Improving prosperity for all people and cultures

The NTT Group is committed to contributing to the development of society by acknowledging diverse cultures.

Improving prosperity for all people and cultures

Social problems are increasing in severity every year, posing a greater threat to social and economic prosperity. The NTT Group is delving into the potential future and underlying reasons, outlining its commitment, and taking concrete action with the aim of achieving prosperity for all people and cultures. There are three key themes when it comes to assessing NTT goals: Shared ethical standards with stakeholders; Preparing for a new future with the power of digital technologies; and Moving toward a safe, secure, and resilient society. The NTT Group is taking action in line with each of these themes.

Today

What should NTT be aiming for?

Prosperity for All People and Cultures

	Potential Future and Underlying Reasons	Commitments	Action
Sharing ethical standards with stakeholders	The NTT Group will be reforming various systems with the aim of promoting DX to create an IT environment where anyone is able to work in any location, at any time. In addition to the introduction of a cloud-based system, we will digitize processes to facilitate automation and standardization while expanding sales approaches by applying digital marketing to implement these initiatives. Around a hundred automated processes will be rolled out under ten DX initiatives with the aim of increasing productivity with service provisioning 1.7-fold (in FY2025), to achieve cost reductions of more than ¥200.0 billion in fiscal 2023 (aggregate total of more than ¥1.0 trillion in cost reductions from FY2017).	**100%: participation rate of corporate ethics policy training (annual)** **Zero cases: illegal actions involving anti-competitive behavior or bribery** We set high ethical standards for ourselves and share them with our business partners.	Establishing and thoroughly complying with ethical standards Appropriately managing conduct risk Thoroughly reinforcing corporate governance and compliance Sharing high ethical standards with business partners
Prepare for a new future with the power of technology	The NTT Group will be promoting Work-in-Life (health management) by adopting a diversity-rich management style based on remote work that will enabling employees to work close to home. More specifically, employees residing further out but working at headquarters, and the organization itself (including headquarters and back-office functions) will be decentralized and spread among various regions to create hubs that serve to revitalize those regions, while regional decentralization will also contribute to BCP operations by ensuring functionality in the event of disasters. Office environments will also be re-examined to enhance space for idea creation and co-creation.	**¥600 billion: revenues from B2B2X business (FY2023)** **Increased from the previous fiscal year: numbers of patent applications** As a leader in digital transformation, we will act and contribute to helping resolve social issues unique to each country—like the aging population and declining birthrate, proper education, equitable healthcare, and regional economic development in Japan—to generate new value that will extend to future generations.	Promoting the B2B2X Model Protection and Respect for Intellectual Property Contribution to the Revitalization of Local Communities and Economies
Moving towards a safe, secure, and resilient society	To achieve the transformation to a New Management Style outlined in the medium-term management strategy revised in October 2021, the NTT Group is implementing security measures (introduction of zero-trust system and systemization of information security) capable of facilitating the shift to remote work styles. As a member of the global community building working to build a digital society, the NTT Group will contribute to solving social issues through our security business. As we progress through the era of Zero Trust and Net Zero Trust, the NTT Group will continue to investigate the value of security as we work to prevent and limit cyber risks.	**Zero cases: major accidents** **99.99%: stable service provision rate** **Zero cases: service suspensions due to cyber attacks** **Zero cases: major personal data leaks** As a company underpinning the vital infrastructure of a digitalized society, we will make full use of technology to keep people safe and secure from epidemics, natural disasters, digital disasters like cyber-attacks, and achieve a more resilient society.	Ensuring the stability and reliability of services Strengthening information security and personal information protection Contribution to the revitalization of local communities and economies

Feature 2: Transformation to a New Management Style

New style premised on remote work

These days there has been a growing need for increased spread and uptake of digital services (including deliveries and video streaming) as part of individual lifestyles. Companies have also had to face sudden changes in working styles toward remote work, and there is greater need for online access and digitalization of social infrastructure. As COVID-19 is now part of our lives, the time has come when society will be utilizing remote and online access technologies.

Under the approach of "Transformation to a New Management Style," the NTT Group set a range of targets with the aim of transforming to a new style based on remote work.

1. Promotion of Work in Life (Health management)
2. Contribution to a decentralized society (facilitate regional economic development)
3. Improve social resilience
4. DX transformation

The management style was a typical one based on office work—where employees commute to offices or job transfers—with regular working hours and personnel allocated by the company.

Looking ahead, the NTT Group will be working towards a diversity-rich management style based on remote work. This will allow employees to choose where they work and reside, freeing them from the pressures of job transfers or working away from their family, give them the option to choose their own working time away from regular working hours, and let them choose their own career path without the constraints of a seniority-based system.

The system of governance we are using will also be re-examined to take into consideration the implementation of zero trust systems and systemization of IT security that is appropriate for remote work, enhanced resilience against epidemics, natural disasters and cyber-terrorism, and conduct risks. Various systems will also be revised for promoting DX transformation, together with reforms to business operations and development of the right environments so that the office is enhanced as a space for creation and co-creation.

We will also contribute to DX to society as a whole, by expanding customer reach with digital marketing as well as providing customers with platforms harnessing our own DX. These initiatives will be used to promote Work in Life (health management) and achieve work processes that are more open, global, and innovative. The NTT Group will continue to take this approach as its core concept of "Improving prosperity for all people and cultures," and strive to enhance CX.
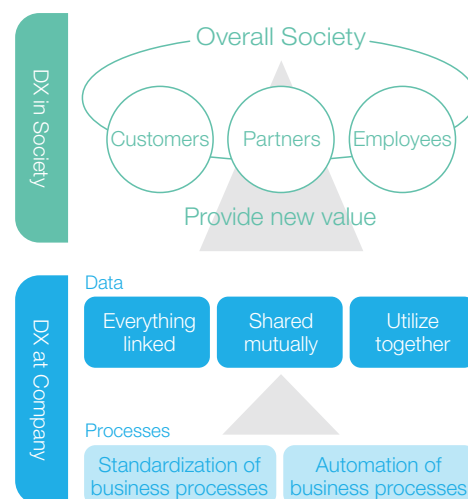
Transformation to a New Management Style

1 Promotion of Work in Life

2 Contribution to a decentralized society (facilitate regional economic development)

3 Improve social resilience

4 DX transformation

Achieve Work from Any where

Office

Home

Any Person, At Any Time, Can Make Any Place a Workplace

Workcation

Destination

Sattelite Office

Shift to new work styles premised on remote work

(1) General Improvements
(2) Promotion of DX
Promote Remote Work
(3) Re-Examination of Systems

Promote work-in-life (health management)
Open, global and innovative business management

Overview of DX Transformation

DX in Society

Overall Society

Customers | Partners | Employees

Provide new value

DX at Company

Data

Everything linked | Shared mutually | Utilize together

Processes

Standardization of business processes | Automation of business processes

Promote work-in-life (health management)
Open, global, and innovative business management

Promotion of Work in Life

As work styles change, it is necessary to review work processes in order to accommodate diverse ways of working. Allowing diverse work styles leads to greater opportunities to employ people of diverse backgrounds, while improving their motivation to work and ease of working. This results in better employee engagement and sparks innovation. The NTT Group engages in a variety of initiatives to promote diverse work styles. In particular, we are changing work styles while focusing on better treatment and environments for mainly remote work. When changing work styles, it is important to ensure openness, globalization and innovative work management from a business perspective. From the standpoint of employees, we believe the first step is to promote healthy workstyle-in-daily life and their well-being.

Promotion of DX

The NTT Group will be reforming various systems with the aim of promoting DX to create an IT environment where anyone is able to work in any location, at any time. In addition to the introduction of a cloud-based system, we will digitize processes to facilitate automation and standardization while expanding sales approaches by applying digital marketing to implement these initiatives. Some 100 automat- ed processes will be rolled out under ten DX initiatives with the aim of increasing productivity of service provision operations 1.7-fold (in FY2025), to achieve cost reductions of more than ¥200.0 billion in fiscal 2023 (aggregate total of more than ¥1.0 trillion in cost reductions from FY2017).

Achieving a decentralized society

The NTT Group will be promoting Work-in-Life (health management) by adopting a diversity-rich management style based on remote work that will enabling employees to work close to home.

More specifically, employees residing further out but working at headquarters, and the organization itself (including headquarters and back-office functions) will be decentralized and spread among various regions to create hubs that serve to revitalize those regions, while regional decentralization will also contribute to BCP operations by ensuring functionality in the event of disasters. Office environments will also be re-examined to enhance space for idea creation and co-creation.

Improve social resilience

To achieve the transformation to a New Management Style outlined in the medium-term management strategy revised in October 2021, the NTT Group is implementing security measures (introduction of zero-trust system and systemization of information security) capable of facilitating the shift to remote work styles. As a member of the global community building working to build a digital society, the NTT Group will contribute to solving social issues through our security business. As we progress through the era of Zero Trust and Next Zero Trust, the NTT Group will continue to investigate the value of security as we confront never-ending cyber risks.
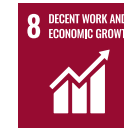
Social Challenge

4

Establish shared ethical standards

Business Activity

12. Establishing and thoroughly complying with ethical standards
13. Appropriately managing conduct risk
14. Thoroughly reinforcing corporate governance and compliance
15. Sharing high ethical standards with business partners

Why it matters

As maintaining high ethical standards with society and sharing those high ethical standards with business partners is an essential part of resolving social issues and ensuring sound corporate activities, a range of initiatives will be implemented for establishing and sharing such ethical standards.

What can be accomplished

We set high ethical standards for ourselves and share them with our business partners.

Future vision

The NTT Group is committed to contributing to the development of society by acknowledging diverse cultures, and thus we will contribute to solving social issues by connecting people, goods, and cultures, including communities, nations, and society, while promoting high ethical standards, diversity, and inclusion in fair and equitable ways, and work towards creating a better workplace through powerful and new digital technologies.

Business Activity 12–13

Establishing and thoroughly complying with ethical standards / appropriately managing conduct risk

Our commitment

We set high ethical standards for ourselves and share them with our business partners

Our objectives

100%

Participant rate of training of corporate ethics policy

0

Cases of legal actions for anti-competitive behavior, bribery
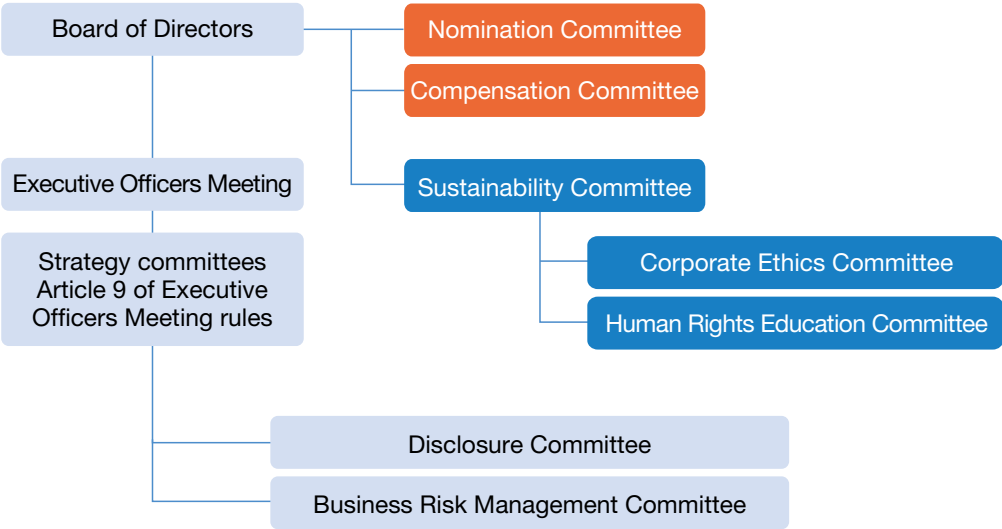
Policies and Concepts

It is imperative to conduct business in compliance with laws and regulations in the jurisdictions where we operate, and maintain high ethical standards in order to promote sound corporate activities. Recognizing this, NTT established the "NTT Group Corporate Ethics Policy."

These standards, which apply to all officers and employees of the NTT Group, lay out the basic principles of corporate ethics and provide specific guidelines for ethical behavior. These stipulations are intended to remind everyone of their duty as members of a corporate group that bears significant responsibility to society in terms of preventing dishonesty, misconduct, and the disclosure of corporate secrets, as well as refraining from exchanging excessive favors with customers and suppliers, and ensuring that they conduct themselves according to the highest ethical standards in both private and public activities.

Organization for Implementation

NTT has a Corporate Ethics Committee with a senior executive vice president as chair. The committee meets twice a year with the aim of thoroughly promoting the NTT Group's corporate ethics and maintaining discipline. It reports to the Board of Directors twice a year, particularly concerning the status of reports made to the Corporate Ethics Help Line, and the Board of Directors discusses reported matters when necessary.

The NTT Group has Corporate Ethics Committees and corporate ethics of officers at Group companies. We foster a corporate climate of observing laws and corporate ethics, investigate wrongful acts and scandals based on our Corporate Ethics Help Line operational rules, hold regular meetings for the compliance officers of Group companies, and work across the Group to promote compliance.

Board of Directors — Nomination Committee — Compensation Committee — Sustainability Committee — Corporate Ethics Committee — Human Rights Education Committee; Executive Officers Meeting; Strategy committees Article 9 of Executive Officers Meeting rules — Disclosure Committee — Business Risk Management Committee

NTT Group Corporate Ethics Policy

1. Recognizing the establishment of corporate ethics as one of its most important missions, top management shall exert its leadership to ensure that the spirit of these Standards is adopted throughout the Company, and shall assume full responsibility for solving any problems when any event inconsistent with that spirit occurs.

2. Every person with subordinate employees shall not only act in a self-disciplined manner, but shall also always provide guidance and assistance to his/her subordinate staff to ensure that their conduct is in conformity with our corporate ethics.

3. Every officer and employee of the NTT Group shall not only comply with all laws and regulations, social standards, and internal company rules whether in Japan or overseas, but officers and employees shall also hold the highest ethical philosophy within himself/herself both in public and in any private situations. Among other things, each officer and employee, as an officer or employee of a member of a Global Information Sharing Corporate Group, shall keep himself/herself fully aware that any disclosure of customer or other internal privileged information constitutes a materially wrongful act. Also, as a member of a group of companies which holds great social responsibilities, he/she shall strictly refrain from giving or receiving from customers, business partners, and other interested parties excessive gratuities. Furthermore, when interacting with public officials and politicians, officers and employees shall not commit bribery or commit any other acts that cause the other party to violate the National Public Service Ethics Act/Code of Ethics and the Ministerial Code, or that cause suspicion that such a violation has occurred.

4. Each NTT Group company, at the first opportunity, shall take initiatives to provide training programs in order to help its officers and employees enhance their awareness of our corporate ethics.

5. Every officer and employee of the NTT Group shall direct his/her efforts to prevent wrongful or scandalous acts which may potentially occur as specialization and advancement of our business proceeds. Each NTT Group company shall improve its system to prevent such acts, including, for instance, the re-assignment of contract representatives who have remained with the same customers for a long period of time, and the improvement of monitoring tools to protect customer and other information.

6. Any officer or employee who may come to know of the occurrence of any wrongful act or any scandal shall promptly report the wrongful act or scandal to his/her superior or other appropriate persons. If he/she is not able to make such a reporting, he/she may contact the Corporate Ethics Help Line (External Contact Point). It should be noted that every officer and employee who reports the occurrence of any wrongful act or scandal shall be protected so that the reporting party shall not suffer any negative consequences due to such reporting.

7. In the event of an occurrence of any wrongful act or scandal, each NTT Group company shall be committed to the settlement of the problem by taking appropriate steps through a speedy and accurate fact finding process, and responding in a timely, suitable, and transparent manner in order to fulfill its social accountability.

Main Initiatives

Prevention of Bribery

The NTT Group Corporate Ethics Policy mandates compliance with all laws and regulations, social standards, and internal company rules whether in Japan or overseas. With regard to the prevention of bribery, we have an Anti-Bribery Handbook containing important matters to be understood and complied with by our employees. The contents of this handbook are made known to all employees in Japan and overseas through emails and other means. In addition, NTT, NTT East, and NTT West stipulate that taking bribes is forbidden under the Act on Nippon Telegraph and Telephone Corporation, etc. (hereafter "the NTT ACT") and that breaches are punishable by law. Following the Act on Prevention of Un- just Acts by Organized Crime Groups, contributions and other types of support are only given to charitable organizations deemed suitable by the NTT Group. We have a zero tolerance approach to corruption. In fiscal 2020 no illegal conduct associated with bribery or contribution/support was confirmed within the NTT Group.

Political Contributions

As a holding company, and in compliance with Japan's Political Funds Control Law, NTT does not make political contributions, while a few Group companies make political contributions at their own discretion and in accordance with the relevant laws and regulations as well as the companies' respective codes of corporate ethics.

Compliance with Anti-Monopoly Laws

The NTT Group has adhered to the Anti-Monopoly Act to ensure its business activities align with a fair and competitive business environment. These initiatives have been effective, as evidenced by the fact that continuing from the previous fiscal year, we were not fined for violation of anti-monopoly regulations in fiscal 2021.

Request to Business Partners for Compliance and Risk Assessment

With the increased globalization and complexity of supply chains in recent years, responding appropriately to global issues, such as disasters/pandemics, environment, human rights, and security, has become an important issue. In light of this, we formulated the NTT Group Supply Chain Sustainability Promotion Guidelines in 2022 that contain detailed requirement items in the seven areas of human rights/labor, health/safety, the environment, fair trade/ethics, quality/safety, information security, and business continuity plans to guide our efforts as we work together with suppliers to create and maintain a safe and secure supply chain and achieve a sustainable society. The guidelines also clearly and directly lay out the responsibility for suppliers to communicate the guideline details with their upstream suppliers and encourage them to comply and verify their compliance status. In addition, we have also published the NTT Group Green Procurement Standards as a supplement to our environmental guidelines and are requesting that continued efforts be made to reduce greenhouse gas emissions throughout the supply chain. We have published these Guidelines in Japanese and English as a way of communicating to a broad range of the NTT Group's suppliers both in Japan and overseas, and we have incorporated them into supplier contracts to ensure compliance. For our key suppliers in particular, we are conducting surveys on the status of sustainable procurement.

We checked activities concerning compliance in general, including their response to preventing corruption, illegal political contributions and antisocial forces, and also requested further improvements where necessary.

Value Chain Management

Policies and Concepts

In recent years, companies find themselves required to monitor the ESG risks and impact on sustainability, including consideration of human rights and mitigation of environmental impacts, of not only their own group companies but also throughout the entire value chain, from raw materials and supplies procurement to disposal and recycling. Also, we are seeking to expand the B2B2X model and global businesses under the medium-term management strategy "Your Value Partner 2025" that we established in 2018. We expect our value chain to expand further globally, requiring us to enhance our value chain management initiatives.

The NTT Group's value chain management focuses on requiring suppliers to adhere to the various guidelines under the "Procurement Policies" established by NTT. For this reason, it is important for us to build partnerships of trust with all of our suppliers. In light of this, we formulated the NTT Group Supply Chain Sustainability Promotion Guidelines in 2022 to create and maintain a safe and secure supply chain and achieve a sustainable society together with our suppliers. In addition, we have also published the NTT Group Green Procurement Standards as a supplement to our environmental guidelines, and are requesting that efforts be made to reduce greenhouse gas emissions throughout the supply chain.

Organization for Implementation

NTT's Technology Planning Department has formulated the NTT Group Supply Chain Sustainability Promotion Guidelines as a guide for promoting sustainability in the supply chain throughout the Group. In coordination with procurement divisions at each NTT Group company, we ensure that a supplier's compliance with key items within the guidelines is a basic condition of procurement and we regularly check that this condition is being met and follow-up with suppliers.

NTT Group Supply Chain Sustainability Promotion Guidelines

A number of supply chain issues have recently come to light, including serious human rights violations such as forced labor and child labor, unlawful disposal of waste, response to stricter regulations on controlling chemical substances, bribery, and other examples of malpractice.

In light of this, we formulated the NTT Group Supply Chain Sustainability Promotion Guidelines in 2022 that contain detailed requirements for suppliers in the seven areas of human rights/labor, health/safety, the environment, fair trade/ethics, quality/safety, and information security to guide our efforts as we work together with suppliers in order to conduct procurement activities in a socially responsible manner.

We have published these Guidelines in Japanese and English as a way of communicating to a broad range of the NTT Group's suppliers both in Japan and overseas, and we have incorporated them into supplier contracts to ensure compliance.

Procurement
https://group.ntt/en/procurement/

NTT Group Supply Chain Sustainability Promotion Guidelines
https://group.ntt/en/procurement/supplier/pdf/NTT_Group_Guidelines_for_Sustainability_in_Supply_Chain.pdf

NTT Group Basic Procurement Policy

The NTT Group has created the "NTT Group Global Sustainability Charter" and is promoting initiatives aimed at achieving a "sustainable society" with both "Growth as a company" and "resolving social issues." With modern supply chains, advances in globalization mean there is a greater importance for dealing appropriately with issues such as human rights, ethics, the environment, disasters and pandemics, and security. To address issues like these, the NTT Group aims to take an independent and proactive stance in achieving a sustainable society, by enhancing mutual understanding and building relationships of trust with all suppliers that make up the supply chain, and working together with high ethical standards to develop and maintain a safe and secure supply chain that provides a range of assurances like the protection of human rights and conservation of the global environment.

To achieve this, we will conduct procurement in accordance with the following "NTT Group Basic Procurement Policy."

1. NTT will strive to provide competitive opportunities with fairness to both domestic and foreign suppliers, and to build mutual trust and understanding.
2. NTT will conduct economically rational procurement of competitive goods and services that meet its business needs, deciding on suppliers based on quality, price, delivery times, and stable supply in a comprehensive manner.
3. NTT will conduct procurement in a manner that follows laws and regulations as well as social norms, and takes the environment, human rights, and other issues into account to contribute to society.

Request to Business Partners for Compliance and Risk Assessment

The NTT Group Supply Chain Sustainability Promotion Guidelines, the operational guidelines we issue to our suppliers, clearly outlines fair trade practices and business ethics (seven articles). With respect to critical suppliers, we conducted a survey on the status of sustainability procurement. We checked activities concerning compliance in general, including their response to preventing corruption, illegal political contributions and antisocial forces, and also requested further improvements where necessary.

ESG Education for Procurement Department Staff

The NTT Group implements training on ESG for staff in procurement departments to reduce the burden of procurement activities on the environment and ensure they persistently comply with the laws, regulations, and norms of society.

VA Proposal System and Supplier Awards System

NTT East and NTT West engage in VA (Value Analysis) activities in which we invite our suppliers to submit proposals for enhancing quality, safety and workability, and for contributing to environmental protection, and then we incorporate their ideas in product specifications. We award suppliers that offer particularly outstanding proposals. In addition, we participate in improvement presentations held by suppliers and work with them to make improvements based on dialogue and cooperation.

Since fiscal 2006, we consolidated contact points for a simpler proposal system and established an environment for further developing improvement activities, including adding a new scheme for VE (Value Engineering) & VA proposals from telecommunications construction companies and suppliers. We will remain active on improving our products and services.

Assessment of Social and Environmental Risks

We assess social and environmental risks by conducting the Supply Chain Sustainability Survey using the Supply Chain Sustainability Promotion Check Sheet to confirm the status of compliance with various guidelines and technical requirements. The survey targets all of the NTT Group's critical suppliers that account for at least 90% of total procurement value, supplier of non-substitutable products and supplier of important products. The survey includes 161 items covering the seven areas of human rights and labor, health and safety, the environment, fair trade and ethics, quality and safety, information security, and social contributions. For example, in the area of human rights, we also conduct monitoring of child labor and forced labor as well as compliance with the freedom of association and collective bargaining rights. We assess the responses from suppliers, and designate those with a certain percentage of low-rated responses, or those with a low rating for specific items, as high sustainability risk suppliers. We visit these designated suppliers to perform additional checks, and when corrective action is necessary, we have them prepare an improvement plan and monitor its implementation. While the survey covers critical suppliers, we seek to assess risks that exist further upstream by also including items that check whether the supplier is making efforts to educate secondary suppliers about social responsibility. The goal of the survey is to request and receive responses from all critical suppliers.

