[4]

Fragmentation caused by government regulation and intervention includes state control and management of the Internet that is based on China and Russia's claim of cyber sovereignty.[5]

Since the 1990s, China has been censoring and fragmenting the Internet under a national strategy called the Golden Projects. To protect its interests being negatively affected by information from other countries, it has created an internet censorship system called the Great Firewall (Golden Shield), which blocks access to Google, Facebook, YouTube, and other sites in China. A survey carried out by Freedom House in 2022 found that of the 65 countries surveyed, China had the least amount of freedom on the Internet.

In addition, in recent years, China has proposed positioning the International Telecommunication Union (ITU), a specialized agency of the United Nations, as an internet management organization, and it has begun to

[1] It is a network program between universities and research institutes that is funded by the Advanced Research Projects Agency of the U.S. Department of Defense. The world's first packet communication was realized in 1969.
[2] https://japanigf.jp/about/igf
[3] See Section 2 in Chapter 2 for information on the concentration of digital data with platform providers, etc. and Section 3 in Chapter 2 for information on the algorithmic selection and restriction of data on the Internet.
[4] https://www.accessnow.org/wp-content/uploads/2023/03/2022-KIO-Report-final.pdf
[5] Unlike the idea espoused by Western countries and Japan, etc. that governments and public authorities should not intervene in internet governance and that the Internet should develop outside of government regulations, China and Russia advocate the concept of cyber sovereignty, which states that active control of cyberspace within their borders should be internationally recognized as a national interest.

strengthen its influence in the ITU. As an intergovernmental organization, the ITU is based on a one-country, one-vote system, and private organizations are not expected to be involved in ITU decisions. It is considered that the aim of China's insistence on centralizing discussions on internet governance in the ITU is for countries to take the lead in managing the Internet and for international agreements to be managed on a one-country-one-vote system that includes developing countries so that China's opinions are more strongly reflected.[6]

In September 2019, China's Huawei, together with the Ministry of Industry and Information Technology (a government agency) and two Chinese state-owned telecommunications companies, proposed to the ITU "New IP." This would form the basic technology of a new Internet on the basis that the quality of the current internet protocol (IP) (best effort type) cannot cope with the introduction of cutting-edge technology in the future. This proposal was strongly opposed by Western countries and the IETF, which argued that New IP is incompatible with the existing IP and would compromise interconnectivity. In December 2020, the ITU concluded that New IP would not be discussed further.

The Russian government has also begun to regulate and intervene in the Internet, and in November 2019, a federal law (commonly known as the Sovereign Internet Law) came into effect to block or restrict internet communications with foreign countries in the event of an emergency, etc. The law requires telecom operators to install technical tools on their networks to counter threats to internet traffic and to restrict access to prohibited websites. It also stipulates that the Federal Service for Supervision of Communications, Information Technology and Mass Media centrally manages communications networks when the Internet in Russia is threatened.

In addition to these developments regarding cyber sovereignty by China and Russia, the current complex international situation has led to new fragmentation. Specifically, four days after Russia invaded Ukraine in February 2022, the Ukrainian government requested ICANN to revoke the Russian domain .ru and to suspend DNS root servers in Russia. As discussed above, the Internet is a global platform that is used under the unwritten law that it is accessible to people all over the world, so this request from the Ukrainian government attracted the attention of various countries as it shook the foundation of the Internet. In response, ICANN refused to accept the Ukrainian government's request, saying the "unilateral disconnection of a domain is not stipulated in ICANN policy." Regarding the invasion of Ukraine, not only governments but also companies are taking actions, and in March 2022, two major U.S. telecom operators cut off their connections to Russian networks.[7]

So far, the Internet has supported the creation of digital services, the expansion of innovation, and active communications as a universal infrastructure that is accessible to all without the influence or intervention of any particular state. In order to avoid the fragmentation of the Internet and to maintain and promote a free and open Internet, it is important to maintain the management and operation of the Internet based on a multi-stakeholder framework rather than national initiatives.

For this reason, in April 2022, the U.S. issued the Declaration for the Future of the Internet[8] together with 60 countries and regions, including Japan, Australia, and countries in Europe. The declaration expresses concern that "Access to the open Internet is limited by some authoritarian governments, and online platforms and digital tools are increasingly used to repress freedom of expression and deny other human rights and fundamental freedoms." It also calls for support for an open, free, global, interoperable, reliable, and secure Internet in the future. Furthermore, with regard to the future of the Internet and the Internet and digital technologies, the declaration presents the following principles: (1) protection of human rights and fundamental freedoms, (2) a global Internet (with no fragmentation), (3) inclusive and affordable access to the Internet, (4) trust in the digital ecosystem, and (5) multi-stakeholder internet governance.

In addition, the G7 Digital and Tech Ministers' Meeting in Takasaki, Gunma, held in April 2023, reaffirmed the importance of maintaining and developing internet governance through a multi-stakeholder framework to ensure open and free access to the Internet. The ministers also expressed their opposition to excessive government intervention that unreasonably restricts the distribution of data on the Internet and their continued commitment to ensuring Data Free Flow with Trust (DFFT).

In October 2023, the annual meeting of the Internet Governance Forum (IGF) will be held in Japan. It is expected that the multi-stakeholder discussions, which included the government, the private sector, and the technical and academic communities, will yield meaningful results that support a free and open Internet.

[6] In February 2022, China and Russia issued a statement stating they share the position that "[Both countries] support the internationalization of internet governance, affirm that countries have equal rights to governance, and any attempt to limit the sovereign right to ensure domestic security by regulating domestic segments of the Internet is unacceptable" and that they were "interested in greater ITU participation in addressing these issues."
https://www.digitalpolicyforum.jp/column/220902/

[7] As the trends and nature of the splinternet itself have changed significantly over time, there are indications that Splinternet 1.0, which is defensive in nature to protect a country's own information environment from other countries, has shifted to Splinternet 2.0 in which specific countries are strategically and aggressively disconnected from global networks in order to exclude them. Professor Toshiya Jitsuzumi of Chuo University stated that in the so-called Splinternet 1.0 stage, internet disruptions were done by national governments, but the Splinternet 2.0 stage is characterized by disruptions being done not only by national governments but also by private companies.

[8] Provisional translation: https://www.soumu.go.jp/main_content/000812030.pdf