Check points for the Supply Chain Sustainability Survey (161 items)

(1) Sustainability promotion in general (4 items)
(2) Human rights and labor (33 items)
(3) Safety and hygiene (25 items)
(4) Environment (25 items)
(5) Fair trade and ethics (27 items)
(6) Quality and safety (10 items)
(7) Information security (15 items)
(8) Business continuity plan (6 items)
(9) Others (Conflict Minerals, Code of Conduct, Due Diligence, Complaint Processing Mechanism, etc.) (16 items)

Requests to Suppliers on Environmental and Social Concerns

We have established the following guidelines as requirements under the NTT Group Supply Chain Sustainability Promotion Guidelines and seek compliance from suppliers. We also ask all suppliers that participate in procurement, whether they are a new supplier or not, to comply with our Notes Regarding Participation in the Procurement Process, including not having any past involvement with organized crime groups or demonstration of improper conduct related to procurement. We revised the NTT Group Guidelines for Green Procurement in April 2021, and added environmental-related requirements that suppliers should comply with. As part of environmental activities announced by the NTT Group such as the Environment and Energy Vision, this revision includes a declaration of environmentally friendly procurement (green procurement), and stipulates that all suppliers are requested to cooperate with the NTT Group's environmental activities aimed at conservation of the global environment. In the past these guidelines applied to products procured by the NTT Group, however following this revision, these guidelines have been expanded to apply to products and services sourced by the NTT Group. It also specifies the requirements of initiatives for suppliers for reducing their environmental impact, such as reducing greenhouse gas emissions, their commitment to resource recycling, and the conservation of biodiversity. The NTT Group will continue to implement initiatives for reducing its environmental impact throughout the entire supply chain. The "NTT Group Guidelines for Green Procurement" has also been renamed to the "NTT Group Green Procurement Standards" that covers environmental-related details in the "NTT Group Supply Chain Sustainability Promotion Guidelines" established in February 2022.

Conducting Risk Assessment for the Supply Chain

We are assessing risks from a range of perspectives as part of sustainability-related initiatives taken toward each of our suppliers. To assess risks, we perform supplier engagement activities that involve direct dialogue with each of our suppliers, in line with results obtained from the "Supply Chain Sustainability Survey," conducted to confirm the status of suppliers' compliance with various guidelines. We will continue to scrutinize the survey method, survey content, and analysis method and use the findings of these questionnaires to provide feedback and continue discussions with suppliers in order to reduce risks across the value chain of the NTT Group.

Communicating with Suppliers

The NTT Group strives to build better partnerships with each of its suppliers by mutually exchanging views and proposals through various modes of communication.

In July 2018, we started introducing a system that enables faster assessment of damage to suppliers following a major earthquake or other disaster. By exchanging information more quickly and accurately, we will continue to work with suppliers on the prompt restoration of telecommunications equipment. The NTT Group companies also engage in various forms of communication with their suppliers. Specifically, these companies inform their suppliers of their business environment and exchange views on how they can continually work together to provide a stable supply of high quality, competitive products.

NTT Group Basic Procurement Policy	Basic procurement activity policy to achieve a sustainable society
NTT Group Supply Chain Sustainability Promotion Guidelines	Requests to suppliers, based on the Basic Procurement Policy, regarding social issues
NTT Group Green Procurement Standards	NTT's latest environmental policies, target figures, specific laws and standards suppliers must reference, procurement evaluation items, etc.
Technical Requirements	Specific technical requirements, including the reduction of environmental loads, for procuring products that pay due consideration to quality, safety, the environment and other aspects

Initiatives to Promote Awareness of the NTT Group Corporate Ethics Policy

At NTT, top management demonstrates that compliance requires the NTT Group to comply with laws and conduct business with everyone having strong ethics. Also, the presidents of each NTT Group company have declared their commitment to identify risks related toillegal or illicit activities and never tolerate any form of impropriety. To ensure the effectiveness of the NTT Group Corporate Ethics Policy, we offer training sessions on corporate ethics to employees and, through a website for employees, we explain the declaration in detail and give examples of corporate ethics issues. Employees are reminded of the importance of ethics in June and December each year in an effort to raise their level of understanding. Furthermore, NTT conducts annual surveys of employees to measure their awareness, and the results are then used for awareness enhancement initiatives.

Corporate Ethics and Compliance Training

Corporate ethics training is conducted as part of continuous educational activities for all officers and employees. This training is tailored to meet the specific compliance and corruption risks of each company throughout the NTT Group. Furthermore, training for officers is also conducted every year.

Anti-Bribery Handbook

The Anti-Bribery Handbook is a revised version of the one we produced in 2015 mainly for the purpose of deepening understanding of regulations concerning the bribing of foreign public officials. In 2021 it came to light that senior NTT Group executives had dined out with persons connected to Japanese ministries and agencies, and reflecting on these incidents, we enhanced the contents and altered the format such as increasing the number of explanations using case studies.

Competition Law Handbook

The NTT Group created a Competition Law Handbook Sustainability Report 2021 in fiscal 2019 as a tool for ensuring compliance with competition law among employees and it has been made known to all employees at NTT Group companies inside and outside of Japan. The handbook contains the basics regarding compliance with competition law within a Q&A format, as well as specific examples that might be found within the Company's business activities, in order to instill correct knowledge and understanding of competition law compliance in employees.

Check System for Penetration of Corporate Ethics

NTT conducts an annual survey that includes NTT Group companies in order to ascertain the extent to which employees are aware of compliance. At each NTT Group company, monitoring is performed under four different functions, comprising the departments in charge of business operations, compliance and internal auditing, as well as the Audit and Supervisory Board members, to ensure neutral and multifaceted checks are being performed.

NTT checks the status of compliance audit implementation at NTT Group companies with an internal auditing department and directly confirms the status of compliance initiatives inside NTT and at NTT Group companies without an internal auditing department.

Establishment of Corporate Ethics Help Line Contact Point

To prevent illegal conduct or a scandal, each Group company has set up an internal consulting center to handle reports of improper activities. In addition, NTT has established the Corporate Ethics Help Line as an external contact point for NTT Group companies and outsources its operation to a law firm. The help line also handles consultations and reports related to human rights issues. The NTT Group Corporate Ethical Standards clearly state that people who file reports with these help lines will be protected from any disadvantage arising from the fact that they filed a report. The content of the consultations and reports are investigated and handled by the staff member in charge, and a report is submitted to the Corporate Ethics Committee of each Group company. All reports are collected at least once a year by NTT, where the response status is ascertained and reported to the Board of Directors.

In addition, since the contact point is independent from management, there is an independent reporting route to Audit & Supervisory Board members. Reports made through our Corporate Ethics Help Line (external contact point) are in principle sent directly to Audit & Supervisory Board members at the same time; reporting only to Audit & Supervisory Board members is also possible.
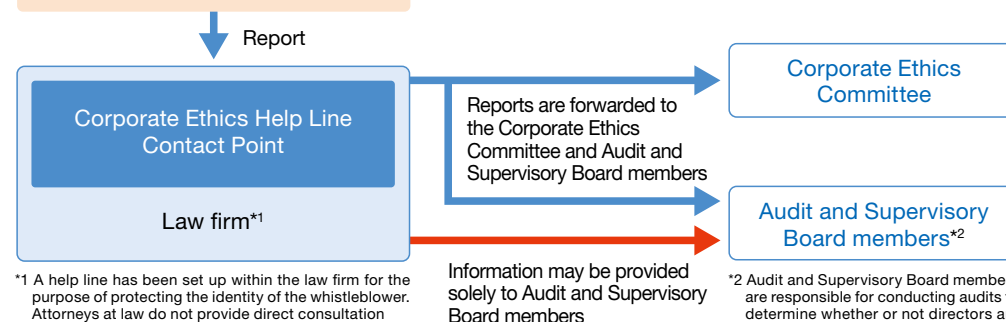
> Corporate ethics helplines
> https://group.ntt/en/csr/governance/compliance.html

Number of Reports Received by the Corporate Ethics Help Line (External Contact Point)

We monitor the number of reports received by the Corporate Ethics Help Line, and publish this number in our Sustainability Report and on the NTT Group's Sustainability website. The Whistleblowing Mechanism Guidelines, revised in December 2016 by the Consumer Affairs Agency, recommend that neutral and fair third-party assessments be carried out. We had such an assessment carried out in May 2017 and received the comment that overall, a whistleblowing mechanism is in place and is being administered appropriately.

> Reports to the corporate ethics help line by type of violation
> https://group.ntt/en/csr/governance/compliance.html

Details of assessment

○ Investigation of the mechanism and operational status of the help line in order to verify its effectiveness in terms of utilization and reliability.
○ Sample survey on the establishment of regulations and responses to whistleblowers, etc.
○ Confirmation of compliance with the Whistleblowing Mechanism Guidelines.
○ Interviews with administrators and discussion about operational issues

Disciplinary Actions against Confirmed Violations

A compliance violation or breach of the NTT Group Corporate Ethical Standards is dealt with using the disciplinary measures taken in accordance with the disciplinary code established at each Group company. This includes pay cuts and work suspension, and may also be reflected in assessments (evaluations) and personnel transfers.

Employees of NTT Group companies and their families, former employees, and staff of companies with which we do business etc.

Report

Corporate Ethics Help Line Contact Point

Law firm*1

Reports are forwarded to the Corporate Ethics Committee and Audit and Supervisory Board members

Information may be provided solely to Audit and Supervisory Board members

Corporate Ethics Committee

Audit and Supervisory Board members*2

*1 A help line has been set up within the law firm for the purpose of protecting the identity of the whistleblower. Attorneys at law do not provide direct consultation

*2 Audit and Supervisory Board members are responsible for conducting audits to determine whether or not directors are executing their duties in accordance with the Articles of Incorporation and relevant laws and regulations.

Business Risk Management

The NTT Group faces a rapidly changing business environment, including intensified competition in the information and telecommunications sector. In this context, NTT Group companies are exposed to an increasing amount of business risk. The NTT Group strives to minimize the impact of losses that could result from the materialization of risk by anticipating and preventing the occurrence of potential risks. As part of these efforts, NTT has formulated the NTT Group Business Risk Management Manual and has distributed it to all Group companies so that the entire Group can work together to conduct risk management. This manual contains policies for addressing various forms of risk facing the NTT Group's business operations and approaches to coordination among NTT Group companies.

In addition, each Group company has formulated its own manuals and other guidelines, which reflect its specific business operations, business environment, and other factors, and is using these materials to control business risks.

Organization for Implementation

At NTT, Risk Management Regulations are in place, which define fundamental policies concerning in-house risk management for effective and efficient business operations. Risk management is carried out based on a continuous PDCA cycle under the leadership of the Business Risk Management Committee, chaired by the representative director and senior executive vice president, and comprised of heads of departments and offices as committee members. At the NTT Group, the representative director and senior executive vice president of NTT is assigned ultimate responsibility for risk management, while each executive officer serves as the risk officer for the business area they are placed in charge of.

Identifying Material Risks

From time to time, NTT reviews assumed risks and management policies based on changes in the social environment.

In the identification of Companywide risks, the Business Risk Management Committee leads analysis processes for the risks faced by the NTT Group are formulated and periodically implements risk analyses in accordance with these processes. In addition, after a correlation analyses on these risks, it specifies those risks with the potential to have the greatest impact as material risks, and we decide on countermeasures.

Matters pertaining to risk management are discussed at meetings of the Business Risk Management Committee. As part of risk monitoring, each department in charge reports on the status of monitoring and risk mitigation effects to the Business Risk Management Committee, while the Internal Audit Department conducts individual audits on the status of initiatives to address material risks and reports results to the Board of Directors in the subsequent fiscal year.

Among other things, risks are also identified by focusing on the perspective of conduct risk—where customers and other stakeholders suffer negative consequences as a result of actions taken by the NTT Group—by ensuring better planning and implementation of appropriate measures.
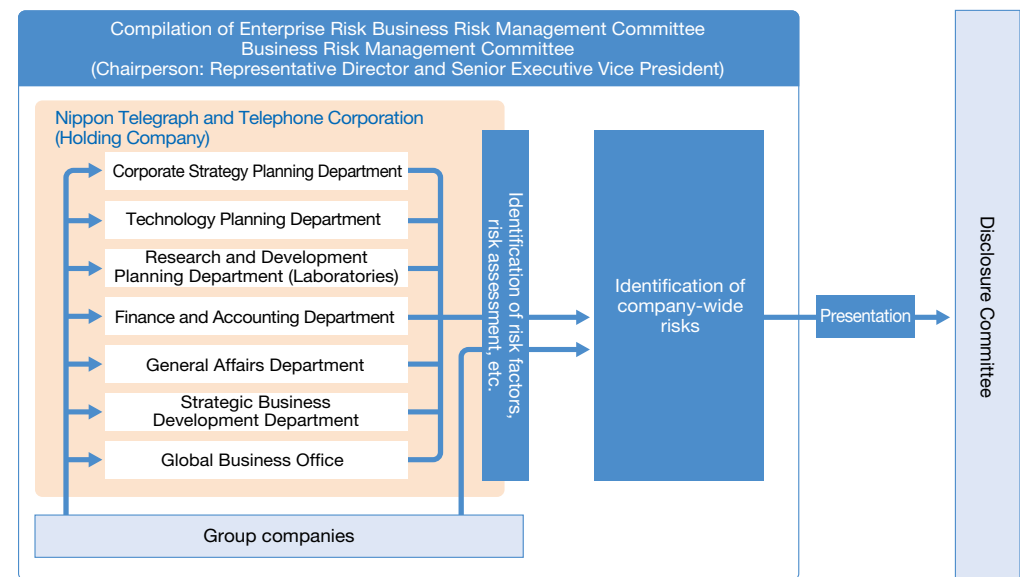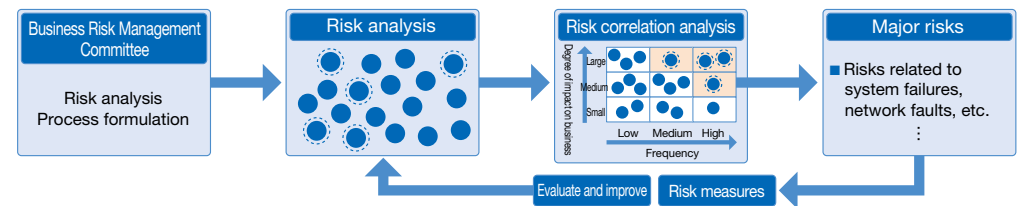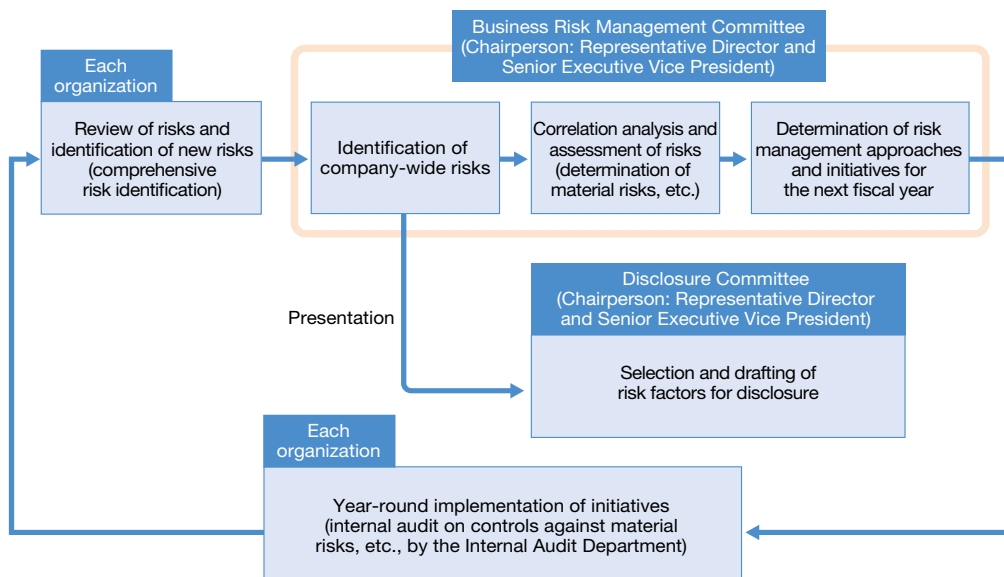
Business Activity 14

Thoroughly reinforcing corporate governance and compliance

Our commitment

We set high ethical standards for ourselves and share them with our business partners

Our objective

0

Cases of legal actions for anti-competitive behavior, bribery

Basic Policy

We believe that strengthening the system of corporate governance in accordance with the purposes of each principle of the "Corporate Governance Code" of the Tokyo Stock Exchange is an important management issue for maximizing corporate value while meeting the expectations of various stakeholders, including shareholders and other investors, as well as customers, business partners, and employees. Therefore, we are working to strengthen corporate governance based on our fundamental policies of ensuring sound management, executing appropriate decision-making and business activities, clarifying accountability, and maintaining thorough compliance.

NTT is implementing all the principles of the Corporate Governance Code it revised in June 2021
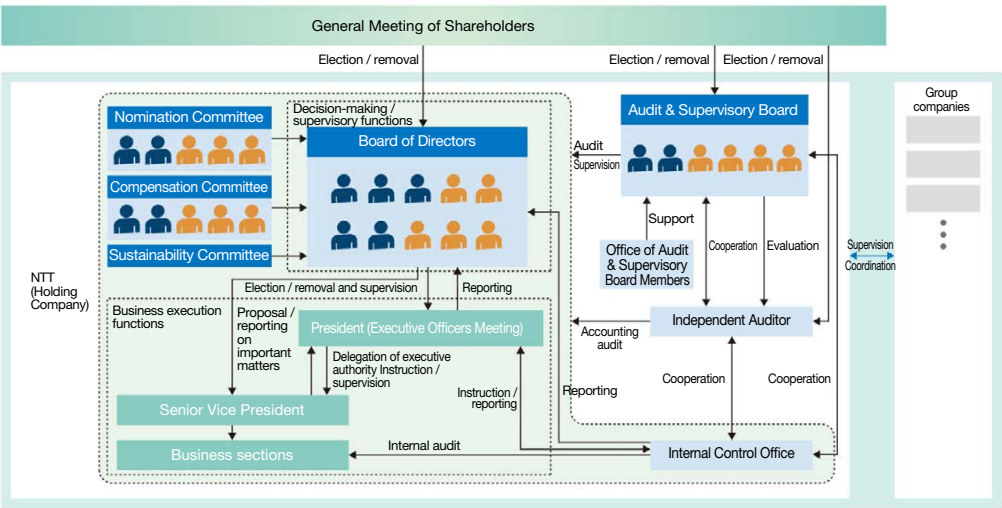
Overview of Corporate Governance Structure

NTT believes that an auditing system based on Audit & Supervisory Board Members, including outside independent Audit & Supervisory Board Members, is an effective means of supervising management. Accordingly, we have adopted the model of being a company with a Board of Company Auditors (Audit & Supervisory Board). In addition, through the election of outside independent Members of the Board, NTT has strengthened the function of appropriately supervising business execution. Furthermore, through its adoption of an executive officer system, NTT intends to clearly separate management-related decision-making and supervisory functions from business execution functions and improve its management flexibility.

Additionally, NTT has voluntarily established a "Nomination Committee" and a "Compensation Committee," each of which consists of five Members of the Board, including three outside independent Members of the Board, to further increase the objectivity and transparency of decisions relating to appointment and compensation. NTT has determined that governance functions based on a Board of Corporate Auditors (Audit & Supervisory Board) are sufficiently effective to achieve this purpose.

Board Member Compensation Determination Policy and Process

Regarding the composition and level of compensation for Members of the Board of NTT under the Determination Policy, in order to secure objectivity and transparency, NTT es-

tablished the Compensation Committee, comprising five Members of the Board, including three Independent Outside Members of the Board. Moreover, decisions on the ratios and calculation methods for compensation for Members of the Board, and amounts of compensation for individual Members, are delegated from the Board of Directors to the Compensation Committee. The reason for delegating these authorities to the Compensation Committee is that such committee is composed of two Representative Members of the Board and three Outside Members of the Board, and we believe that it is able to make the appropriate judgements from an outside perspective while also taking a bird's-eye view of the Company's overall performance.

Compensation of individual Members of the Board (excluding outside Members of the Board) consists of a monthly salary (base salary) and a bonus (compensation related to performance over the short term), NTT stock purchase through Board Members Shareholding Association and stock compensation (compensation related to performance over the medium to long term). The composition ratio of compensation in a case where standard business results are achieved is roughly as follows: Fixed compensation: Short-term performance-linked compensation: Medium- to long-term performance-linked compensation = 50%: 30%: 20%.

Governance Chart

Bonus Performance Indicators (FY2022)

Category	Performance Indicators	Weight	Evaluation method
Financial indicators	EPS	35%	Year-on-year improvement
	Consolidated Operating Income	35%	
	Overseas operating profit	10%	
	ROIC	5%	Achievement of targets
Sustainability indicators	Greenhouse Gas Emissions	5%	
	B2B2X earnings	5%	
	Ratio of women newly promoted to management positions	5%	

Clawbacks System

A performance-linked stock compensation system was adopted in fiscal 2021 for members of the board and officers of NTT and its major subsidiaries. A system has been established such that, in the event that an Eligible Member of the Board or Officer engages in significant illegal or inappropriate activity, or takes employment at another company in the same industry without the permission of the company, the system enables the revocation of rights to receive Company Shares under the Compensation System with respect to such person (malus clause) and the request for the return of funds corresponding to previously delivered Company Shares (clawback).

Committee name	Function
Board of Directors	The Board of Directors has ten Members of the Board including five outside independent Members of the Board, which brings the total percentage of outside Members of the Board to 50%. In addition, the introduction of an executive officer system that clearly separates the management decision-making and oversight functions from the business execution function ensures closer supervision of execution and enhanced management flexibility. In principle, the ordinary meetings of the Board of Directors are held once per month, and extraordinary meetings are held as needed. The Board of Directors discusses the group management strategies and makes decisions on matters stipulated by laws and regulations and on important matters related to company management and group management. Moreover, through such means as periodic reports from Members of the Board and Executive Officers on the status of business execution, the Board of Directors supervises the business execution of Members of the Board and Executive Officers. With the objective of further strengthening the independence, objectivity, and accountability in decisions with respect to appointments and compensation of officers and related matters made by the Board of Directors, the Company has voluntarily established a Nomination Committee and Compensation Committee, each consisting of five Members of the Board, of which a majority (three) are outside independent Members of the Board, as preliminary review institutions of the Board of Directors, thereby increasing the effectiveness of governance. Moreover, in recognition of the fact that response to sustainability issues is an important management challenge, the Company has voluntarily established a Sustainability Committee that reports directly to the Board of Directors. The committee will work to further promote initiatives after important issues and indicators have been decided by resolution of the Board of Directors.
Audit & Supervisory Board	The Audit & Supervisory Board comprises four outside independent Audit & Supervisory Board Members (including one female member), who have experience and knowledge in a range of fields—as a lawyer, university professor, and Certified Public Accountant—and two internal Audit & Supervisory Board Members (including one female member). NTT conducts effective audits by combining the independence of outside Audit & Supervisory Board Members with the superior information collection capabilities of internal Audit & Supervisory Board Members.
Nomination Committee / Compensation Committee	With the objective of further strengthening independence, objectivity, and accountability in decisions made by the Board of Directors with respect to appointments and compensation of the Members of the Board and officers, the Company has voluntarily established a Nomination Committee and a Compensation Committee, each consisting of five Members of the Board, of which a majority (three) are Independent Outside Members of the Board, as preliminary review institutions of the Board of Directors, thereby increasing the effectiveness of governance.
Executive Officers Meeting	Important corporate matters to be decided are, in principle and in advance, discussed at the Executive Officers Meeting, which is made up of senior vice presidents and others. The Executive Officers Meeting is held about once a week. To improve the transparency of management decision-making, one Audit & Supervisory Board member participates in the Executive Officers Meeting.
Various Committees	A number of committees have been established below the Executive Officers Meeting to discuss specific important business execution-related matters. Major committees include the Technology Strategy Committee, which deliberates on the Group's R&D vision and technology development strategy; the Investment Strategy Committee, which examines investment projects that are larger than a certain scale; and the Finance Strategy Committee, which discusses basic financial strategies and issues. These committees, which are held as necessary throughout the year, are in principle chaired by the president or a senior executive vice president and are attended by relevant senior vice presidents and other designated members.

A History of Strengthening Corporate Governance

Period	Theme	Year	Details
2022–	Strengthening of governance functions, diversification of members	2022	• Increase in number of Board Members: from 8 to 10 (5 from outside) • Increase in number of Audit & Supervisory Board Members from 5 to 6, by adding 1 full-time outside corporate auditor in order to strengthen the corporate auditor system • Increase the ratio of female directors, Audit & Supervisory Board Members, and executive officers to more than 30% • Reorganize the Internal Control Office into an Internal Audit Department under direct control of the President
2021–	Further strengthening of corporate governance	2021	• Transfer the Appointment and Compensation Committee into the separate Nomination Committee and Compensation Committee based on their applicable functions • Transfer the Sustainability Committee under the Executive Officers Meeting to a Committee reporting directly to the Board of Directors
2020–	Separation of the functions of managerial decision-making / supervision and business execution	2021	• Expanded ratio of performance-linked compensation: 30% ➡ 50% • Increased number of outside directors on Nomination Committee and Compensation Committee: 2 ➡ 3 • Transfer the existing Appointment and Compensation Committee into the separate Nomination Committee and Compensation Committee based on their application functions • Disclosed skill matrix for Members of the Board and Audit & Supervisory Board members
		2020	• Optimizing the size of the Board of Directors: 15 ➡ 8 Ratio of outside directors: 27% ➡ 50% • Adoption of executive officers system Separation of the functions of managerial decision-making / supervision and business execution • Disclosure of specific KPIs for officers' earnings-linked remuneration
2018–	Further reinforcement of oversight function by enhancing diversity, advancement of disclosure	2019	• Establishment of NTT, Inc. (strengthening of the governance of the global business), appointment of three foreign-national directors • Conducting of evaluation questionnaire on the effectiveness of the Board of Directors • Commencement of ESG information disclosure in notices of convocation
		2018	• Appointment of two female directors (one inside and one outside), a Company first • Increase in the number of outside Members of the Board: 2 ➡ 4 • Strengthening of the reflection of KPIs in performance-linked compensation • Expansion and improvement of statements regarding the compensation of directors, strategic shareholdings, succession plans, and evaluations of the effectiveness of the Board of Directors
2011–	Strengthening of information disclosure with an awareness of dialogue with stakeholders	2017	• Introduction of notices of convocation that are viewable via smartphones
		2015	• Response to Corporate Governance Code • Establishment of independence standards for independent Members of the Board and independent Audit & Supervisory Board Members • Commencement of issuance of sustainability reports • Commencement of disclosure of the notices of convocation before they are sent (henceforth, 42–45 days before the date of the convening of the Ordinary General Meeting of Shareholders, in Japanese and English on the same date)
		2011	• Appointment of first female corporate officer (1 outside Audit & Supervisory Board Member)
2006–	Strengthening of supervisory function and improvement of corporate governance transparency	2006	• Increase in number of outside Audit & Supervisory Board Members: 2 ➡ 3 • Appointment of financial expert as Audit & Supervisory Board Member • Commencement of disclosure of Corporate Governance Report
	Establishment of a foundation for corporate governance	2005	• Establishment of Disclosure Committee • Establishment of Nomination Committee and Compensation Committee • Commencement of issuance of CSR reports
		2003	• Increase in number of Audit & Supervisory Board Members: 4 members (2 inside members, 2 outside members) ➡ 5 members (3 inside members, 2 outside members)
		1985	• Appointment of multiple outside Members of the Board

Governance Reinforcement Policy

(1) The number of directors will be increased from the current 8 to 10 (the number of independent directors will be increased to 5 to make up a majority).
(2) To strengthen the corporate auditor structure, add one outside full-time corporate auditor and increase the number from five to six (four or more outside corporate auditors represent the majority).
(3) Implementing a policy to increase the ratio of female directors, corporate auditors and executive officers to at least 30%.
(4) The Internal Control Office was reorganized into the Internal Audit Department, an organization directly connected to the president.

We are anticipating outside directors to provide a wide range of management perspectives and expert opinions, and we internal and external directors are appointed by actively considering the promotion of diversity (Gender, race, or ethnicity (Ethnicity)). As a result, more than 30% of executives are women, and we are actively promoting diversity. In addition, Article 10 (Directors and Audit & Supervisory Board Members) of the Act on Nippon Telegraph and Telephone Corporation, etc., provides that "Any person who does not have Japanese nationality may not be appointed as a director or an auditor for the Company or the Regional Companies." and therefore nationality cannot be included in the policy. Accordingly, we cannot invite foreign directors under the NTT Act. However, eight foreign directors and three foreign directors of Data and Ltd are invited as directors of the intermediate holding company (global business).

Tax Policy

Basic Policy

All directors and employees of NTT Group have declared their commitment to complying with all laws and regulations (including their spirits), social standards, and internal company rules, whether in Japan or overseas, and acting in accordance with the highest ethical standards in both private and public activities. In tax-related operations, we also strive to maintain and enhance tax compliance by setting up guidelines and educating our employees.

Governance Structure

NTT has established a basic policy of internal control systems for NTT Group to deal with various risks including tax risks which has been approved by NTT's board. We define each company's roles in tax-related operations as shown below, to the left.

1. NTT
NTT establishes the basic policy and guidelines of tax-related operations and promotes appropriate measures in cooperation with its consolidated subsidiaries. NTT strives to gather information regarding regulations, notifies subsidiaries of any changes to regulations, and supervises subsidiaries.

2. NTT's Consolidated Subsidiaries
NTT's consolidated subsidiaries fulfill their tax duties including preparing and filing tax returns, making tax payments, and dealing with tax audits appropriately in accordance with the basic policy and guidelines. NTT's consolidated subsidiaries report information and submit relevant documents to NTT as necessary.

Optimizing Tax costs

NTT and its consolidated subsidiaries should strive to utilize appropriately and effectively the tax relief measures with a view to maximizing shareholder value of NTT Group. NTT and its consolidated subsidiaries shall not implement any measures which may be considered or interpreted as tax evasion by regulators.

Tax Risks

When undertaking international transactions, NTT and its consolidated subsidiaries should ensure such transactions are given due consideration in advance of execution. NTT and its consolidated subsidiaries should consult with tax advisors and seek advice as necessary. Furthermore, we have laid out the following measures regarding transfer pricing taxation and controlled foreign companies rules.

Transfer Pricing Taxation
- Prices that are applied to NTT Group's international transactions will be calculated in accordance with the laws and regulations of each country or region and the Transfer Pricing Guidelines published by the OECD and also in accordance with the "arm's length principle."
- In cases where the documentation of the price calculation method is obligatory, or where such documentation is necessary due to factors such as transaction size and potential taxation risks, we will generate the documents in an appropriate manner.

Controlled Foreign Companies Rules
- NTT and its consolidated subsidiaries shall not use a low-tax country for tax avoidance. When investing in a low-tax country for business reasons, we will make appropriate tax payments in accordance with the laws and regulations of the relevant country or region.

Relationship with Tax Authorities

NTT Group aims to maintain good relationships with tax authorities through communication with them. All explanations given to tax authorities should be based on facts. NTT and its consolidated subsidiaries should work with them in a sincere and appropriate manner. If tax authorities were to notify NTT and its consolidated subsidiaries of tax adjustments, NTT and its consolidated subsidiaries should determine the cause of such issue(s) immediately, and take appropriate measures to prevent similar recurrences, unless NTT and its consolidated subsidiaries file a petition of objection or tax lawsuit.

Revenues (FY2020)

Revenues (billions of yen)	Approx. 12,559.9	
	Japan Approx.	10,451.0
	U.S.A. Approx.	736.4
	Germany Approx.	220.4
	Others Approx.	1,152.0

Profit before Income Tax (FY2020)

Profit before Income Tax (billions of yen)	Approx. 1,695.2	
	Japan Approx.	1,651.0
	Overseas Approx.	44.2

Taxes Incurred (FY2020)

Taxes Incurred (billions of yen)	Approx. 487.3	
	Japan Approx.	452.9
	Overseas Approx.	34.4

Income Taxes Paid (FY2020)

Income Taxes Paid (billions of yen)	Approx. 455.7	
	Japan Approx.	441.4
	Overseas Approx.	14.3

The above amounts are based on "Country-by-Country Report" submitted to Japanese Tax Authorities, and not directly related to the Consolidated Financial Statements.

Business Activity 15

Sharing high ethical standards with business partners

Our commitment

We set high ethical standards for ourselves and share them with our business partners

Our objective

0

Cases of legal actions for anti-competitive behavior, bribery

Prevention of Bribery

Understanding that it is essential to comply with laws and regulations and to operate its business with high ethical standards, NTT Group prohibits all forms of corruption, including bribery, improper benefits and facilitation payments*1. In particular, with respect to the prevention of bribery, NTT Group has created a "Anti-Bribery Handbook" and distributed it to employees of Group companies, including its overseas subsidiaries, and has also posted the handbook on its internal website to ensure thorough awareness.

Furthermore, for NTT, NTT East, and NTT West, bribery is prohibited pursuant to the NTT Act, and any violations are subject to legal penalties.

Began holding "NTT Group Sustainability Conferences"

In order to share superior sustainability initiatives across the NTT Group, we have held the NTT Group Sustainability Conference for the entire Group every year since fiscal 2013. This initiative takes the form of a conference setting where operating companies present their achievements of various measures implemented in line with nine challenges and 30 activities based on three themes. The best measures are commended by the President as "superior sustainability measures" at the conference. The FY2021 Sustainability Conference was the first to be held under the "NTT Group Global Sustainability Charter" established in November 2021, but as COVID-19 infections continued to spread around the world, it was held online in the same way as the previous year.

There were 98 submissions by group companies in Japan and overseas, with the Grand Prize going to six of those initiatives. A People's Choice Award was created specifically for this online conference, where employees could offer their direct support of initiatives submitted by each company. The People's Choice Award was eventually given to four initiatives as a result of voting. The voting system was particularly valuable for increasing employee awareness as it allowed them to better understand each particular initiative before submitting their vote. The award ceremony was held in June 2022 in person for the first time in two years, and proved to be extremely popular. In addition to holding the conference in the next fiscal year and beyond, we also aim to further build on sustainability awareness among employees by improving the content of initiatives and enhancing measures that involve employee participation. Details of successful examples are also released outside the company so that they can be viewed by business partners.

NTT Group Sustainability Conferences
https://group.ntt/en/csr/management/management_system/conferences_8th.html

NTT Group activities around the world
https://group.ntt/en/csr/sustainability_action/

*1 Facilitation payments: Small payments used only for the purpose of ensuring ordinary administrative services are processed smoothly

Business Activity

Examples at the 9th Sustainability Conference Award

Revitalization of rural areas with AI-operated buses

The decreasing birthrate and aging population is leading to a social problem where there is a lack of transportation for the elderly. In light of this background, this initiative contributes to regional revitalization by providing AI-operated buses for more than 500,000 people in more than 50 areas around the country.

Smart fisheries industry (ICT Buoy)

We worked with fishermen in the Tohoku region to develop the "ICT Buoy" as part of reconstruction efforts in the wake of the Great East Japan earthquake, contributing to the revival of the fisheries industry with the aim of creating sustainable communities.

Supporting the treatment of stroke in Thailand by utilizing mobile services

We harnessed our technology to provide remote treatment inside emergency vehicles as a way of addressing issues in certain regions prone to traffic congestion in Bangkok, Thailand.

AI-based tuberculosis image diagnosis for 100,000 people in India

We provided image diagnoses for residents of local communities without easy access to hospitals in India (Chennai), a country with the highest number of tuberculosis patients in the world. This initiative has already helped to prevent tuberculosis in more than 100,000 people.

OriHime x sports x community development

In addition to opportunities for tuning in to sports events, we are helping to create a new way to promote corporate sports for addressing regional social issues, with initiatives like dietary education and eating together virtually with rugby players.
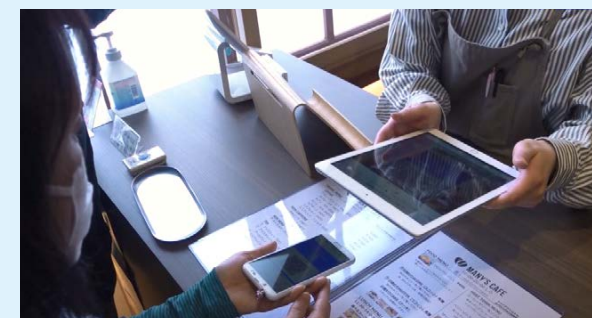
Development of smart city in Nagai City, Yamagata Prefecture

To address issues like aging populations and decreasing birthrates in regional areas, we combined our group-wide resources and technologies to provide a range of services like child protection systems, e-sports, and digital currencies for regional communities.

Social Challenge

SDG 8 DECENT WORK AND ECONOMIC GROWTH | SDG 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE | SDG 11 SUSTAINABLE CITIES AND COMMUNITIES | SDG 17 PARTNERSHIPS FOR THE GOALS

5

Prepare for a new future with the power of technology

Business Activity

16. Promoting the B2B2X Model
17. Protection and Respect for Intellectual Property
18. Contribution to the Revitalization of Local Communities and Economies

Why it matters

In recent years, various social issues have come to the fore: rapid increase in the global population, growing severity of natural disasters, worsening of food supply and environmental problems, and in Japan, low birthrates and an aging population are leading to a rapid shrinking of the working-age population and shortage of labor. To solve these problems, significant social and economic transformations are being demanded in every society and economy, and the advancement of digital transformation utilizing ICT (Information and Communications Technology) is required in every situation.

What can be accomplished

As a leader in digital transformation, we will act and contribute to helping resolve the social challenges unique to each country. For example, the declining birthrate and aging population, proper education, equitable healthcare, regional economic development, and long-term value through technology for the next generations.

Future vision

The NTT Group is committed to contributing to the development of society by acknowledging diverse cultures, and thus we will contribute to solving social issues by connecting people, goods, and cultures, including communities, nations, and society, while promoting high ethical standards, diversity, and inclusion in fair and equitable ways, and work towards creating a better workplace through powerful and new digital technologies.

Business Activity 16

Promoting the B2B2X Model

Our commitment

As a leader in digital transformation, we will act and contribute to helping resolve the social challenges unique to each country
For example, the declining birthrate and aging population, proper education, equitable healthcare, regional economic development, and long-term value through technology for the next generations

Our objective

Generate ¥600 billion in B2B2X revenue by 2023

Policies and Concepts

In recent years, various social issues have come to the fore: rapid increase in the global population, growing severity of natural disasters, worsening of food supply and environmental problems, and in Japan, low birth-rates and an aging population are leading to a rapid shrinking of the working-age population and shortage of labor. To solve these problems, significant social and economic transformations are being demanded in every society and economy, and the advancement of digital transformation utilizing ICT (Information and Communications Technology) is required in every situation.

Collaborating with companies in different indus-tries and local governments as Your Value Partner, the NTT Group has been applying its management re-sources and capabilities, including human resources, research and development, and the ICT base to pro-mote digital transformation and resolve social issues.

Going forward, we will seek to make a greater contribution to society based on our awareness that promoting the B2B2X business model that constitutes one of the pillars of our medium-term management strategy will be particularly effective.

Organization for Implementation

The NTT Group has made promotion of the B2B2X business model one of the pillars of our medium-term management strategy and has been taking action by establishing a B2B2X Strategy Committee with the president as chairman to facilitate Group collaboration while expanding projects.

We are also deepening discussion about future deployment of the B2B2X business model at regularly held Board of Directors meetings and reporting on progress at general meetings of shareholders.

What is the B2B2X model?

B2B2X is a business model aimed at resolving social issues by creating new value through collaboration with various partners.

This business model aims to provide our part-ner's customers (users) with new value by combining the industry expertise and customer platforms of our partners with the NTT Group's "data services" and "data management technology."

Development of B2B2X business

The model is being developed as an All NTT Group ini-tiative in areas like (1) Advancing industry value chains (2) Providing better customer service (3) Utilization of mobile data (4) Community-based service and urban development.

Examples of value created with the B2B2X model

(1) Advancing industry value chains in sectors like agriculture, forestry and fisheries, manufacturing and construction, and logistics

Example 1 ▷ Digitalization of agricultural growth and cultivation process management

Example 2 ▷ Digitalization of manufacturing processes and machine tool management

(2) Providing better customer service in logistics, services, and financial sectors

Example 3 ▷ Digital integration into a unified channel for bank customer contacts

Example 4 ▷ Logistics branch reform utilizing digital payment and purchasing data

(3) Utilization of mobile data x company owned data (mobile cross data)

Example 5 ▷ Support for financial services credit

Example 6 ▷ Attracting more customers by harnessing data from sports teams

Example 7 ▷ On-demand type ride sharing services

(4) Community-based service and urban development

Example 8 ▷ Increasing business opportunities for local businesses by analyzing tourist patterns

Example 9 ▷ More efficient budgeting, transportation and logistics in communities with digitalization of snow removal work

Example 10 ▷ Using sensor data to quickly detect accidents or other incidents and minimize damage
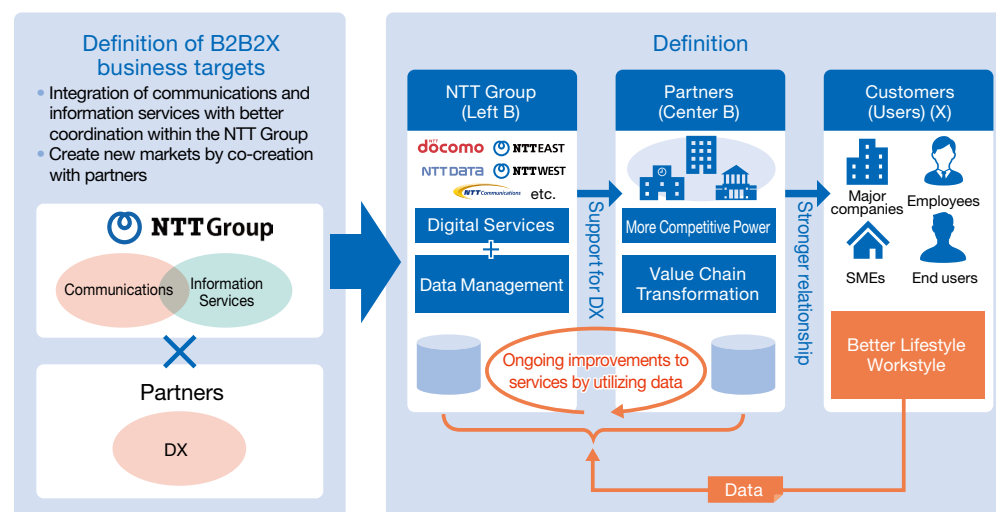
Facilitating collaboration with partners

- Entered into a business alliance with Mitsubishi Corporation in December 2019 to transform industrial value chains and to generate new value through digital transformation (DX), and in July 2021 established the joint venture company "Industry One" for providing DX services.
- Agreed to form a multi-year strategic alliance with Microsoft Corporation in December 2019 to promote the creation of a Global Digital Fabric, development of digital enterprise solutions, and co-innovation of next-generation technologies to deliver secure, reliable solutions that help enterprise customers accelerate their digital transformation.
- Entered into a business and capital alliance with Toyota Motor Corporation in March 2020 to establish a long-term, ongoing cooperative relationship that enables the commercialization of businesses to realize smart cities that continue to evolve in accordance with resident needs.
- The entire NTT Group is implementing initiatives aimed at achieving regional growth and developing smart cities by working with municipalities around Japan, with examples including a Community Development Partnership Agreement, concluded with Sapporo City (2015), a Comprehensive Partnership Agreement related to joint regional initiatives concluded with Fukuoka City (2015), an Agreement for Comprehensive Collaboration for developing a super-smart society by utilizing public and private data concluded with Yokohama City and Yokohama City University (2018), and a Comprehensive Partnership Agreement for future urban development concluded with Chiba City (2019).

Business Activity

Capital alliance formed with Genesis Healthcare Co.

In the healthcare and medical business domain, the NTT Group is working to achieve Smart Healthcare that leads to a well-being society by promoting comprehensive DX, from healthcare to medical care, through the use of data for individual consumers, as well as by supporting the advancement of medical care in a data-driven manner. Genesis Healthcare is a pioneer in genetic testing and research in Japan. In addition to "GeneLife," a genetic test for general consumers, the Company offers "GenesisPro," a genetic analysis service commissioned by medical institutions, and "GenesisGaia," a bioinformatics and data science (genome AI) service for pharmaceutical companies and research institutions.

The two companies agreed to enter into a capital and business partnership with the aim of accelerating the acquisition, analysis, utilization, and distribution of medical and healthcare data, including genetic data, by leveraging and complementing each other's broad knowledge base and expertise. They also aim to contribute to the creation of a healthy society that respects humanity and recognizes diversity rooted in genetics, as well as one where each person can benefit from personalized, optimized precision services.

Business Activity

E-textbook/teaching material delivery service

- Publishers
- Electronic distributors
- Publishing agents
- NTT EDX
- Electronic distributors
- Bookstores, etc.
- Institutions of higher education

Businesses aimed at publishers | Businesses aimed at institutions of higher education

E-textbook distribution/distribution support service | Support service for developing original teaching materials

Learning data utilization service

Business expansion

Creating online/remote environments in institutions of higher education → Using data to achieve learner-oriented education → Achieving diverse learning (promoting learning after graduation)

Cargo tracking and simplified insurance procedures across the entire supply chain

- Visualization of the entire supply chain (End-to-End monitoring of transit status)
- Clarification of the scope of responsibilities between stakeholders (easier management of transportation insurance)
- Automatically apply insurance policy if product cannot be transported under pre-defined conditions

<Description of utilization for reducing costs throughout entire ecosystem>

Established NTT EDX, a company working to advance higher education

NTT West, DNP, and NTT East have been working together to accumulate know-how in the digitization of education using ICT, with the aim of enhancing cooperation with publishers of textbooks and teaching materials and expanding the effectiveness of their collaborative efforts.

For previous efforts, we provided solutions individually to institutions of higher education, but we deemed it necessary to provide this service as a platform service so that we can provide more advanced functions at a reasonable price, and to expand the service to institutions of higher education nationwide as soon as possible. In addition, a number of institutions of higher education, publishers of textbooks and teaching materials, and bookstores that have sold textbooks for many years have requested that we commercialize this service in order to make students' education more convenient and resolve issues related to textbooks and teaching materials. We established our joint venture to address these requests.

Development of new solutions together with SAP

NTT DATA and SAP have jointly developed the "Connected Product" solution for tracking transportation of fragile cargo with IoT sensors and making insurance procedures smoother. These initiatives help simplify cargo tracking and insurance procedures throughout the entire supply chain, with plans in place to cover actual business with international insurance and logistics companies.

Research and Development to Promote the B2B2X Model

Promoting the B2B2X business model is a central pillar of the NTT Group's initiatives contributing to the realization of a smart society. In the B2B2X model, instead of providing services to customers directly, the NTT Group supports service providers by offering ICT tools such as AI and IoT, to which various values are added before being delivered to customers. In addition, the NTT Group has been working to create B2B2X models with many partner companies and local governments. We will further develop them and advance a model that uses digital services and data management.

Example of initiatives

NTT and Tokyo Century Corporation working together for data center business operation in India

With demand in the data center market growing on a global scale, NTT established NTTGDC as a company in charge of investments and asset holding related to data center construction, with the aim of supporting the core infrastructure that is the foundation of the NTT Group's full-stack global strategy. In the data center business, where demand will continue to grow worldwide, NTT aims to provide high-quality services to global companies by maximizing investment efficiency and accelerating data center business investments. Tokyo Century is focusing efforts on promoting business strategies that integrate the three spheres of "Finance x Services x Business Expertise" by cooperating with good business partners. As an operating company with financial functions, Tokyo Century will be able to create unique financing and service opportunities for helping to address social issues, develop a solid business portfolio and expand global businesses in areas where growth is anticipated. NTTGDC and Tokyo Century have agreed that blending the core strengths of both companies and working together for the operation and promotion of data centers will help to boost corporate value. Partnering with NTTGDC marked Tokyo Century's first data center business that involves external capital.

NTT and Macquarie Asset Management enter into strategic partnership for data center businesses in Europe and North America

NTT and Macquarie Asset Management agreed to enter into a strategic partnership covering NTT's data centers in Europe and North America.

This strategic real estate partnership will give Macquarie Asset Management the opportunity to invest real estate capital alongside NTT, while also providing NTT with the opportunity to further build on its businesses in Europe and North America, two key regions for its data center business. NTT is also aiming to provide high-quality services to global companies by maximizing investment efficiency and making further growth investments in the data center business in the globally expanding DX market.

Improving prosperity for all people and cultures

Business Activity

Establishment of New Company, NTT DX Partner

In January 2022, NTT East established a new company, NTT DX Partner, which will provide support for business reform centered on DX consulting, create and provide a cloud-based digital platform, and analyze customers' various operations and client data. NTT DX Partner will also utilize NTT East Group's DX promotion know-how and assets to provide one-stop support, ranging from DX consulting to implementation and promotion of digital platforms, in a collaborative, joint development style. This will contribute to customers' success and address local and social issues that arise as well.

Launch of XR Service Brand "NTT XR," collaborative creation with partners

With the XR market slated to grow as a new type of lifestyle infrastructure, the NTT Group launched a new service brand called "NTT XR" in March 2022, allowing customers to select optimum services that suit their requirements. The new XR service brand will provide a full range of services, from those catering to both corporate and individual users through to XR technical platforms and devices common to group companies.

Together with content providers and other partners, we will provide an extensive range of services including entertainment, tourism, education, industry, commerce and many more to meet diverse needs of corporate and individual customers.

A range of services will be provided by group companies to customers in Japan and around the world in line with its vision of "Going beyond the limits of reality to share and enjoy dreams and experiences." For the consumer market, NTT QONOQ has already released the multi-device metaverse platform "XR World" and is expanding on features within the platform covering a wide range of areas including music, cartoons, dance events and more. Services available for corporate customers include remote conferences, on-site support, training, and marketing-related services. In addition, we will develop services in the educational and tourism sectors. To accommodate the increase in traffic and amount of data as XR continues to grow, "NTT XR" services are developed extensively on photonics-electronics convergence devices, cloud rendering and other IOWN-related technologies designed to provide a smooth, high-quality XR experience.

QUINTBRIDGE Opens

In March 2022, NTT West opened QUINTBRIDGE, a co-creation space originating in Kyobashi, Osaka, to promote open innovation and help revitalize the overall market.

QUINTBRIDGE will support business co-creation and human resource development and aims to become a place where companies, startups, local governments, universities, and others can "learn, connect, gather, and create with one another." In business co-creation, we do not stop at formulating ideas, but work with partners to help these business ideas take shape and implement them in local communities, as well as provide various programs (interactive pitch programs, acceleration programs, etc.) to support this effort.

https://group.ntt/jp/nttxr/

CEO Message | Ensuring the positive coexistence of nature and humanity | **Improving prosperity for all people and cultures** | Maximizing well-being for all | 089   Sustainability Report 2022

Business Activity

Launched SmartPRO®, a Data Collection Service that Improves the Accuracy of Clinical Trial Evaluations

SmartPRO® (hereinafter "the Service"), which increases the accuracy of clinical trial evaluations conducted by pharmaceutical companies and research institutions, was launched on May 20, 2022. This service is an ePRO[2] that digitizes subjective evaluations (hereinafter "PRO"[1]) obtained directly from subjects or patients, and allows subjects or patients to relay their condition, such as "pain" or "feeling ill," from their own smartphones. Pharmaceutical companies and research institutions can view and download patient and subject PROs on the Service. In addition, a logbook function that allows subjects and patients to record all health-related data after the clinical trial as well will be provided as part of the Service by the end of FY2022. We will also consider new healthcare services that contribute to improving subjects' and patients' quality of life by safely and securely utilizing the data collected by the Service. Through the Service, we will strive to achieve Smart Healthcare that uses digital technology to contribute to the development of healthcare.

[1] A PRO (Patient Reported Outcome) is a subjective evaluation of the course and symptoms of the disease obtained directly from subjects or patients during clinical trials.

[2] An ePRO (electric patient-reported-outcome) is a PRO that is filled out and collected electronically.

2025 World Exposition - Japan Pavilion

NTT will take the opportunity at the Expo 2025 Osaka Kansai to showcase its efforts for achieving a sustainable society through its new vision for society, by harnessing its various management resources and capabilities, such as its advanced R&D like the new IOWN communications and social infrastructure platform powered by optical technology, ICT platforms, and personnel. And for children growing up in an uncertain world, NTT will give them hope for the future, making for a truly memorable pavilion for visitors to the world expo.
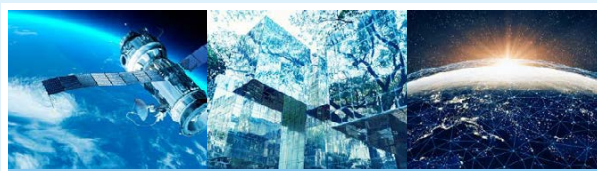
NTT Pavilion 2025 NATURAL - Between Life and IT

Strengthening operations for guidance with VR spatial platform "DOOR"

A guidance service was launched in February 2022 within a DOOR virtual salon, provided by OriHime-D avatars piloted by handicapped people or others with difficulties going outside. DOOR users can interact with the OriHime-D avatar and ask them questions about piloting the avatar or acquire information they need. New advances include an AI avatar providing reception duties for the DOOR virtual salon. The AI avatar developed by the NTT Group on the basis of NTT R&D technology uses automated responses to provide information outlining content available in the virtual salon, and also applies federated learning to non-verbal cues like audio data, facial expressions and intonations in voice, to give users an interactive experience.

Business Activity 17

Protection and respect for intellectual property

Our commitment

As a leader in digital transformation, we will act and contribute to helping resolve the social challenges unique to each country
For example, the declining birthrate and aging population, proper education, equitable healthcare, regional economic development, and long-term value through technology for the next generations

Our objective

More than in the previous fiscal year

Number of patent applications per employee

Intellectual Property Management Our Approach to Intellectual Property

The business activities of the NTT Group are sustained by products and services derived from the results of our aggressive R&D. For this reason, we believe that appropriate protection and utilization of intellectual property generated by R&D is vital for the NTT Group to achieve continuous growth, which in turn will enable us to continue contributing to our customers and society at large. We strive to protect the intellectual property of the NTT Group and promote activities that respect the intellectual property of others in every aspect of our business activities.

System of Intellectual Property Management

NTT protects the results of its R&D to maintain its competitive edge but at the same time makes its intellectual property available to a wider audience by licensing technologies that would contribute to the development of industries and businesses as well as standardized technologies that are already used in society.

Under the leadership of the NTT Intellectual Property Center, NTT has established policies for intellectual property activities involving the entire NTT Group and also provides support and coordination for the use and management of intellectual properties, aggregates the opinions within the Group on the intellectual property system and disseminates information outside the Group.

Protection of Third Party Intellectual Property

In order to prevent the infringement of domestic and overseas third party rights, NTT examines the third party rights of technologies used in our business at every step from the early stage of research and development up to the provision of the developed technologies to Group companies. NTT also strives to enhance the Group's compliance with intellectual property laws and regulations in Japan and abroad and mitigate potential business risks by sharing among the Group companies information on system amendments, and trends concerning intellectual property including disputes and court cases.

> NTT Intellectual Property Center
> https://www.rd.ntt/e/chizai/index.html

External Utilization of R&D Outcomes

Since its founding, NTT has promoted cutting edge technological development as a leading company in the information communication industry. For this reason, we own a vast number of patents.

NTT licenses its proprietary technologies so that they can be used broadly by all for the benefit of the telecommunications market as well as other markets. For example, as part of our initiatives for standardization, we efficiently promote the spread of technology by licensing patents on standardizations to many companies through various patent pools.

IP Open Access Declaration Against COVID-19

Recognizing the need to contain the spread of COVID-19, the NTT Group expressed its consistent support for the IP Open Access Declaration Against COVID-19 in May 2020 and declared that it will "not assert any patent, utility model, design or copyright (hereinafter referred to as the "Intellectual Property Rights") against any individual or other entity during the period starting with the date of this declaration and ending on the date on which the World Health Organization declares that the COVID-19 outbreak no longer constitutes a Public Health Emergency of International Concern, with respect to activities whose sole purpose is stopping the spread of COVID-19, such as diagnosis, prevention, containment, and treatment of COVID-19." NTT discloses its licensing policy and procedures along with detailed information on its R&D activities and technological licenses.

> R&D Activity
> https://www.rd.ntt/e/
>
> NTT Technology Licensing Site
> https://www.rd.ntt/e/ntt-tec/
>
> Licensing policies and procedure
> https://www.rd.ntt/e/ntt-tec/procedure/index.html
>
> Participation in the "IP Open Access Declaration Against COVID-19" (Japanese only)
> https://group.ntt/jp/topics/2020/05/29/oacvd19/

Medium-term management strategy
1 Transformation to a New Management Style
2 Enhance Domestic / Global Business
3 Enhancement of Corporate Value

Business strategy

Intellectual property strategy
1) Strategic rights creation (build an intellectual property portfolio)
2) Risk management
3) Deploy intellectual property

R&D strategy

NTT Group's Vision

NTT Intellectual Property Center Activity Policy

NTT Group, which engages in research and development, from basic to applied, in a wide range of technological fields, has accumulated intellectual property investments (R&D investments) over the years as a telecommunications operator that are unparalleled around the globe.

The NTT Intellectual Property Center has established an Activity Policy to provide security and safety to NTT Group's businesses, which is on the verge of expanding globally under the slogan of "Your Value Partner," and to support its growth. The Center formulates intellectual property strategies, provides appropriate protection for the results obtained through intellectual property investments, and promotes the use of intellectual property while respecting that of others.

IOWN, which is generating significant expectations and interest both at home and abroad, is not something that NTT Group can achieve on its own. Through an array of activities in line with our Activity Policy, we will support collaboration with our partners to address various social issues from a global perspective.

Formulating and Advancing Our Intellectual Property Strategy

The NTT Intellectual Property Center is NTT Group's core organization for managing intellectual property. The Center aims to secure competitive advantages by proactively and appropriately protecting and managing intellectual property rights (i.e., patents), or internal expertise, from the results of R&D, the source of all business activities.

NTT aims to share the benefits of its R&D by broadly licensing out its technologies that help advance industry, as well as technologies that have been standardized and can be used throughout society. When deploying the results of R&D in their operations, each company in NTT Group respects the intellectual property rights of other companies.

Our intellectual property strategy forms the basis of these activities, and together with our business strategy and R&D strategy, we are aiming to achieve the NTT Group's vision by taking a three-pronged approach to formulating and advancing our medium-term business strategy: (1) developing strategic intellectual property rights, (2) managing risks, and (3) utilizing our intellectual property.

(1) Strengthening our competitiveness with strategic rights creation (build an intellectual property portfolio)	• Build an intellectual property portfolio through the strategic development of intellectual property rights from fruits of R&D activities, based on technologies and anticipated business models
(2) Risk management that protects our intellectual property rights and respects the rights of others	• When Group companies deploy the results of R&D in their operations, we examine the intellectual property rights of others inside and outside Japan up until the stage where R&D results are applied in order to avoid infringing on the rights of third parties • Reduce business risk and comply with laws and regulations related to intellectual property rights, by sharing among Group companies information about intellectual property trends and their impact, such as revisions to systems around the world, cases of conflict and court decisions
(3) Develop business and partners through broad deployment of intellectual property rights	• Deploy intellectual property in business to contribute to our customers and society, and to secure competitive advantages in business • Proactively engage in activities to standardize intellectual property

Intellectual Property Portfolio

The results of R&D, which plays a major role in the creation of intellectual property for NTT Group, has translated into ownership of approximately 18,000 patents around the world.

The NTT Intellectual Property Center is not only responding to NTT Group's global business by strengthening overseas patent applications, but also working to obtain rights to a wide range of energy reduction technologies, such as photonics-electronics convergence technologies that will advance carbon neutrality, which IOWN aims to achieve by FY2040.

Number of NTT patents held

(Patents)

Legend: ■ Domestic ■ Overseas

Fiscal year	Overseas	Domestic
2017	3,321	13,879
2018	3,644	14,337
2019	4,083	13,187
2020	4,621	13,265
2021	5,136	12,966
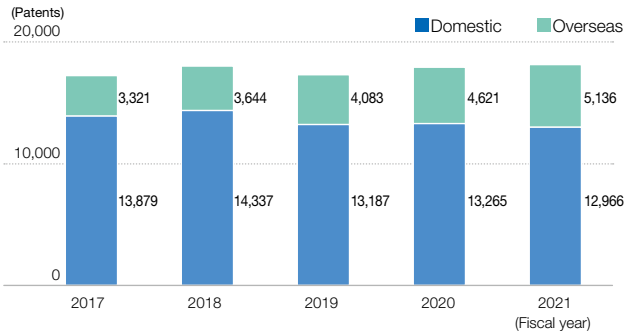
Number of patents held by NTT in energy reduction-related technologies

Other (ICT services, etc.) 12%
Advanced materials 14%
Network-related 74%

Approx. 1,000 cases (5.5% of total)
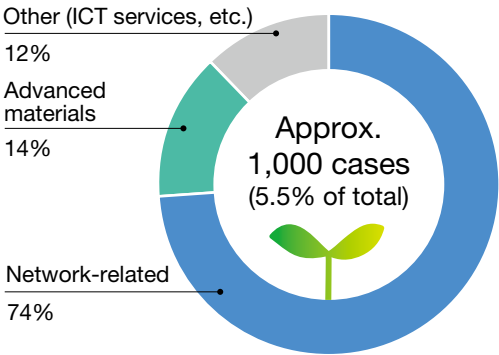
Open & Closed Strategy (Initiatives related to Standard Essential Patents)

IOWN will not be achieved via a limited number of companies whose core business is information and communications technology. In fact, companies and organizations in various fields active around the world have gathered at the IOWN Global Forum to discuss use cases and technical specifications for making IOWN a reality. In these discussions, it is important to clarify open (cooperative) and closed (competitive) areas while working toward the same goal. In open areas, for example, it is essential to define technology standards to achieve stable communication between devices from different vendors (standardization).

While NTT laboratories play a central role in pro-posing NTT technologies as standards, the NTT Intellectual Property Center is working to enhance its Standard Essential Patents (SEP) in coordination with these activities. SEPs are patents that must be used in the manufacture and sale of products and provision of services that conform to certain standards. The NTT Intellectual Property Center provides a secure platform for handling standardized technology rights by participating in and establishing patent pools, whereby companies and organizations in collective possession of SEPs manage patent royalties and other conditions, thereby maintaining relationships of trust with other companies and contributing to the safe and secure business operations of NTT Group.
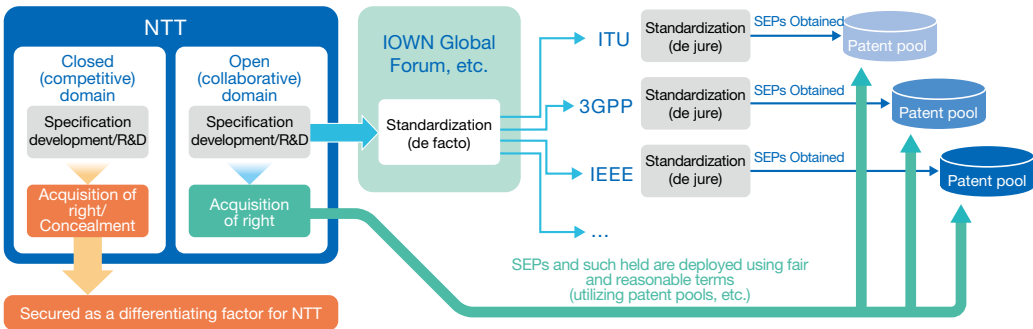
Open & Closed Strategy Summary

Business Activity

Model for Regional Revitalization through Intellectual Property Matching Events Hosted by Local Governments and Others
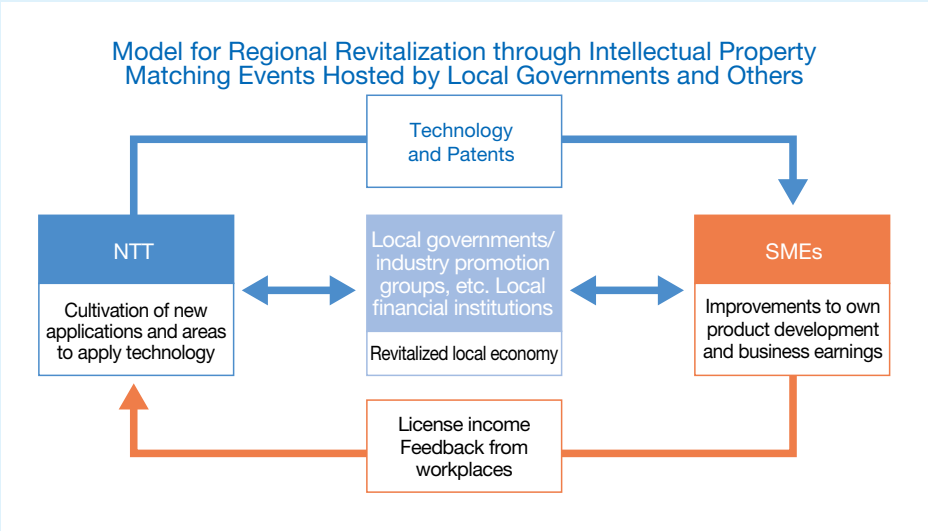
Participation in Intellectual Property Matching Events Organized by Local Governments and Organizations

In an effort to help vitalize regional business structures, we actively participate in intellectual property (IP) matching events sponsored by local governments to offer licensing agreements that enable local companies to use NTT's proprietary technologies in developing their own products. In the case of a company based in Kawasaki City, Kanagawa Prefecture, we signed a licensing agreement through a matching event organized by Kawasaki City and the Kawasaki Institute of Industrial Promotion that has enabled the company to use NTT's patented technology to provide a new service starting in 2019. We are committed to continue contributing to the vitalization of regional economies through this initiative.

Reinforce and Globalize Research and Development
Policies and Concepts

As ICT companies leading the world, the NTT Group recognizes R&D as a material issue that gives Group companies their competitive edge. R&D supports the digital transformation of our customers and lifestyle transformations tailored to individuals, and the R&D department works with operating companies to develop new technologies that provide the wellspring for new value creation in a variety of domains to enhance the NTT Group's R&D, a pillar of our medium-term management strategy.

The NTT Group seeks to overcome numerous problems involving safety, disaster readiness, and the improvement of productivity through R&D and, as a result, strengthen industrial competitiveness and resolve social issues. Since ICT is applied in a variety of fields, we are forging partnerships with counterparts in wide-ranging industries as we pursue our R&D initiatives.

IOWN GLOBAL FORUM Linking Companies and Academic Institutions Across the Globe

We established IOWN Global Forum, Inc. (hereinafter "IOWN GF"), a new industry forum based in the United States, together with Intel Corporation and Sony Corporation in January 2020. This forum has grown to boast membership by 111 organizations as of November 2022.

IOWN GF's objective is to accelerate the adoption of a new communication infrastructure that will bring together an all-photonic network infrastructure including silicon photonics, edge computing, and wireless distributed computing to meet our future data and computing requirements through the development of new technologies, frameworks, specifications, and reference designs.

Organization for Implementation

The NTT Group's R&D activities focus on making the IOWN concept a reality, as well as basic research and applied research. Basic research serves as the backbone of telecommunications, such as basic and component technologies related to services and networks, while applied research is conducted by operating companies and is closely related to their respective businesses. These R&D activities are undertaken by NTT's IOWN Integrated Innovation Center, Service Innovation Laboratory Group, Information Network Laboratory Group, and Science and Core Technology Laboratory Group. Also, we promote general producer activities, in which we formulate marketing and business plans and forge alliances so that the results of research by NTT laboratories can be transformed into Group businesses. In these general producer activities, we seek to develop business in a timely manner by combining the wide-ranging basic technologies of NTT laboratories with external technologies in collaboration with Group companies and with various other companies to create new services. In order for innovation to continually be an important driver of the NTT Group well into the future, we will aim to contribute to the realization of a sustainable society by promoting innovations for social issues. These efforts will include patent applications and the publication of scientific papers.

Laboratories

NTT IOWN Integrated Innovation Center	Research and development of cross-sector technologies to make the IOWN concept a reality
	IOWN Product Design Center
	NTT Network Innovation Center
	NTT Software Innovation Center
	NTT Device Innovation Center

Service Innovation Laboratory Group	Research and development of new communication services
	NTT Human Informatics Laboratories
	NTT Social Informatics Laboratories
	NTT Computer and Data Science Laboratories

Information Network Laboratory Group	Research and development of future network core technologies
	NTT Network Service Systems Laboratories
	NTT Access Network Service Systems Laboratories
	NTT Space Environment and Energy Laboratories

Science and Core Technology Laboratory Group	Research and development of most-advanced core technologies with an eye to a decade from now
	NTT Network Innovation Laboratories
	NTT Device Technology Laboratories
	NTT Communication Science Laboratories
	NTT Basic Research Laboratories

Research Centers in Specific Fields		
NTT Machine Learning and Data Science Center	NTT Bio-Medical Informatics Research Center
NTT Research Center for Theoretical Quantum Physics	NTT Institute for Fundamental Mathematics
NTT Digital Twin Computing Research Center	NTT Nanophotonics Center
NTT Innovative Photonic Network Center	NTT Smart Data Science Center

NTT Group's Overall R&D Organization	Number of Researchers	Approx. 5,000[1]
	Research and development expenses	¥430.0 billion[2]

[1] As of March 31, 2022 [2] R&D expenses and total equipment investment and expenses related to system development

Driving collaboration to make the IOWN concept a reality

IOWN GLOBAL FORUM linking a broad range of companies

NTT, Intel Corporation and Sony Corporation established IOWN Global Forum, Inc. (hereinafter, "IOWN GF"), a new industry forum. IOWN Global Forum's objective is to accelerate the adoption of a new communication infrastructure that will bring together an all-photonic network infrastructure including silicon photonics, edge computing, and wireless distributed computing to meet our future data and computing requirements through the development of new technologies, frameworks, specifications, and reference designs.
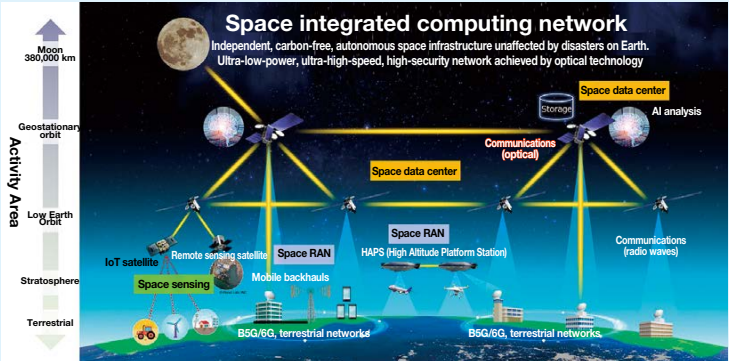
Space integrated computing network

To establish sustainable economic and social activities, it will become ever more important to effectively maximize the use of stratospheric and near-Earth space as an ICT infrastructure platform in a diverse array of fields such as energy, environment and climate change, disaster prevention, marine infrastructure, and security. Based on the "Space Integrated Computing Network Concept," NTT will take on the challenge of building new infrastructure, beginning with an optical wireless communication network to be constructed in space and a mobile network to be constructed in the stratosphere.

NTT and SKY Perfect JSAT Corporation established the "Space Compass" joint venture company that operates a novel integrated space computing network business with the aim of achieving a sustainable society. The new company is involved in space data center (high-capacity communication and computing infrastructure in space) and space RAN (communication infrastructure for Beyond5G/6G) business and services as the first step to developing an integrated space computing network. The joint venture will take on the challenge of building new infrastructures in space, where business led by the private sector is expected to grow in the future, and contribute to the creation of a sustainable society.

Reinforce and Globalize Research and Development

- The NTT Group is advancing innovative research and development that drives change worldwide while stepping up basic research at overseas centers. Specifically, we will use the research centers established overseas to strengthen joint research with a varied range of research bodies, actively utilize the latest external technologies, and increase investment in research on new growth fields. We will also promote the global rollout of R&D results and globalization of research targets. More specifically, in July 2019 we opened NTT Research, Inc., which operates three research laboratories, in Silicon Valley in the United States for the purpose of reinforcing fundamental research. We have launched a collaboration with universities and research institutes in the United States and Europe in the fields of quantum computational science, medical/health/healthcare, and basic cryptography/blockchain. We will further globalize our research and development by opening research centers in areas around the world, starting with Silicon Valley.
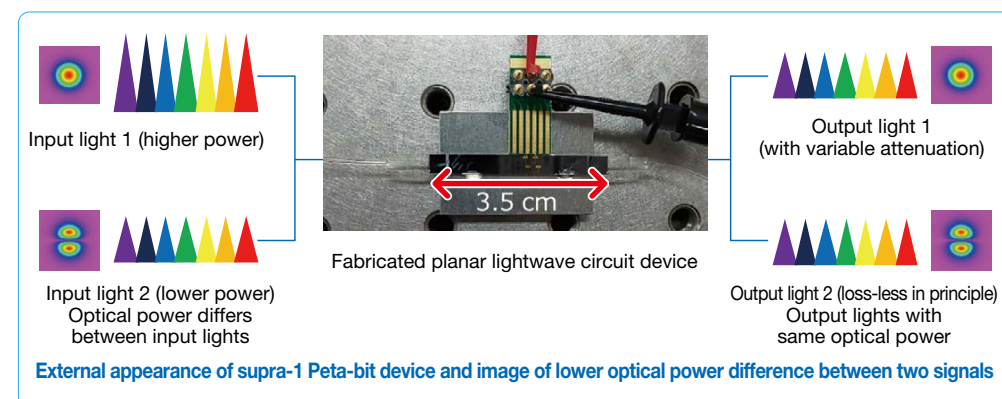
- The creation and utilization of photonics-electronics convergence technology that combines optical and electric signals will be key to the development of IOWN. The "NTT IOWN Integrated Innovation Center" was established in July 2021 in order to advance development and accelerate the creation and utilization of this technology. In addition to the three centers (the Network Innovation Center, Software Innovation Center, and Device Innovation Center) involved in cross-sector product development, the NTT IOWN Product Design Center has been established at the facility. This center formulates a development and expansion strategy backcast from market needs and social demands and consistently promotes technology development, dissemination activities, and implementation support based on that strategy.

  NTT also assembled researchers who are known authorities in their respective fields to form the NTT R&D Authority Team. These Authority Team researchers take part in R&D activities at NTT to contribute to the development of IOWN and help shape our vision after making this concept a reality. Specifically, they are responsible for driving research in their fields of expertise by directing, providing guidance, and advising activities regarding research themes. As one facet of our efforts to accelerate R&D from a long-term perspective, NTT established the new Institute for Fundamental Mathematics, headed by Dr. Masato Wakayama, a member of the NTT R&D Authority Team who serves as the Fundamental Mathematics Research Principal. It will work on establishing a basic theoretical framework for modern mathematics and will accelerate research towards innovation in quantum technology by challenging to uncover the basic principles behind the superior power of quantum computing. It will also seek to contribute to NTT's R&D aimed at achieving IOWN by proposing the use of modern mathematics in groundbreaking new approaches to addressing various research problems, including the elucidation of unknown diseases and the discovery of new drugs.

R&D to make the IOWN concept a reality

- NTT has established a feed-forward AI air-conditioning control system that predicts comfort levels even with short-term data, and demonstrated its ability to achieve energy conservation and comfortable environments. This technology was developed as part of the Urban DTC® initiative aimed at optimization of entire urban areas, by making predictions of the future and links between digital twins using the 4D digital platform® capable of observing the entire city in real-time in sophisticated detail. And to achieve the "Another Me" digital twin of oneself, NTT redefined and announced the philosophy behind the concept of "We" that encompasses oneself and Another Me, based on the Self as We theory developed together with research partners at Kyoto University.

- We teamed up with Hokkaido University to be the first in the world to demonstrate the capabilities of a compact optical device that achieves low loss, wideband and variable compensation of optical power difference between different kinds of signals (modes). This was a major step forward for achieving the high-volume optical transmission backbone exceeding 1 Peta-bit capacity target of the IOWN concept. Development of a supra-1 Peta-bit class optical transmission backbone as the target of IOWN proposed by NTT calls for optical transmission line technology and optical transmission technology utilizing spatial modes. NTT will continue its industry-academia collaborative research in this field.

Input light 1 (higher power)

Input light 2 (lower power)
Optical power differs
between input lights

3.5 cm

Fabricated planar lightwave circuit device

Output light 1
(with variable attenuation)

Output light 2 (loss-less in principle)
Output lights with
same optical power

External appearance of supra-1 Peta-bit device and image of lower optical power difference between two signals

- NTT has developed a digital signal processing circuit and optical device that achieves the world's largest capacity of 1.2 Tbit/s per wavelength for coherent optical transmission.

  Using the proprietary developed world's highest class digital coherent signal processing circuit and world's fastest optical device increases the optical signal modulation speed to the world's highest 140 Giga baud, and achieves 1.2 Tbit/s per wavelength, the world's highest capacity. When compared with existing technology, the optical signal modulation speed is 1.4 times faster, and the transmission capacity has increased by 1.5 fold. The developed device can also be expanded to more than double the optical transmission distance of 800 Gbit/s.

Promoting Other Cutting-Edge Research

- **6G experimental trials with world-leading vendors:**
NTT DOCOMO and NTT agreed to collaborate with world-leading vendors Fujitsu, NEC, and Nokia to conduct experimental trials for sixth generation mobile communications technology (6G) with the view of launching commercial 6G services by around 2030. Research and development of 6G systems is advancing as the technology capable of expanding communication coverage in the sky, at sea and in space, and enabling both ultra-low-power consumption and low-cost communications. Indoor trials will begin within fiscal 2022, with outdoor trials slated to begin from fiscal 2023 and after. NTT will continue working with these world-leading vendors to conduct experimental trials, with each company moving forward with other major vendors in developing initiatives that build on their individual expertise. This will help to accelerate research and development of 6G, and contribute to faster global standardization and commercialization of 6G.

- **High-precision Detection of Rust in Social Infrastructure Facilities using Image Recognition AI:**
NTT successfully developed an image recognition AI that detects rust in various social infrastructure facilities with a high level of accuracy. The image recognition AI can distinguish multiple types of infrastructure facilities from images of roadside facilities taken by NTT's Mobile Mapping System (MMS) to detect rust that has formed on those facilities (roadside facilities and utility pole-mounted facilities), with a detection accuracy of 97.5%. The image recognition AI can identify and inspect in one run multiple infrastructure facilities in images captured simultaneously by MMS, which reduces operational costs as it allows consolidation of separate field inspections that had been performed by each infrastructure manager. Uniform inspection quality can also be achieved because the image recognition AI uses uniform standards that eliminates the variations in detection results between individual inspectors. Further improvements made to AI in the future will provide added value for social infrastructure maintenance management work and help achieve a smart society.

- As part of NTT's "Medical and Health Vision," a simulator called the Bio-Digital Twin has been developed to support risk control and improve well-being by predicting future physical and mental conditions of a person. A new type of sensing instrument is the wearable electrocardiographic device. The device being developed is centered on the apical region of the chest, where the heart is closest to the rib cage, as a reference point with opposite electrode poles in three nearly orthogonal directions to capture the activity of the heart in three dimensions.

- The quest to develop more compact quantum computers for more practical applications has struggled due to their need for large cooling and vacuum equipment, amongst other challenges. NTT, together with the University of Tokyo and RIKEN, has jointly developed an optical fiber-coupled quantum light source (squeezed light source), which is a key technology for achieving large-scale optical quantum computers.

- NTT was the first in the world to successfully acquire knowledge on the process of spin-wave generation and the electrical control of spin waves in a graphene quantum Hall state. This resulted in acquiring a means of investigating the fundamental properties of spin waves. Feeding back this knowledge to applied research will make a significant contribution to the development of magnonic devices.

Why IOWN is essential

The development of digital technology has brought about a number of technological innovations, such as ultra-high definition images, but we believe that we must change our mindset to achieve further evolution. With IOWN, we believe it is important to try to grasp phenomena and information as they are through a more diverse set of values and perceptions, as opposed to filtering them through human-only values. Dr. Jakob von Uexküll, a German biologist, proposed the concept of the "self-centered world" ("Umwelt" in German), which states that all living things have a species-specific perceptual system, and that each has a world based on its own species-specific perception and acts as its own subject. The IOWN concept is based on the idea that different subjects see things in different ways, and that the information being conveyed and the processing method will vary according to the values of each subject. Thus, it aims to convey and process every bit of information in accordance with the values of each subject.

While dramatically low latency, enormous bandwidth, and very small latency fluctuations are required to make these new ideas a reality, the current internet is reaching its limits in terms of both transmission and processing capacities. Furthermore, power consumption continues to increase in tandem with the enormous amount of information being processed, and the increase in CO_2 emissions has become a serious global issue. NTT Group's vision of a high-capacity, low-latency, low-power-consumption infrastructure that can handle information as-is requires an end-to-end, full-stack redesign and optimization that breaks away from individually designed layers, from networking to computing. The key to this is "photoelectric merging" technology. Conventionally, optical signals and electronic signals have had their roles completely separated into "transmission" and "processing," respectively, and the task of converting the two types of signals is inefficient and consumes a lot of power. If we tightly integrate optics and electronics, we can apply optical technology to the entire system, down to the processor level, and we can rethink the architecture (structure) from a full stack perspective.
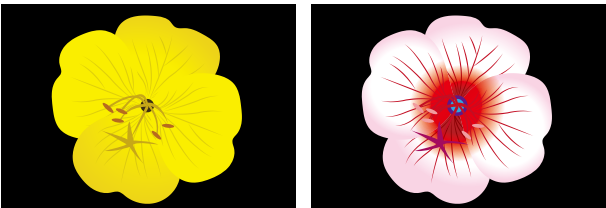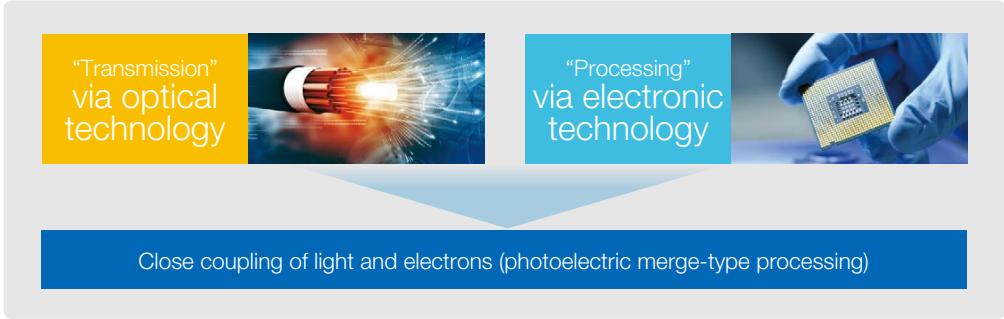
A flower as seen by a human (left)/A flower as seen by a bee (right)

Limitations of Increasing Resolution

The Latency Problem

The Energy Consumption Problem

The CO_2 Emissions Problem

"Transmission"
via optical technology

"Processing"
via electronic technology

Close coupling of light and electrons (photoelectric merge-type processing)
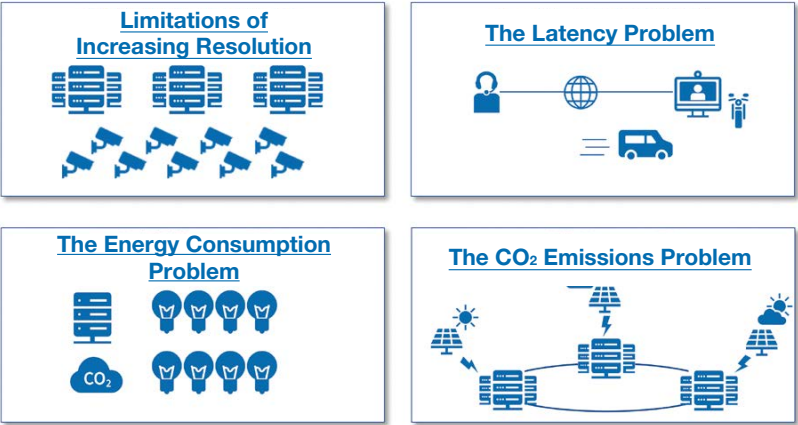
The advantages of IOWN

I think the optics-related expertise that NTT has accumulated over the years is a big advantage. What everyone is probably most familiar with is internet connection services using fiber optic cables, but NTT has long been researching the possibility of not only using fiber optic cables as a transmission medium, but using optics as a basis for transmission equipment and information processing. The results of these research projects are being put on a development track that brings them closer to commercialization, with the goal being practical applications. In terms of recent achievements, the core of "photoelectric merging technology" is the ability to perform optical-electrical and electrical-optical conversion at ultra-high speeds and with ultra-low power consumption. In LSI, the input/output (I/O) consumes the most electricity, and the impact of replacing this with light is quite significant. Moreover,

with electricity, power consumption increases rapidly as the distance over which signals are transmitted increases, but with light, power consumption does not increase very quickly. Thus, by utilizing light through photoelectric merging technology, it is possible to achieve not only ultra-high speeds, an original characteristic of light, but also ultra-low power consumption. A typical example is the optical transistor developed by NTT in 2019, the first in the world to combine ultra-high speeds with ultra-low power consumption. A transistor is a conversion device that can output an electrical signal in its proper form by providing it with a control signal. Converting signals is called switching.

Conventional light-switching devices are huge and cost several hundred billion yen, but now that optical transistors have been created, they have been reduced to the size of a piece of chewing gum. In addition, the research and development of optical

transistors involves not only signal processing technology, but also the creation of optical modulators. This requires know-how regarding stabilization at high accuracy so as not to disturb the spectrum of a certain wavelength, which is an analog technology that is part of a cottage industry. The fact that we are now able to connect long distances optically is largely due to utilization of our technology. To cope with the increase in data volume and power consumption, a structural evolution from electronic processing to optical transmission is essential, and the breakthrough in the technology supporting this structural evolution hinges on the higher precision, smaller size, and lower cost of optical transistors. Therein lies NTT's advantage.

Anticipated business model

IOWN will be available in a variety of domains, but here are two easy-to-understand scenarios.

First, let's consider the interior of a data center, disaggregated computing. A personal computer has a similar structure, but a server has an interface, a CPU, memory, and storage. The current trend is for the CPU to issue instructions, temporarily store information in memory, and then store the information resulting from its calculations in storage. The CPUs used to be run by electrical signals, but by directly connecting accelerators such as GPUs and DPUs via light and linking them with different wavelengths, it is no longer necessary for each server to have its own CPUs and memory. CPUs are located in one casing and memory in another, and connecting them optically makes it possible to create a situation in which it appears as if a very large amount of CPUs and memory are installed on a single server.

Disaggregated computing

Low power consumption and high performance
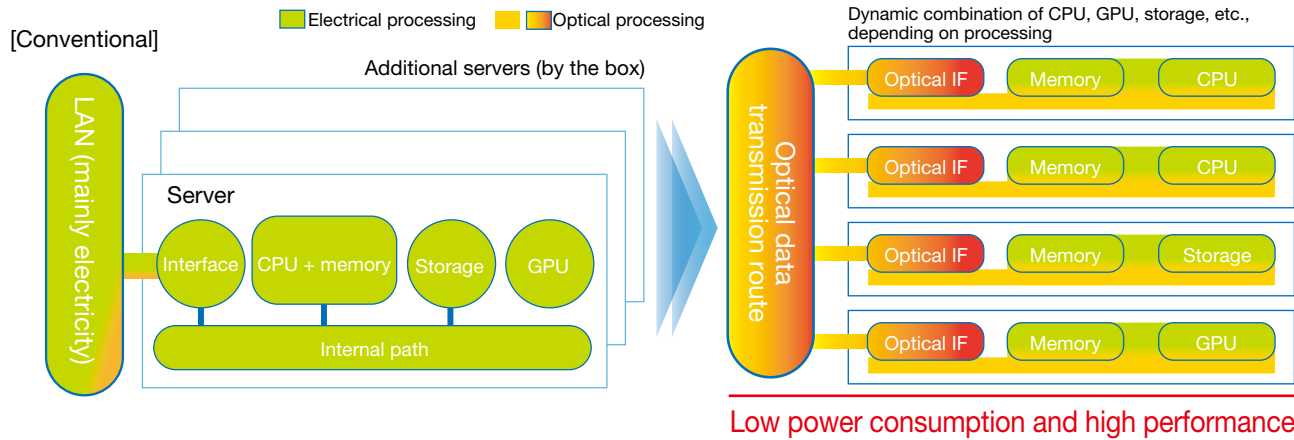
This allows for a scalable computing infrastructure with ultra-low power consumption, high-speed processing, and the ability to add as many parts as required. One potential business model in this case would involve selling optical transistors. In addition to the optical transistors themselves, products that incorporate photoelectric merging technology and optical modulators into computer motherboards and semiconductor packages are also a possibility. Essentially, we would be selling key components. Next, we will expand the scope somewhat to include all-photonics networks, which utilize optics between networks, and areas outside the data center. Optical transmission technology used in the core of relay systems that connect cities and in metro networks that extend throughout cities can be expanded to the end user's neighborhood, which would allow for flexible configuration of ultra-high-capacity optical paths, such as a "one wavelength per person" model, for each application. It

would be like having a dedicated, on-demand, one-to-one optical line with no video compression and almost no delay in transmission and reception. APNs could be used for the mobile fronthaul portion that links base stations and mobile antennas. In urban areas, the population changes depending on whether it is day or night, so traffic volumes will inevitably vary. For this reason, load balancing, which dynamically constructs optical paths, can be used to reduce power consumption.

APNs can also be used as lines linking data centers. These days, it is difficult to set up large data centers that require enormous amounts of power.

In the future, small- and medium-sized data centers will be dispersed over a broad area, and it will be necessary to connect these distributed data centers using light so that they can operate at a level comparable to that of large-scale data centers. Large-scale data centers require enormous amounts of electricity,

but if spread out, they can also make use of renewable energy generated close to their locations, thus enabling local production for local consumption of energy. Potential business models for cases in which APNs are provided include: acting as an infrastructure service provider, such as providing mobile fronthaul and networks between data centers; a data center business that provides distributed data centers connected by APNs; and a product business selling optical transceivers to be installed in data centers edges.

All-photonics network (APN) characteristics

Existing network

Packet NW

Communication node — Packet network — Communication node
■ Increased delay & power consumption due to increase in relay nodes (number of stages)

Dark fiber

Communication node — Dark fiber — Communication node
■ High availability and dynamic load balancing are not possible to achieve Difficult to improve resource usage efficiency

APN

Communication node / Optical TRX — **APN** — Optical TRX / Communication node
■ Connect using wavelength paths between communication nodes
■ Dynamic control of wavelength paths for high availability and dynamic load balancing
■ Low-power data transfer achieved

Photonic disaggregated computing

Data Centers Thus Far

Department store type

Extensive power consumption at a single large consolidated site

Large-scale power generation and electricity supply to a broad area are prerequisites

Decentralized data centers

Data station

Convenience store type

High-speed, low-latency connection of small- to medium-sized sites (data stations) via APNs

Support local production and consumption of energy

What are some use cases?

IOWN is an innovative concept based on light that communicates and processes things as-is and helps to create a new smart society with low energy consumption in a sustainable manner that is not attainable with our current internet. Some use cases that are anticipated at this stage include the following.

While (1) providing interconnect solutions for data center operators and (2) providing mobile networks for mobile operators have already been intro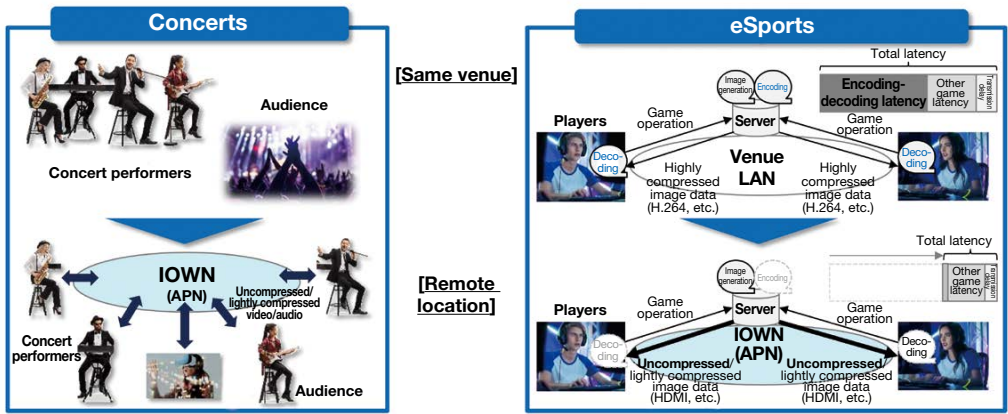duced, (3) providing networks for events (live broadcasts, cloud-based e-sports broadcasts) is another potential use case. We have already conducted demonstration tests for cloud-based e-sports event broadcasts. Competitive games via the cloud are fought in real time, and it will be essential to exchange large amounts of 8k video data with a delay of less than 20 ms. A delay of a few milliseconds compared to a delay 10 times that amount will result in a different attack timing. It is impossible to fight within a game in an environment where the timing of attacks is off due to delay. The delay in the demonstration test was 20 ms, but we are making efforts to lower this to a few milliseconds, and we are currently developing a system that can control the delay in 1-μs increments to enable synchronization.

Future schedule and milestones

We hope to conduct early demonstrations of these use cases, receive feedback from customers, and further refine the IOWN technology. Then, starting around 2020, we have been proceeding with field demonstrations to users and areas that need advanced services, such as smart cities and critical infrastructure. Around fiscal 2022, we will roll out services, though it will still be limited to specific uses and areas. After 2026, we will expand the service nationwide by connecting areas where it has already been implemented. Also, an important event coming up in the near future is the Osaka Kansai Expo 2025. We hope to convey a part of our IOWN-based worldview in an easy-to-understand manner, combining some of the IOWN technologies we have mentioned thus far with existing technologies as well. In doing so, we hope to present a new kind of value through partnerships with various companies and organizations, which will lead to these technologies subsequently being implemented throughout society.

Virtual reproduction of real life (concerts, eSports)

• Reproduction of events offering two-way exchange of high-definition video and audio within a virtual space
• Low-latency data exchange allows for those at remote locations to have the same experience as those at the venue
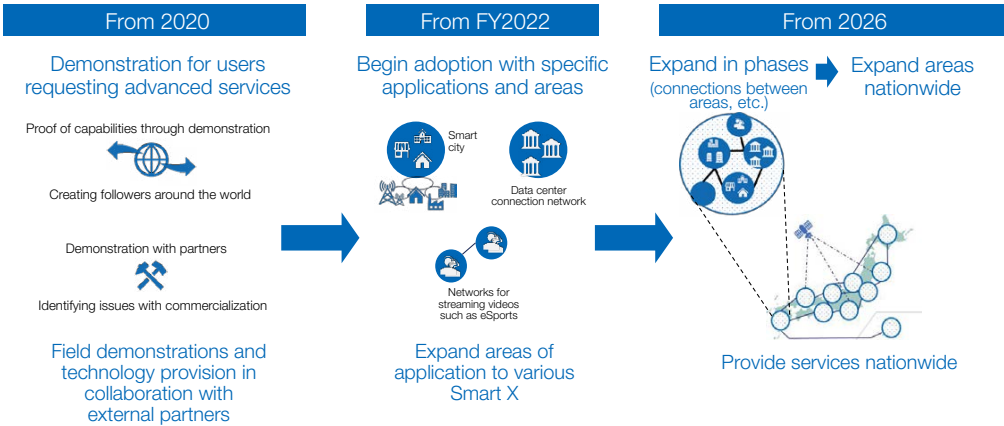

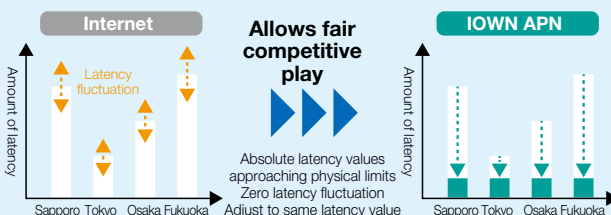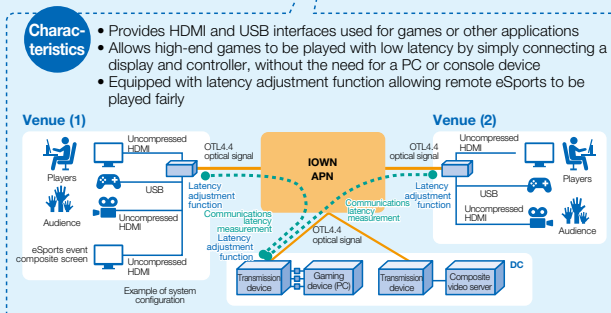Copyright © 2021 Nippon Telegraph and Telephone Corporation

IOWN Expansion Roadmap
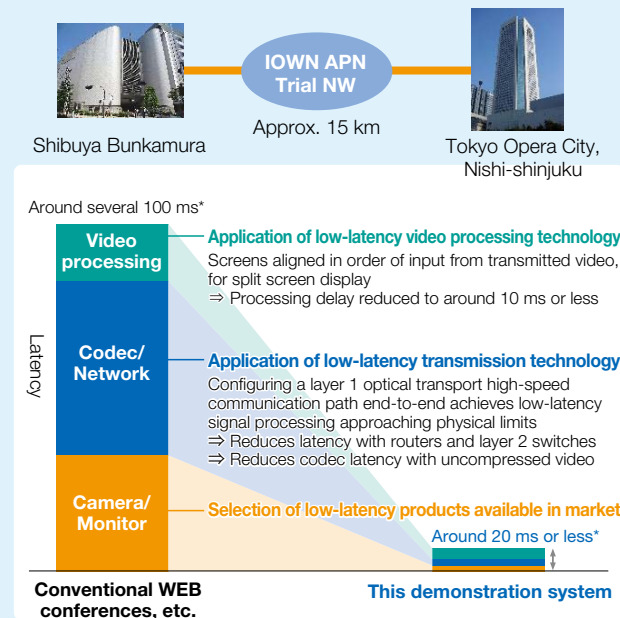
IOWN Case Studies

(1) Optical Network Technologies to Support eSports

- For eSports events hosted among multiple sites, IOWN APN offers a gaming UX no way inferior to the UX of in-person events.
- Transferring uncompressed or slightly-compressed video signals enable users to use remote servers in distant data centers with simple operational inputs and video displays. Functions that offer network delay measurement and adjustments also ensure fairness in remote events held among multiple sites.

Sapporo

Fukuoka Osaka Tokyo

Charac-teristics
- Provides HDMI and USB interfaces used for games or other applications
- Allows high-end games to be played with low latency by simply connecting a display and controller, without the need for a PC or console device
- Equipped with latency adjustment function allowing remote eSports to be played fairly

Venue (1)

Players
Uncompressed HDMI
USB
Audience
Uncompressed HDMI
eSports event composite screen
Uncompressed HDMI

OTL4.4 optical signal

IOWN APN

Latency adjustment function
Communications latency measurement
Communications latency measurement
Latency adjustment function
OTL4.4 optical signal

Venue (2)

OTL4.4 optical signal
Uncompressed HDMI
USB
Uncompressed HDMI
Players
Audience

Transmission device Gaming device (PC) Transmission device Composite video server DC

Example of system configuration

Internet

Amount of latency

Latency fluctuation

Sapporo Tokyo Osaka Fukuoka

Allows fair competitive play

▶▶▶

Absolute latency values approaching physical limits
Zero latency fluctuation
Adjust to same latency value

IOWN APN

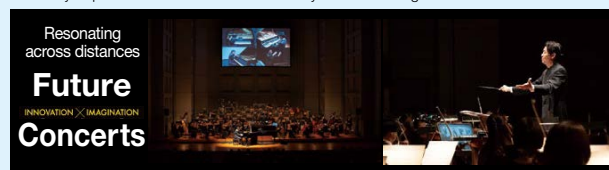Amount of latency

Sapporo Tokyo Osaka Fukuoka

(2) Real-time Remote Orchestral Ensembles with "Future Concerts"

- Allows for real-time remote sessions over IOWN APN that eliminates the need for performers to gather in the same location.
- Forming a split screen from multiple video streams delivered from multiple locations with low latency makes it possible to reduce video delays without sacrificing the low latency features of the APN, and allows multiple remote locations to exchange video without perceptible time lag.
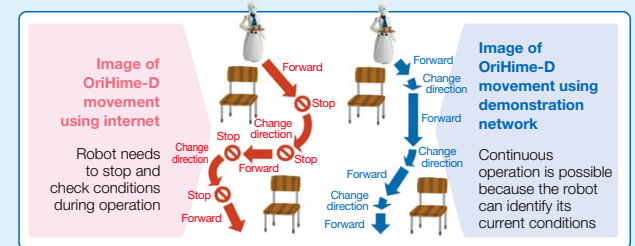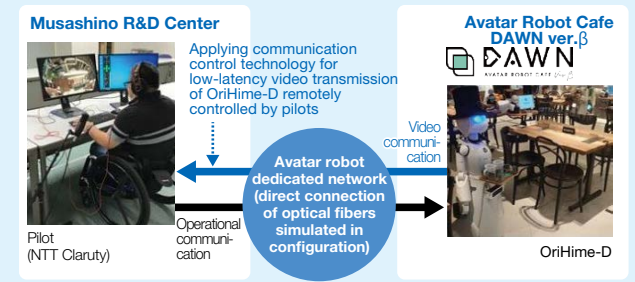
IOWN APN Trial NW

Approx. 15 km

Shibuya Bunkamura

Tokyo Opera City, Nishi-shinjuku

Around several 100 ms*

Latency

Video processing

Application of low-latency video processing technology
Screens aligned in order of input from transmitted video, for split screen display
⇒ Processing delay reduced to around 10 ms or less

Codec/ Network

Application of low-latency transmission technology
Configuring a layer 1 optical transport high-speed communication path end-to-end achieves low-latency signal processing approaching physical limits
⇒ Reduces latency with routers and layer 2 switches
⇒ Reduces codec latency with uncompressed video

Camera/ Monitor

Selection of low-latency products available in market

Around 20 ms or less*

Conventional WEB conferences, etc.

This demonstration system

* Latency depends on conditions and overall systems including factors other than transmission

Resonating across distances

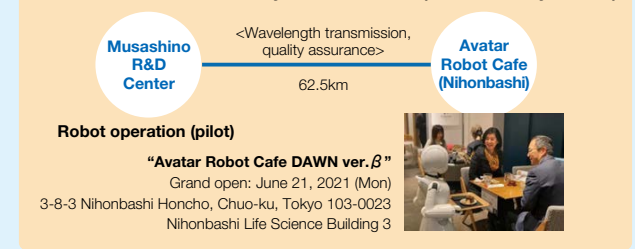**Future**
INNOVATION × IMAGINATION
Concerts

Source: NHK News "Good Morning Japan"

(3) Natural Remote Control Utilizing Avatar Robots

- The low latency of IOWN has enabled remote robot operation without any time lag perceived by the operator.
- Video delays transmitted over the internet make it difficult to operate the robot because the robot had to be stopped often to check its status. This demonstration allowed robots to be controlled in real time with feedback, verifying that the robots could move along the same route in half the time.

Musashino R&D Center

Applying communication control technology for low-latency video transmission of OriHime-D remotely controlled by pilots

Pilot (NTT Claruty)

Operational communi-cation

Avatar robot dedicated network (direct connection of optical fibers simulated in configuration)

Avatar Robot Cafe DAWN ver.β
DAWN
AVATAR ROBOT CAFE

Video communi-cation

OriHime-D

Image of OriHime-D movement using internet
Robot needs to stop and check conditions during operation

Forward Stop
Change direction Stop
Change direction Stop
Change direction Forward
Stop
Forward

Image of OriHime-D movement using demonstration network
Continuous operation is possible because the robot can identify its current conditions

Forward
Change direction
Forward
Change direction
Forward
Change direction
Forward

Demonstration test of remotely controlled robot (linked with OryLab Inc.)

Musashino R&D Center
<Wavelength transmission, quality assurance>
62.5km
Avatar Robot Cafe (Nihonbashi)

Robot operation (pilot)

"Avatar Robot Cafe DAWN ver.β"
Grand open: June 21, 2021 (Mon)
3-8-3 Nihonbashi Honcho, Chuo-ku, Tokyo 103-0023
Nihonbashi Life Science Building 3

Business Activity 18

Contribution to the revitalization of local communities and economies

Our commitment

As a leader in digital transformation, we will act and contribute to helping resolve the social challenges unique to each country
For example, the declining birthrate and aging population, proper education, equitable healthcare, regional economic development, and long-term value through technology for the next generations

Our objective

97%

Development rate of 5G infrastructure maintenance (by FY2023)

Contributing to the Vitalization of Regional Societies and Economies

- NTT ArtTechnology Corporation was established in December 2020 to protect various tangible and intangible cultural and artistic assets, and to promote the appeal of regions both domestically and abroad by broadly spreading new online-based styles of cultural and artistic appreciation.
- Provided a simple and secure online storage service for SMEs. "Cowork Storage" was released in March 2021 to provide a more flexible and extensive service with file sharing functions to build secure computing environments, and used in a similar way to NAS or file servers.
- Established Co-Designing Institute for Polyphonic Society in July 2021 to promote regional vitalization by providing consulting services aimed at supporting the activities of municipalities, companies, organizations and other associated groups (local communities, public private partnerships) that are facing issues achieving revitalization at a local level.

Advancing Personalization by Supporting the Transformation of Lifestyles

We support customers as they transform ever-diversifying lifestyles by providing personal solutions centered on DOCOMO that closely align with individual needs. Number of cell phone subscribers totaled 84.75 million in fiscal 2021.

In terms of service, we are enhancing electronic payment and contents while utilizing AI and big data to improve communication with every customer.

Promoting Digital Transformation

We are raising operational efficiency by introducing robotic process automation (RPA)[*1]. The operational process has been adopted in approximately 2,900 cases within the NTT Group as of the end of June 2020. We are also recommending the use of RPA among our customers, and more than around 6,500 of them have adopted the process as of the end of June 2020. We also sought to advance our Group management by actively introducing a unified enterprise resource planning (ERP)[*2] system for our personnel, finance, and procurement operations.

Business Activity

Initiatives for the Realization and Deployment of 5G

We launched our commercial 5G services in March 2020, and we will provide billing plans such as 5G Gigaho and 5G Gigalight, seven types of 5G devices, services in the gaming, music and sports genres, and solutions that contribute to advancing industry and driving digital transformation.

Furthermore, we are promoting initiatives that will increase convenience and enrich people's lives by creating new value and offering solutions for social issues toward our goal of rolling out services to all 1,741 municipalities in Japan, and achieving coverage for 90% or more of the population, by March 2024.

*1 Solution for automating operations previously handled by humans by establishing procedural rules to replace humans with robots.

*2 Management method for implementing centralized management of corporate resources to achieve optimization across the entire company.

Promotional Activity

"Regional agricultural culture connected with 'NTT-grown' tomatoes"

NTT East is advancing the agricultural DX concept as part of efforts to achieve a local, sustainable recycling-oriented society.

Proving support for smart agriculture by utilizing AI, IoT, drones and other ICT is part of this initiative.

While agriculture makes up the core industry in many regions, the reality is that the majority of agricultural produce relies on imports. As an IT operator, efforts were made to see if we could address the challenges that the agricultural business faces, such as an aging population and shortage of workers. NTTe-City Labo (NTT Central Training Center) harvests "NTT-grown" tomatoes available in the market grown by NTT AgriTechnology cultivation staff in its state-of-the-art vinyl greenhouses, and supplies for municipal elementary school lunches as part of a local production and consumption model. To learn how the tomatoes they eat were cultivated, 80 students from the local elementary school visited the farm as part of a field trip, making the initiative a valuable lesson for dietary education.

Robot equipped with a 4K camera.
The remotely controlled robot moves around the greenhouse to carefully check the condition of tomatoes.

Initiatives for Universal Design[*1]

The NTT Group actively encourages the broader adoption of universal design, which ensures that products and services are easy for all customers to use, regardless of age, gender or physical abilities.

Examples of Universal Design Products and Services in Fiscal 2021

- Oshaberi Annaiban, an AI-based information board capable of engaging in natural conversation
- Smart Room Mimamori, a system for monitoring elderly citizens
- Home Currency Anywhere, which allows consumers to use their own country's currencies anytime, anywhere
- Face Sharing, a technology that reproduces the mouth movements and facial expressions of someone else onto the user's own face
- Small self-driving mobility technology and free rental service for next-generation electric wheelchairs

*1 Products and services that can be used by senior citizens, children, persons with disabilities, and foreign visitors facing language barriers (includes expanded functions)

*2 JIS X 8341-3:2016: "Guidelines for older persons and persons with disabilities—information and telecommunications equipment, software and services— Part 3: Web content" of Japanese Industrial Standards

*3 Refers to compliance with the description defined in the "Compliance Performance Announcement Guidelines for JIS X 8341-3:2016. March 2016 Edition (published on March 22, 2016)" of the Web Accessibility Infrastructure Committee, Info-communication Access Council. This means that we have established and disclosed an accessibility policy and confirmed that the pages fulfilled all the requirements through the tests implemented and based on JIS X 8341-3:2016.

Establishment of the NTT Group Web Accessibility Policy

The NTT Group is working to ensure and improve the accessibility of its websites for a wide spectrum of customers, including senior citizens and persons with disabilities. Specifically, the Group established the NTT Group Web Accessibility Policy. The policy for official websites of the Group companies with head office functions in Japan is set according to JIS X 8341-3:2016[*2] and each works to comply[*3] with Level AA.

NTT Group "Web Accessibility" Initiatives (Japanese only)
https://group.ntt/jp/accessibility/

User-Friendly Service Lineup

We offer a broad range of discount services for various users, including senior citizens and persons with special needs, to facilitate access to ICT services.

Special discounts on dedicated lines for educational facilities (NTT East and NTT West)

Since January 2001, NTT East and NTT West have offered special fees for schools on FLET'S services suitable for using the Internet at a fixed sum in an effort to promote educational use of the Internet.

NTT EAST (Japanese only)
https://business.ntt-east.co.jp/service/schoolplan/

NTT West (Japanese only)
https://flets-w.com/limited/school/

Discounts on mobile phone use for persons with special needs (NTT DOCOMO)

NTT DOCOMO offers the Hearty Discount programs for encouraging more social participation by persons with disabilities.
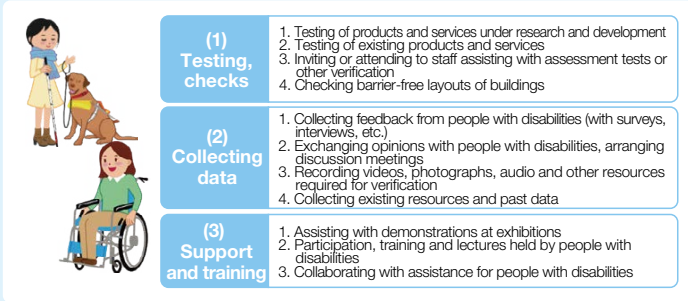
Examples of Hearty Discount Programs

- DOCOMO's GIGA plans ➡ **1,370 yen discount** (rate plan for subscribers after October 1, 2019. includes discount for sp-mode usage)
- Voice options ➡ **700 yen discount**
- Monthly fees on various services such as voice mail ➡ **60% discount**
- Video phone call charges ➡ **Set at same level as voice call charges**
- Charges for some subscription options ➡ **No charge**
- Support for setup of smartphones etc. ➡ **No charge**
- Dialing and obtaining information via 104 directory assistance ➡ **No charge**

https://www.nttdocomo.co.jp/charge/discount/hearty/about/index.html (Japanese only)
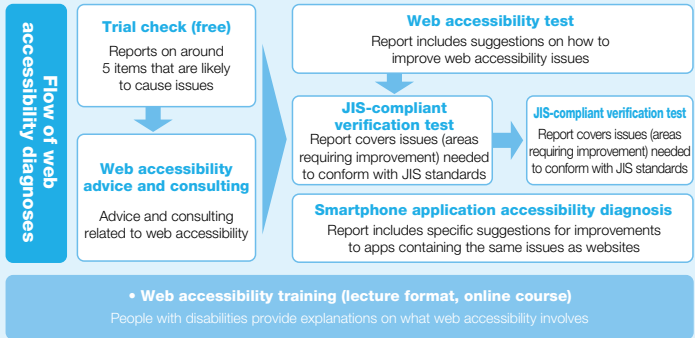
Promotional Activity

Consulting for universal design

NTT Claruty employs a large number of people with various disabilities. The company provides consulting services to suit customer requirements from an early stage of research, development and planning, with the view to designing structures with barrier-free layouts, accessibility assurance, universal design, and inclusive design.

(1) Testing, checks	1. Testing of products and services under research and development 2. Testing of existing products and services 3. Inviting or attending to staff assisting with assessment tests or other verification 4. Checking barrier-free layouts of buildings
(2) Collecting data	1. Collecting feedback from people with disabilities (with surveys, interviews, etc.) 2. Exchanging opinions with people with disabilities, arranging discussion meetings 3. Recording videos, photographs, audio and other resources required for verification 4. Collecting existing resources and past data
(3) Support and training	1. Assisting with demonstrations at exhibitions 2. Participation, training and lectures held by people with disabilities 3. Collaborating with assistance for people with disabilities

Web accessibility diagnosis

NTT Claruty offers a broad range of services catering to web accessibility, by suggesting ways to make improvements to barriers present on websites from the perspective of use by people with disabilities.

Flow of web accessibility diagnoses

Trial check (free)
Reports on around 5 items that are likely to cause issues

Web accessibility advice and consulting
Advice and consulting related to web accessibility

Web accessibility test
Report includes suggestions on how to improve web accessibility issues

JIS-compliant verification test
Report covers issues (areas requiring improvement) needed to conform with JIS standards

JIS-compliant verification test
Report covers issues (areas requiring improvement) needed to conform with JIS standards

Smartphone application accessibility diagnosis
Report includes specific suggestions for improvements to apps containing the same issues as websites

- **Web accessibility training (lecture format, online course)**
People with disabilities provide explanations on what web accessibility involves

Policies and Concepts to Pursue Customer Satisfaction

The NTT Group serves various customers, from general consumers to corporate customers, providing a broad range of products and services.

Its main business fields, the telecommunications and ICT industries, continue to innovate, producing new products and services. Mobile devices such as smartphones and tablets continue to evolve almost daily, giving rise to a number of new services utilizing the NTT Group's network. At the same time, with the evolution of technology and services, the amount of information needed to use them has increased, and this has also increased opportunities for us to receive various confirmations, inquiries, feedback and requests from customers with regard to device malfunctions and questions about various fees and services.

The NTT Group believes that resolving customers' concerns or questions about the services they use and maintaining a high level of satisfaction for all customers will foster a relationships of trust with customers and lead to the acquisition of new customers.

Organization for Implementation

The NTT Group companies have built a system for making operational improvements that will lead to reductions in the time taken to respond to customers, enhancing products and services, and influencing development based on the voice of customers received through surveys, the Customer Services Center, and other departments. In turn, we work toward developing and providing services closely in tune with the voice of our customers. Specifically, we work continuously to improve our year-over-year results for the KPIs of the reduction in waiting and customer service times at DOCOMO shops, the number of improvements made based on suggestions from customers, and the response rate of our call centers, which will give rise to a positive cycle of improvement.

The NTT Group will keep on making efforts to raise the level of customer satisfaction, including service quality and on-site responsiveness required by customers, in conjunction with the business operations of individual NTT Group companies.

Main Initiatives

Customer Contact Points

Each Group company has set up a call center that responds to customer inquiries on products and services, requests for repairs, and complaints. Major call centers of the NTT Group receive over 180,000 calls each day and endeavor to respond promptly to customers. Each call center has set its own targets aimed at improving response rates and enhancing the quality of responses and support. They also engage in various efforts including telephone response competitions and training to enhance skills for providing better responses.

COVID-19 Outbreak and Support for Customers

In March 2020, NTT Group companies announced their policy of extending payment dates upon request from customers facing difficulties in paying for services on time, and this policy was extended through to the end of November 2021.

Recognizing that the government's stay home request created an environment that made it difficult for customers to use their d POINTS, NTT DOCOMO decided to reactivate d POINTS that expired between March and May 2020 and award them to customers, effectively extending their expiration dates.

In light of schools implementing remote classes and online education, a partial waiver of data communication fees was announced to support the use of smartphones for online learning. NTT Group companies have also been supporting telework, education, and health by setting up customer contact points and providing some services free of charge as initiatives. At the same time, the NTT Group has been using the way cell phones connect to analyze demographic changes caused by government policies addressing the spread of COVID-19 and providing information to central and local governments and the media.

Reflecting the Voice of Customers

The NTT Group listens to the voice of its customers, including their opinions and requests, through its call centers. Each Group company has constructed a system for reflecting the voice of customers in making operational upgrades and improving and developing products and services, and they are making an active effort in related activities as well.

For example, NTT Communications collects the voice of customers through various contact points in an effort to reinforce initiatives for enhancing services and improving operational processes. This includes not only annual surveys, but also soliciting customer feedback at the time of application and during various support processes.

For more information on these initiatives, please refer to each company's website, Sustainability Report, and other materials.

NTT East "Service with a Smile" activities (Japanese only)
http://www.ntt-east.co.jp/smile/

NTT West "Customers First" activities (Japanese only)
https://www.ntt-west.co.jp/withc/

NTT Communications "For Increased Customer Satisfaction" (Japanese only)
https://www.ntt.com/about-us/cs

NTT DOCOMO "Initiatives That Utilize Feedback from Customers" (Japanese only)
https://www.nttdocomo.co.jp/support/cs/case/index.html

Promotional Activity

Social impact of "flow of people data" generated from approximately 85 million samples

DOCOMO InsightMarketing provides "mobile spatial statistics" that visualizes the movement of people. Society and the economy are closely linked to how people move around. "Mobile spatial statistics" provides a way to "visualize" the movement of people, and is an essential technology as the foundation of all efforts to support society. Providing citizens with accurate data on clusters with high concentrations of people, particularly during the COVID-19 pandemic, made a significant contribution to society.

When the state of emergency was first declared in April 2020, countless people were restricted from going outside. At the time, preventing infections required avoiding "clusters," and DOCOMO received inquiries from media outlets around the clock requesting the use of "mobile spatial statistics" for identifying areas of congestion in real-time. DOCOMO also felt the need for neutral information that was not subjected to the bias of any particular media outlet.

In response to these requests, efforts were made to make "mobile spatial statistics" accessible to everybody so that information could be viewed from anywhere. Population maps shown to visualize areas of congestion as heat maps were made available for free, to much positive response.

Social Challenge

8 DECENT WORK AND ECONOMIC GROWTH

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

11 SUSTAINABLE CITIES AND COMMUNITIES

17 PARTNERSHIPS FOR THE GOALS

6

Moving towards a safe, secure, and resilient society

Business Activity

19. Ensuring the stability and reliability of services
20. Strengthening information security and personal information protection
21. Contribution to the revitalization of local communities and economies

Why it matters

As a company that supports the vital infrastructure of a digitalized society, the NTT Group believes one of its responsibilities is to make use of technology to keep people safe and secure from the major threats of this century: epidemics, natural disasters, and digital disasters like cyber-attacks.

What can be accomplished

As a company that supports the vital infrastructure of a digitalized society, we will make full use of technology to keep people safe and secure from epidemics, natural disasters, digital disasters like cyber-attacks, and achieve a more resilient society.

Future vision

The NTT Group is committed to contributing to the development of society by acknowledging diverse cultures, and thus we will contribute to solving social issues by connecting people, goods, and cultures, including communities, nations, and society, while promoting high ethical standards, diversity, and inclusion in fair and equitable ways, and work towards creating a better workplace through powerful and new digital technologies.

Business Activity 19

Ensuring the stability and reliability of services

Our commitment

As a company that supports the vital infrastructure of a digitalized society, we will make full use of technology to keep people safe and secure from epidemics, natural disasters, digital disasters like cyber-attacks, and achieve a more resilient society

Our objectives

0

Number of major accidents

99.99%

Stable service provision rate

Policies and Concepts

As a corporate group with the mission of serving society by sustaining telecommunications infrastructure in normal times, the NTT Group is committed to building highly reliable telecommunications networks that connect people anytime, anywhere. Since telecommunications takes on a greater importance in the event of a disaster, we endeavor to secure the means of communication necessary for maintaining public order and for rescue and restoration operations at times of disasters, and for emergency communications, such as 110, 118, and 119. Japan is a country particularly prone to natural disasters such as earthquakes and typhoons. The importance of telecommunications networks was reaffirmed by the devastating Great East Japan Earthquake. Facing the possibility of an earthquake directly underneath Tokyo or the Nankai Trough off Japan's southern coastline, there is a pressing need for society to prepare for such potential disasters while ensuring the stability and reliability of its telecommunications infrastructure.

The NTT Group has defined three key themes for disaster countermeasures: securing critical communications, prompt restoration of telecommunications services, and improving network reliability. We have been strengthening efforts based on these themes since the Great East Japan Earthquake. We have also included Disaster Countermeasure Initiatives in our medium-term management strategy and are making a focused effort to further reinforce the communications infrastructure, seek proactive disaster response, and adequately provide information to the affected people.

Organization for Implementation

Five Group companies—NTT, NTT East, NTT West, NTT Communications, and NTT DOCOMO—are designated public institutions under the Basic Act on Disaster Control Measures. Accordingly, based on this Act, in preparation for a disaster, the NTT Group has formulated the Disaster Management Operation Plan for the purpose of smooth, appropriate implementation of measures to prevent damage. Each company has prepared their respective Disaster Management Operation Plan by organizing response efforts that are mobilized at the time of a disaster in a manner proportionate to the scope and circumstances of the situation. At the same time, we will maintain close contact with the relevant government institutions to ensure a smooth and appropriate recovery from the disaster and secure critical communications.

We are also taking measures in normal times to improve the reliability of our telecommunications infrastructure. To ensure that our telecommunications services operate without interruption at all times, we employ transmission trunk line multi-routing, have enacted blackout countermeasures for telecommunications buildings and base stations, and are making telecommunications buildings more quakeproof. In addition, we are expanding the assortment of power supply vehicles and other disaster response equipment that we have positioned throughout Japan and are repeatedly conducting training to prepare for major natural disasters. We are making a daily effort to secure the necessary emergency and critical communications.

NTT Group Disaster Management Operation Plan
https://group.ntt/en/disaster/plan/

Main Initiatives

Securing Critical Communications

To secure necessary communications in the event of a disaster, the NTT Group is implementing various response measures, including the installation of emergency-use public phones, a mobile phone lending service in affected areas, and providing means to confirm the safety of people in affected areas. We simultaneously install multiple lines to secure connections to the headquarters of the police department, fire department, and coast guard to prepare against the possibility that the 110, 119, and 118 emergency call services may be damaged.

A major disaster could also lead to social disorder, such as the disruption of transport systems. In such an event, we would consider the overall situation, including whether other telecommunications carriers have put restrictions on mobile and fixed line phones and, if necessary, offer the use of public phones for free.* We will not charge carriers for which we have set call fees and will not settle payments between carriers for which we have set connection fees. For the specific names of carriers, please refer to the following websites.

(Japanese only)

Free charge public phone policy for areas covered by NTT East
https://www.ntt-east.co.jp/info-st/saigai/

Free charge public phone policy for areas covered by NTT West
https://www.ntt-west.co.jp/ptd/basis/disaster.html


Improving communications network reliability

Building disaster-resistant facilities and transmission trunk line multi-routing 24/7 network monitoring and control, etc.

Countermeasures strengthened since the Great East Japan Earthquake
- Enhanced disaster resistance (damage prediction, hazard map utilization)
- Stable provision of telecommunications services (improving trunk line reliability, etc.)
- Introduction of large-zone base stations to provide backup for broad disaster relief in densely populated areas

Additional efforts in light of the growing intensity of disasters in recent years
- Introduction of medium zone base stations with enhanced disaster resilience compared to existing base stations
- Looking into placing cables underground, wireless fixed-line phones, etc.

Three key themes for countermeasures
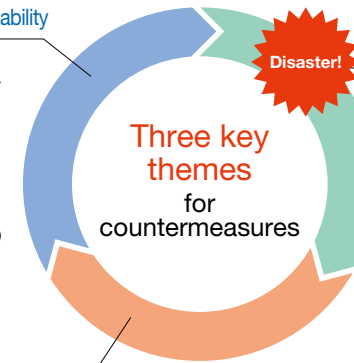
Disaster!

Securing Critical Communications

Securing 110, 119, and other emergency services and critical communications Installing emergency-use public phones and providing safety status checking services when disasters strike, etc.

Countermeasures strengthened since the Great East Japan Earthquake
- Measures for securing critical communications
- Early resolution of communications blackouts
- Enhancements of disaster message services
- Further Information Station implementation

Prompt restoration of telecommunications services

Early restoration of services by utilizing disaster countermeasure equipment, procurement of materials, equipment, and manpower for restoration purposes, etc.

Countermeasures strengthened since the Great East Japan Earthquake
- Building up stock of disaster response equipment
- Enhancement of organization for disaster countermeasure operations
- Exercises and practice for a major earthquake
- Training of crisis management personnel and utilization of knowledge and skills

Additional efforts in light of the growing intensity of disasters in recent years
- Centralized management and operation of Group-owned power supply vehicles
- Advance launch of restoration system based on damage estimation made using AI
- Appropriate information dissemination (service availability, recharging spots, availability of public phones for disasters, etc.)
- Consultation about problems in disaster-stricken areas (113 on-site visits)

Further Enhancing Our Ability to Respond to Severe Disasters

Considering our disaster response based on unexpected scenarios for possible future catastrophic disasters, such as a massive earthquake or eruption at Mt. Fuji

- **Faster** : Predictive support for complex troubleshooting that exceeds human judgment through DX, such as AI and data utilization
- **Stronger** : Utilizing self-supplied energy, such as battery-equipped electric vehicles and on-site renewable energy generation
- **Safer** : Implement BCP measures such as diversifying supply chains and dispersing business locations and employee residences

Providing Services for Easy Safety Status Checking and Information Gathering When Disaster Strikes

The NTT Group launches and provides the following services to enable people to confirm the safety of relatives and friends in areas hit by a major disaster that has disrupted phone connections.

When we launch these emergency services in the event of a disaster or other contingency, we promptly inform our customers through the mass media, website, and other means.

By integrating the Web 171 Disaster Message Board with the Disaster Message Board Service for mobile and PHS phones (i-mode/sp-mode), we have also made it possible to conduct one-stop searches spanning both services from the companies providing those services. There are additional functions for notifying designated contacts by e-mail or voice when safety status information is posted.

We are continuing to make improvements, such as by offering support in English, Chinese, and Korean for the Web 171 Disaster Message Board, and in English for the Disaster Message Board Service (i-mode/spmode), increasing the number of messages that can be posted and extending message storage time.

With regard to the Web 171 Disaster Message Board, NTT East, and NTT West agreed to collaborate with the disaster message boards operated by NTT DOCOMO, KDDI, and SoftBank to allow users to check each other's messages left with these carriers since August 2019.

Main Services
- 171 Disaster Emergency Message Dial
  We store recorded voice messages left by users to confirm the safety of those in affected areas
- Web 171 Disaster Message Board
  We store text messages left by users via the Internet
- Disaster Message Board Service (i-mode/sp-mode)
  We store text messages left by users via mobile phone

Securing the Stability and Reliability of Telecommunications Services

Damage from natural disasters is becoming increasingly common in recent years as climate change causes more frequent instances of heavy rains, frequent typhoons, and other natural disasters. As a result, there is a growing risk of water and lightning damage and power outages, which now threaten to cause extensive damage should they occur.

The NTT Group is devoted to early restoration of telecommunications services by deploying and enhancing the functions of mobile power supply vehicles, portable satellite equipment, and other mobile equipment as well as participating in disaster drills held in the respective regions. The NTT Group endeavors to build disaster-resistant communications infrastructure and maintain and operate it in a way that ensures its proper functioning at all times by conducting regular safety patrols, replacing devices as a preventive maintenance measure, and other such means, in an effort to develop disaster-resilient communication networks and equipment.

Ensuring the Disaster Resistance of Telecommunications Equipment

We also strive to enable telecommunications equipment housings, pylons, and other facilities to withstand contingencies such as earthquakes, storms, flooding, fire, and power outages in accordance with predetermined design standards.

Main Measures
- NTT's telecommunications buildings and pylons are designed to withstand earthquakes of a seismic intensity of 7 on Japan's intensity scale and 60 m/sec winds experienced during the strongest typhoons
- Our facilities are equipped with flood doors and other defenses according to location to prevent inundation of telecommunications equipment by tsunamis or floods
- We equip our telecommunications equipment rooms with fire doors or shutters
- Our telecommunications buildings and wireless base stations are fitted with backup power sources to keep them running for extended periods in the event of sudden power outages
- As a further fallback, power supply vehicles can be hooked up to them to supply power
- We use trunk line multi-routing to ensure that our telecommunications services operate without interruption at all times
- We deploy large-zone base stations capable of covering wide areas during disasters and other emergency situations
- We install emergency power supply fuel tanks

Increasing the Resilience of Equipment and Speeding Up Our Response

In recent years, disasters of greater magnitude have had significant impact. To address the increased impact on telecommunications equipment and services, as well as the longer time required to resume operations, we are also promoting additional initiatives toward such goals as increasing the resilience of our equipment and speeding up recovery.

Main Initiatives for Increasing the Resilience of Telecommunications Equipment
- Expansion in medium-zone base stations equipped to deal with disasters, such as blackout countermeasures
- Blackout countermeasures that use electric vehicles at base stations
- Centralized management and mobilization of approximately 400 power supply vehicles owned by the NTT Group
- Consideration of underground installation of power transmission cables and use of fixed line phones to deal with the impact of disasters

Main Initiatives for Speeding Up Service Recovery
- Advanced launch of recovery framework (national wide-area support system and other frameworks) based on damage prediction using AI
- Reinforcement of the recovery framework and recruitment of personnel, including the use of retired NTT employees

Initiatives for Bolstering Support for Disaster Victims
- Delivery of realistic and concise information, including status of damage to communications, status of recovery, location of charging stations, public phones in operation during disasters, information for visitors and foreign residents, and more to support evacuation and other activities
- Response to consultations on problems related to communications through emergency 113 call centers dispatched to affected areas

- Collaboration with local governments and other public offices for installing Wi-Fi and charging stations inside public phone booths to secure telecommunications during a disaster

Providing Stable Telecommunications Services in Normal Times

To consistently provide secure telecommunications services to our users, the NTT Group operates a system for monitoring its telecommunications networks, implements measures for preventing accidents and failures, and works to enhance the skills of personnel responsible for network maintenance and operations.
- Operational system for monitoring and controlling the status of network operations on a real-time basis, 24-hours a day, 365 days a year
- Collection and analysis of performance data for telecommunications equipment under ordinary circumstances to identify and deal with signs of failure
- Establishment of a system and a review of procedures to enable prompt and appropriate restoration measures in the event of unexpected problems
- Application of lessons learned from past accidents to similar cases and thorough reinforcement of standard procedures based on an analysis of cases that may result in serious accidents
- Implementation of training and drills and development of related mechanisms for fostering personnel handling network maintenance and operations

Providing Stable Telecommunications Services to Address a Large Spike in Demand Due to the COVID-19 Pandemic

NTT and its major subsidiaries in the telecommunications business have formulated operation plans to execute their responsibilities as designated public institutions and contribute to preventing infections from the standpoint of respecting human life. The spread of infections has been accompanied by an increased demand for Internet use and telework, significantly increasing data traffic, particularly between stationary communication terminals during daytime weekdays. The NTT Group companies have designed their existing networks to meet peak nighttime traffic and are currently capable of providing network capacity for daytime traffic. We will continue to bolster our equipment to deliver stable telecommunications services.

Operation of mobile phone base stations and terminals (NTT DOCOMO)

For more than 60 years, research has been conducted worldwide on the impact of radio waves on the human body. As a result, standards and systems have been put in place for the safe use of radio waves not only in Japan, but around the world, too.

In 1990, Japan's Ministry of Posts and Telecommunications (presently the Ministry of Internal Affairs and Communications) established its own Radio Radiation Protection Guidelines for Human Exposure to Electromagnetic Fields (RRPG) as a set of reference values for the safety of radio waves on the human body based on the results of research conducted over the preceding 40 years both inside and outside Japan. The reference values of these guidelines are the same as those recommended by the World Health Organization (WHO). Radio waves below these reference values are recognized internationally as having no adverse effects on health.

Mobile base stations and terminals of NTT DOCOMO are operated at levels lower than the reference values of the RRPG. Services are provided in compliance with related laws and ordinances incorporating the RRPG, which ensures DOCOMO mobile phones can be safely used.

NTT DOCOMO Radio Wave Safety (Japanese only)
https://www.nttdocomo.co.jp/corporate/csr/network/radio/safe.html

Business Activity

Drones, as a public tool, bring a revolution to "infrastructure inspections" for social infrastructure

"Infrastructure" is something that people do not pay much attention to on a day-to-day basis. The importance of infrastructure underpinning our lifestyles—such as water, electricity, communications, and transportation—first comes to light when any of these services are disrupted. Any disruptions with infrastructure can have a significant impact on so many people, and thus pausing infrastructure inspections is not feasible. Infrastructure across Japan was built rapidly during the period of high economic growth, and after half a century, their dilapidation is becoming a serious issue. Consequently, the importance of regular infrastructure inspections is greater than ever.

A closer look at the cost of inspections of bridges, steel towers and other structures around Japan reveals that they amount to some 30 billion yen annually. When repairs are factored in, this cost increases to around 1 trillion yen. Japan will soon be facing a declining population. This will result in a decrease in tax revenue, which means less costs set aside for inspections. The engineers capable of conducting inspections are also getting older. It is because of this background that efforts are currently being made to use drones to increase the efficiency of inspection work. Japan Infra Waymark was established with the aim of resolving the issue of

deteriorating infrastructure, and uses drones to cover staff shortages for infrastructure inspections. An example that illustrates this is the inspection of elevated bridge supports—inspectors usually assemble scaffolding, use lifts, or sling ropes up to conduct visual inspections of supports. Yet these methods all take time, and are also dangerous to perform.

Instead, drones are being used for this work. A drone jointly developed with an American company is equipped with three cameras on both the top and bottom, which identify target areas just like human eyes, and operates autonomously to avoid flying into obstacles. This is the only type of drone capable of automatically flying to avoid obstacles in areas like below bridges, where GPS signals cannot reach, making it possible to conduct inspections under bridges—something that was not possible in the past. When the drone approaches a target area and takes a photograph, cracks (fractures) as small as 0.05 mm can be identified. When the drone returns back to base, image data is automatically uploaded to the cloud, and an inspection record is created. This increases the efficiency of the entire inspection process, and in the three years since being established, the company has a proven track record of inspecting 6,400 structures (as of June 2022).

NTT Communications and GS Yuasa work together to help create a safe, secure, and stable infrastructure for a carbon-neutral society

Batteries are used in a wide range of applications, including for the shift to electric vehicles to achieve a carbon-neutral society, as well as for curbing output fluctuations from renewable energy sources such as wind power. Advancements in technologies (quicker, more uniform detection level) for detecting failures have become a key challenge for facilitating reliable battery operation.

NTT Communications has jointly developed technology successfully to detect early signs of battery failures by utilizing AI. This technology will be used for more efficient monitoring of large-scale storage battery systems while also achieving labor

savings. Development of AI involved trial and error of systems for detecting different types of batteries, allowing for more advanced detection of failures (quicker, more uniform detection level) and automation.

This means only batteries with potential failures need to be replaced before a failure actually occurs—it also enables monitoring of large-scale systems under more efficient, labor-saving environments, ensuring that batteries are a safe, secure and stable type of infrastructure.

Social Contribution Coordination Agreement with KDDI

On September 11, 2020, NTT formed a social contribution coordination agreement with KDDI to begin mutual cooperation the for joint utilization of ships transporting necessary supplies in the event of large-scale disasters, as well as joint disaster preparedness drills and awareness-raising activities.

Building resilient social infrastructure through these initiatives has the goal of developing a sustainable society. In addition to disaster countermeasures and job assistance, NTT and KDDI will coordinate efforts to identify areas that can benefit from the mutual use of assets of both companies, such as the sound use of smartphones and addressing climate change.

Cooperation with mutual utilization of ships owned by both companies for faster restoration

KDDI cable laying ship KDDI OCEAN LINK

NTT cable laying ship KIZUNA

Employment support for the Employment Ice Age Generation

The employment support initiative developed by NTT together with KDDI provides support for employment such as training related to remote work and ICT skills from March 2021, to applicable people whose employment has been significantly affected due to sudden changes in the social environment such as the employment ice age and the increasing number of infections of novel coronavirus infections in recent years.

The second stage of this initiative provided employment support for the employment ice age generation, leading to 248 successful employees from both companies.

Overview of employment support initiative

	Target number	Overview
Invitations open	8,300	Applications open on special site
Provide remote work skills training	5,800	ICT skills foundation • Web conference usage • Tips for remote work to increase productivity
Provide skills counselling	3,400	Dedicated counsellors provide counselling to 3,400 applicants of the remote work skills trainees
Support for acquiring certification	500 (321 certified)	Support for acquiring certification by providing a 2-month online training program for 500 applicants seeking positions in the ICT and communication industry or roles that utilize ICT
Recruitment and employment activities	500	Provide support for recruitment and employment activities to graduates of the past support-for-acquiring-certification program graduates
Secure employment	248	Employment at the NTT Group, KDDI Group and other suitable companies sought by trainees

[Reference] (breakdown of certified employees) MOS (Microsoft Office Specialist): 97, IT passport: 152, CCNA: 46, CompTIA: 26
(target number of recruitments at time of release) 300 (NTT 100, KDDI 30, other companies 170)

Past Initiatives

1 Improve Communications Network Reliability

- Employ transmission trunk line multi-routing
- Install large-zone base stations
- Build disaster-resistant facilities

2 Secure Critical Communications Systems

- Secure 110, 119, and other emergency services
- Provide tools to check safety status (171)

Disaster!

Telephone
171
Disaster Emergency Message Dial

i-mode cell phones, smartphones, tablets
Disaster Message Board

Internet
web171
Disaster Message Board

3 Promptly Restore Services

- Deploy disaster countermeasure equipment (power supply vehicles, portable satellite equipment, etc.)
- Procure and convey materials and equipment for restoration purposes
- Use drones

Lessons from the Great Hanshin-Awaji Earthquake and the Great East Japan Earthquake

Further Efforts

Major Facility Resilience Initiatives

- Expansion in medium-zone base stations equipped to deal with disasters, such as blackout countermeasures
- Blackout countermeasures that use electric vehicles at base stations
- Centralized management and mobilization of approximately 400 power supply vehicles owned by the NTT Group
- Consideration of underground installation of power transmission cables and use of fixed line phones to deal with the impact of disasters

Main Initiatives for Speeding Up Service Recovery

- Advanced launch of recovery framework (national wide-area support system and other frameworks) based on damage prediction using AI
- Reinforcement of the recovery framework and recruitment of personnel, including the use of retired NTT employees

Initiatives for Bolstering Support for Disaster Victims

- Delivery of realistic and concise information to support evacuation and other activities (status of damage to communications, status of recovery, location of charging stations, public phones in operation during disasters, information for visitors and foreign residents, etc.)
- Response to consultations on problems related to communications through emergency 113 call centers dispatched to affected areas
- Collaboration with local governments and other public offices for installing Wi-Fi and charging stations inside public phone booths to secure telecommunications during a disaster

Disasters causing wider, bigger, and more lasting damage

Countermeasures for Earthquakes, Fires, and Floods

NTT's communications buildings and towers are designed to be sufficiently earthquake-resistant to avoid collapse even in the event of an earthquake with a seismic intensity of 7, and were built to our own strict standards to be able to withstand the worst disasters Japan has ever experienced.

For fires, communications buildings and other buildings were made noncombustible and fireproof, fireproof shutters and doors were installed in communication machinery rooms, and fireproof sealing was applied to through holes.

To prepare for tsunamis and floods, we have taken location-appropriate measures to prevent communications buildings from being flooded, such as replacing building doors with flood doors, closing windows and other openings, and reinforcing walls with concrete to withstand the water pressure from a tsunami.

Blackout Countermeasures at Communications Buildings and Base Stations

Communications buildings and wireless communications base stations are equipped with batteries, engines, and other auxiliary power supplies that can be used as a prolonged source of electricity in the event of a blackout.

Moreover, we are enacting the lessons learned from the Great East Japan Earthquake by implementing blackout countermeasures for engine generators and having batteries available for use around the clock at its roughly 1,900 base stations in important areas, such as those where municipal disaster response headquarters or city offices are located.

In addition, mobile power supply vehicles and portable power generators are deployed in each area as backup to provide support over a wide area to disaster-stricken regions as the situation requires.

Transmission Trunk Line Multi-Routing and Distributed Location of Important Communications Buildings

Our nationwide network of trunk lines has been designed to secure communications and prevent disruption of services over the network as a whole by automatically diverting transmission through other routes when a certain route is damaged. Meanwhile, if communications buildings (important communications buildings) fitted with transit switches suffer disaster damage, communications via such buildings may be severed. Distributing important communications buildings in different locations helps avoid the risk of multiple buildings suffering disaster damage at the same time.

Prompt restoration of telecommunications services

Should a disaster strike, swift action will be taken to restore service via the utilization of mobile disaster response equipment and the use of drones to confirm the situation.
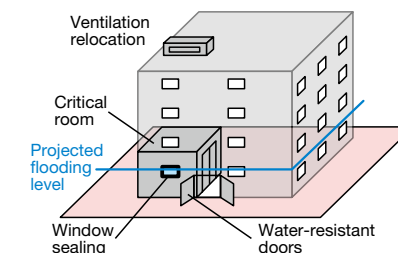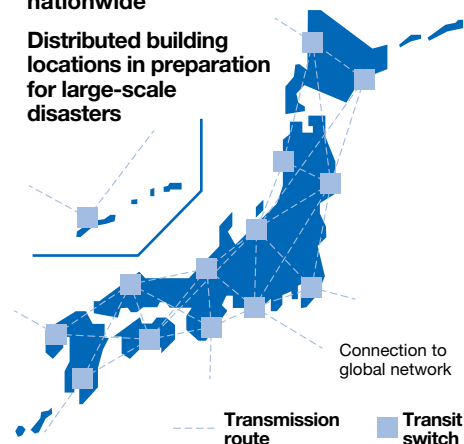
Disaster Response Equipment

NTT has positioned mobile base stations and power supply vehicles across Japan that can be quickly deployed to disaster sites should a wireless communications base station be damaged by a disaster. Moreover, we have adopted off-shore base stations comprised of mobile communications base stations mounted on ships. Should a tsunami or other disaster knock out service over a wide spread of coastal area, we can provide service by using entrance satellite lines to transmit signals to the coastal areas from anchored ships.

Disaster Site Confirmation with Drones

When damage to roads or other conditions prevent us from reaching base stations, drones will be deployed to confirm the status of the site and facilitate the quick restoration of service thereafter.

Improvement of reliability through multi-routing nationwide

Distributed building locations in preparation for large-scale disasters

Connection to global network

Transmission route

Transit switch

Initiatives for Maintaining Stable Telecommunications Services

Real-time Network Monitoring and Control

The nationwide communications network monitors and controls operational status in real time, 24 hours a day, 365 days a year, and responds immediately to breakdowns and disasters.

To respond immediately to emergencies and other contingencies, the monitoring system is reinforced as required in response to social conditions.

Improved Response to Disasters and Major Failures

To enable prompt and appropriate recovery measures in the event of a disaster or unexpected equipment failure, training and drills are conducted as required to train the personnel involved in network maintenance and operation.

Ventilation relocation

Critical room

Projected flooding level

Window sealing

Water-resistant doors

Large-scale power supply vehicle for powering communications buildings

Further, lessons gleaned from past disaster responses are deployed across the organization to implement measures to prevent recurrences, review action procedures, and ensure that basic operations are thoroughly implemented.

Business Activity 20

Strengthening information security and personal information protection

Our commitment

The NTT Group works together with its partners to resolve social issues through its business operations toward a zero-trust & cloud connected age. Based on this approach, we are contributing to the healthy development of a digital economy and remote society by exercising our responsibility as a supplier of safe and secure ICT infrastructure to guarantee effective information security.

Our objective

0

Number of service suspensions due to cyber attacks (annual)

Reinforce information security

Policies and Concepts

With the progressing digitalization of society and the economy and changes in international circumstances, security threats are becoming more serious and sophisticated, particularly cyber-attacks. Within this environment, the NTT Group has a responsibility to protect ICT service infrastructure and customers' basic rights, freedoms, and information assets, as well as to provide a sound foundation for the growth of the digital economy. When formulating our medium-term management strategies in 2018, we made it our mission in terms of security to contribute to the building and development of a free, open, and safe ICT platform for supporting the infrastructure of the digital economy.

We also made it our vision to realize the digital transformation of both customers and NTT itself, and for that reason, we will be chosen by customers. In order to realize these, we will strive to engage in research and development that leverages the scale of the Group, realize superior abilities for early detection and rapid response, cultivate human resources who share the values of sincerity and advanced skill, and transcend profit-focused principles to transmit pioneering knowledge to society. Furthermore, to achieve the transformation to a New Management Style outlined in the medium-term management strategy refined in October 2021, NTT Group is implementing security measures capable of facilitating the shift to remote work styles.

As a member of the global community building the digital society, NTT Group will contribute to solving social issues through our security business.

The concept of cybersecurity is no longer just an aspect of crisis management that reduces negatives to zeroes, but is now entering an era in which it is a positive driving force that offers stabilizing support for the prosperity that technology provides. As we progress through the era of Zero Trust and Next Zero Trust, NTT Group will continue to investigate the value of security as we confront never-ending cyber risks.

NTT Group's Security Governance Goals

NTT Group enforces information security management under the charge of the Chief Information Security Officer (CISO), and is thorough in its information security management. We have also established a Group CISO Committee, and are working to formulate Group information security management strategies, plan and implement related measures, undertake human resources training, and otherwise engage in activities in collaboration with companies across the Group. We are also advancing efforts to maintain and improve security defenses within the Group based on the idea of a "three-line organization."

Organization for Implementation

NTT Group's Security Governance Goals
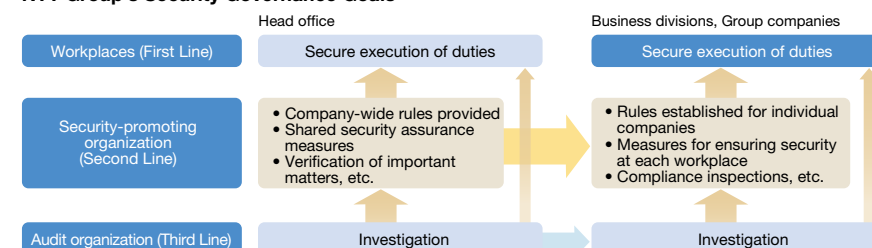
Security Initiatives Supporting the Medium-Term Management Strategy

Security is one of the three pillars defined in the refined medium-term management strategy that is a particularly important for supporting "Transformation to a New Management Style."

Transformation to a New Management Style

Introduction of zero-trust systems
Development of IT infrastructure with security measures prefaced on cloud and mobile usage for accommodating the shift to remote work styles.

Systematizing Information Security
Completely revised with zero-trust security measures. Regulations that are less ambiguous and more easily understood will be developed to ensure compliance, in order to increase the security awareness of all employees, not just information security staff.

Main Initiatives

Systematizing Information Security

The NTT Group will be completely revising information security regulations to implement zero-trust security measures based on flexible working styles that are not constrained by working location. The goal is to develop regulations that are less ambiguous and more easily understood, and ensure compliance in order to increase the security awareness of all employees, not just information security staff.

Strengthen Service Security

Information communication services are an important social infrastructure and a foundation for the digitalization of society and the economy, so to provide these services in a safe and secure manner, we are working to strengthen the security of telecommunications equipment, IT service environments, and all services provided by smart cities, smart buildings, and the like.

Global Cooperation within the NTT Group

We are advancing global partnerships in the security field in order to enhance competitiveness in global business under One NTT. This NTT Group cooperation includes many businesses and regions and in- corporates an approach to risk-based management, the introduction of a framework that acts as a shared language, and the setting of standards that should be met by all Group members in regard to identification, defenses, detection, response, and recovery.

Engaging with and Contributing to the Global Community

We are engaging with the cybersecurity initiatives of governments and industries around the world, particularly in North America and Europe, by sharing information and best practices in regard to security threats and building a community of companies and organizations based on mutual trust.

NTT Group Information Security Policy

As "Your Value Partner," NTT Group will aim to resolve social issues together with our partners through our business activities. As a trusted global provider of safe and secure ICT services, NTT Group will strive to ensure the security of the information entrusted to us and contribute to the sound development of the digital economy and the Remote World in accordance with the following policies.

1. NTT Group will (a) be fully aware of the importance of information security in the digital economy and the Remote World, (b) strive to establish a safe, secure and convenient ICT-related service environment and (c) strive the security of information entrusted to us.

2. Under the supervision of the Chief Information Security Officer (CISO), NTT Group will establish a unified information security management framework. Furthermore, NTT Group will continuously enhance its strict security measures (including Baseline Security Standards), employee security education, and audits, in order to prevent and minimize damage from unauthorized access, and information loss/falsification/leakage. NTT Group also require contractors and suppliers who handle confidential information to ensure appropriate information security, in order to strive to protect information throughout the entire supply chain.

3. All board members, executive officers, supervisors, managers and employees of NTT Group fully recognize that (a) information is a valuable asset for business and economic activities, and that (b) the protection of information is the basis of NTT Group's business activities and a corporate social responsibility. Upon these recognition, NTT Group shall comply with relevant laws and regulations (country and jurisdiction), including those relating to the protection of personal information as well as the secrecy of telecommunications, and shall establish the information security management rules. If any violation of these rules is found, NTT Group will take strict action in accordance with its disciplinary rules.

NTT Group Information Security Policy https://group.ntt/en/g_policy/
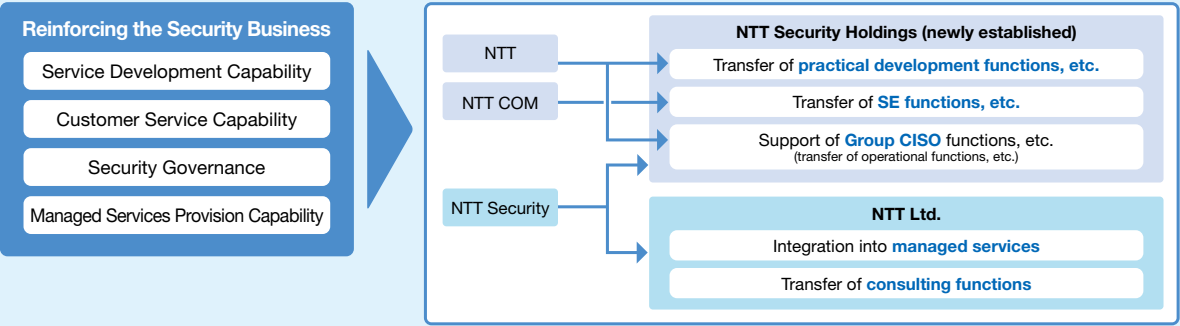
Business Activity

Advanced Security (1) Protection and Resiliency (Resiliency)

The international sporting event held in Tokyo in 2021 was subjected to the largest cyberattack ever seen. However, there were no cyber incidents during the events that disrupted operations. Behind the victory was the expertise and cutting-edge technologies of NTT, who has been thinking about communication and information security for the last 30 years and more, combined with the capabilities of human beings armed with wisdom and resolve. In particular, the "4 T's" on the right supported our efforts. These are ingrained far and wide in NTT Group's overall cybersecurity resiliency maintenance and improvement.

T1: Threat Intelligence & Monitoring (Threat Intelligence & Monitoring)	NTT meticulously evaluated case studies on past events as well as the latest threat information, thoroughly developing scenarios in advance, monitoring every item of threat information, whether it came from internal or external systems. The key was NTT's ability to put together information in partnership with global ICT service operators and security providers.
T2: Total Security Solutions (Total Security Solutions)	Within a complex ICT operation environment. NTT selected safe and secure equipment and organized a Cyber Hygiene environment. NTT also employed its proprietary technology Wide Angle MSS to detect and respond to risk factors early. This equipment and technology were put to use at the security operation center for the event, in collaboration with a wide range of specialists from both inside and outside the company.
T3: Talent, Mind & Formation (Talent, Mind & Formation)	The development of a prevention and maintenance mindset was also as important for security program personnel as learning advanced knowhow and technologies. NTT enhanced the staff's capabilities through preliminary training programs and red teams. At the event operation center, NTT clarified the roles for each team and how their movements should be coordinated, with a focus to maximize human capabilities.
T4: Team 2020 (Team 2020)	Everyone had to form one team because the event was so large. The strongest-ever defense would not have been possible without this. ICT service operators and providers inside and outside Japan, key infrastructure organizations, government, the Tokyo 2020 Organising Committee... NTT collaborated with all stakeholders to bring a wealth of wisdom and technological integration, leading the event to a success.

Advanced Security (2) Responding to Change (Agility) - Resiliency: A Blend of Knowledge, Cutting-edge Technology, and People Power

The time has come to consider security even in cyberspace. Given the circumstances, we especially want to strengthen our threat analytics, which are the cornerstone of cybersecurity. For this reason, we reorganized NTT Security in April 2022 to strengthen its service development, client support, security governance and managed services. We established NTT Security Holdings as a new wholly owned subsidiary. Practical development functions were transferred from NTT Laboratories, SE functions were transferred from NTT Communications, and operational functions from NTT were transferred to support the group's CISO functions. In addition, security services will be merged and integrated with NTT Ltd.'s managed services, and consulting functions of NTT Ltd. will be transferred to each region. These moves will strengthen NTT Ltd.'s managed services. Further, in July 2022, NTT East, Trend Micro Incorporated, and Tokio Marine & Nichido Fire Insurance Co., Ltd. jointly established the new company NTT Risk Manager Corporation, to develop a wide range of risk management businesses, with a focus on the cybersecurity domain.

Reinforcing the Security Business
- Service Development Capability
- Customer Service Capability
- Security Governance
- Managed Services Provision Capability

NTT
NTT COM
NTT Security

NTT Security Holdings (newly established)
- Transfer of **practical development functions, etc.**
- Transfer of **SE functions, etc.**
- Support of **Group CISO** functions, etc. (transfer of operational functions, etc.)

NTT Ltd.
- Integration into **managed services**
- Transfer of **consulting functions**

Information Security Training

Each Group company seeks to raise information security literacy by organizing training for all employees as well as the employees of partner companies. Training is offered through e-learning, and all employees are obliged to participate in the course once a year. Looking ahead, we are considering unifying training content throughout the Group to provide employees with a standard level of knowledge on information security required in their business operations. By doing so, we will seek to enhance the security capabilities of the NTT Group and reinforce its human resources to deliver safe, secure services for our customers and society at large.

Overhaul of Security-related Regulations

From FY2021 to FY2022, we proceeded with a company-wide overhaul of security-related regulations. We are taking steps to prepare not just for the zero-trust era, but beyond.

Research and Development Initiatives

In addition to advancing the technological development of service security, we are focusing on developing elemental security technologies. In 2019, we established a global research center for research into cybersecurity and encryption technology centered around some of the world's leading researchers.

(1) Clarification of governance targets	• Clarify the scope of CISO responsibilities to include commercial services, customer SIs, and partners
(2) Utilization of risk-based management	• Besides the minimum baseline to be followed by the Group as a whole, craft additional rules based on the risks faced by each company • Adopt the National Institute of Standards and Technology (NIST) methodology as a risk-based approach * NTT Group actively provided comments during the NIST-Cyber Security Framework (CSF) revision process
(3) Rules based on the assumption of remote work	• Give new consideration to system construction work • Reinforce precautions and other procedures during normal operations • Create a structure that takes the readers into consideration and prevent it from becoming a formality

Business Activity

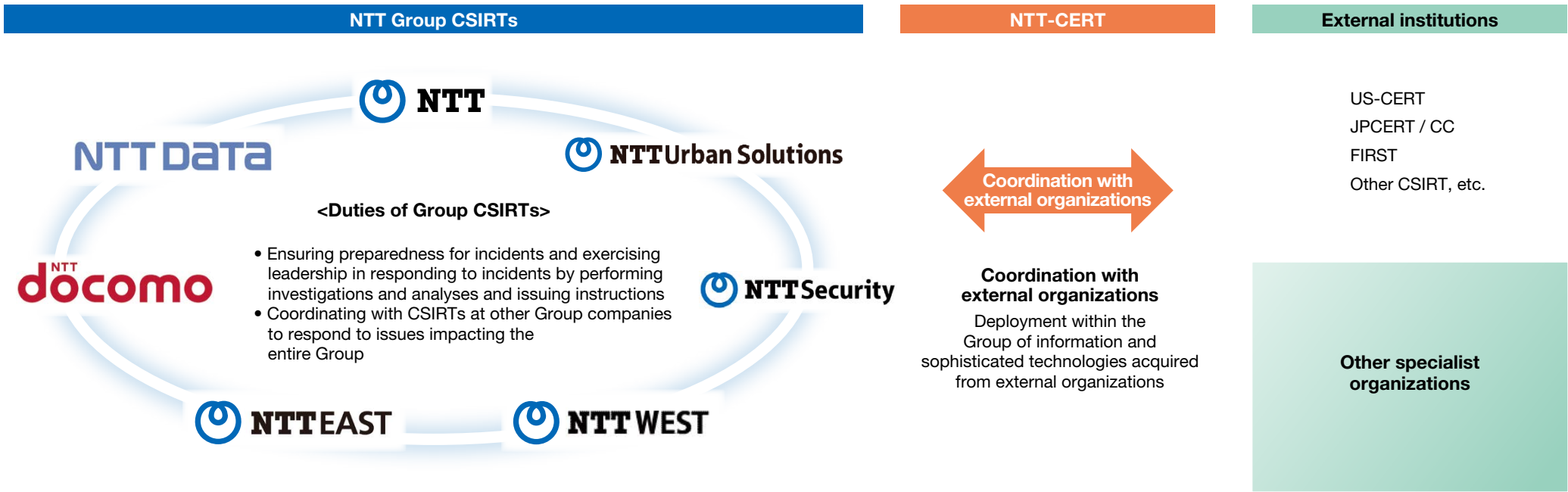### Basic Level Information Security Training

NTT Group launched a security expert certification system in 2015 with the aim of increasing the quality and number of its security personnel. This system defines three levels based on human resource type and skill level.

We must be constantly vigilant in our effort to remain abreast of the recent changes in security technologies and circumstances (zero trust, cloud native, DX, teleworking, etc.). As such, the effective and consistent training of security experts is a matter of utmost importance.

NTT used to offer basic level certification, but the rising number of certification holders coupled with the increase in awareness regarding the importance of security prompted us to develop security training programs targeting all employees worldwide.

People tend to shy away from security training due to its level of difficulty or by being turned off with the limited applicability of the subjects covered. To address this issue, we positioned raising employee interest in these subjects as our top priority, which we went about doing with animated videos and other endearing content, including a humorous introductory message by the CISO structured like a dramatic performance. Through these programs, we hope to make all employees recognize the necessity of security awareness and instill in them the basic practice of reporting any suspicious activities in their daily work. We thereby aim to motivate employees to participate in and contribute to our organization-wide drive to quickly detect and address security issues.

NTT Group CSIRT Activities

NTT Group CSIRTs	NTT-CERT	External institutions

NTT

NTT DaTa

NTT Urban Solutions

NTT docomo

<Duties of Group CSIRTs>

- Ensuring preparedness for incidents and exercising leadership in responding to incidents by performing investigations and analyses and issuing instructions
- Coordinating with CSIRTs at other Group companies to respond to issues impacting the entire Group

NTT Security

NTT EAST

NTT WEST

Coordination with external organizations

Coordination with external organizations

Deployment within the Group of information and sophisticated technologies acquired from external organizations

US-CERT
JPCERT / CC
FIRST
Other CSIRT, etc.

Other specialist organizations

Management of CSIRT

The NTT Group established NTT-CERT in 2004 to function as a computer security incident response team (CSIRT). This team collects information regarding security incidents associated with the Group. It then offers support for addressing these incidents, formulates measures to prevent recurrence, develops training programs, and provides security-related information.

As a central element of the NTT Group's security initiatives, NTT-CERT provides a reliable venue for consultations regarding information security. The team also collaborates with organizations and specialists inside and outside the NTT Group to offer support for detecting and resolving security incidents, minimizing damages, and

preventing occurrence. NTT-CERT is thereby contributing to better security for both the NTT Group and societies that are permeated by information networks.

Moreover, NTT-CERT coordinates with the United States Computer Emergency Readiness Team (US-CERT*1) and the Japan Computer Emergency Response Team Coordination Center (JPCERT/ CC*2) and is also a member of the Forum of Incident Response and Security Teams (FIRST) and the Nippon CSIRT Association*3, which enables it to coordinate with domestic and overseas CSIRT organizations. This coordination makes it possible for NTT-CERT to share information on relevant trends and response measures.

In addition, NTT-CERT participates in the cross-industry drills held by the National Center of Incident Readiness and Strategy for Cybersecurity (NISC) to share expertise and gather information. NTT-CERT also plays a role in promoting the establishment of CSIRTs at Group companies and helping improve their response capabilities.

NTT-CERT will expand its collection of information on vulnerabilities and attacks to cover areas including the dark web and will strengthen its information analysis platform and further automate and enhance its response to cyber threats in order to continually respond to threats as they change.

*1 US-CERT: An information security preparedness organization under the Department of Homeland Security (DHS)

*2 JPCERT Coordination Center: An organization that collects reports inside Japan, supports responses, monitors situations, analyzes entry points, and reviews and provides advice on measures for preventing reoccurrences from a technical standpoint with regard to computer security incidents such as intrusions through the Internet or service interruptions

*3 NTT-CERT founded the Nippon CSIRT Association

NTT-CERT
https://www.ntt-cert.org/index-en.html

Nippon CSIRT Association
https://www.nca.gr.jp/en/index.html

FIRST Forum of Incident Response and Security Teams
https://www.first.org/

Personal Information Protection

Policies and Concepts

Every year, the importance of ensuring the protection of personal information and the comprehensive management of information around the world continues to grow. The NTT Group has been entrusted with a considerable quantity of personal information, ranging from data on individual customers to that of corporate customers, and as such ensure that personal information is handled appropriately in accordance with the laws and regulations of each country, such as Japan's Act on the Protection of Personal Information and the EU's General Data Protection Regulation (GDPR).

Under these circumstances, personal information leakage could have various repercussions for the NTT Group in the operations of its businesses, including damage to its corporate value and loss of customers, which makes it essential to rigorously manage personal information as the NTT Group's top priority.

Organization for Implementation

Under the NTT Group Information Security Policy, we disclose on our website specific policies for protecting the personal information of customers and shareholders and policies for protecting personally identifiable information re- quired by Japan's Social Security and Tax Number System. In this policy, we also define how we respond to requests for disclosure, correction, and suspension of use related to the personal information retained by the NTT Group. We have also put in place a security management system that ensures thorough and rigorous security practices, with the Chief Information Officer (CISO) placed in charge (see page 054).

Policy on Protecting Personal Information

About personal information protection
https://group.ntt/en/protection/

Policy on Protecting Personal Information of Customers
https://group.ntt/en/protection/customers.html

Policy on Protecting Personal Information of Shareholders
https://group.ntt/en/protection/shareholders.html

Policy on Protecting Specific Personal Information of Business Partners
https://group.ntt/en/protection/partners.html

Policy on Protecting Specific Personal Information of Shareholders
https://group.ntt/en/protection/specific_personal_information.html

Main Initiatives

NTT has systematic security control measures, human security control measures, physical security control measures, and technical security control measures in place for handling our customers' personal information.

(1) Systematic security control measures
We have created a statement outlining the building of management systems such as placing a person responsible for management of the committee and each organization, the establishment of internal regulations, management ledgers and process management charts, and other matters. Furthermore, we are also building management systems for handling ongoing improvements and the like.

(2) Human security control measures
All employees who handle customers' personal information are informed and made aware of the importance of protecting this information, regardless of whether they are officers, regular employees, or temporary employees. We ensure employees conclude non-disclosure agreements and provide necessary auditing and supervision to ensure their effectiveness.

(3) Physical security control measures
We enact various measures including controlling access to physical equipment which handles customers' personal information and the floors where these are kept, measures to prevent theft, measures to prevent damage to customers' personal information during incidents such as fires and lightning strikes, and the use of locks when taking out, moving, or storing systems and documents.

(4) Technical security control measures
We have put in place various technical security control measures such as access management when accessing personal data including authentication, authority administration, control, and recording, countermeasures against viruses and malware in systems, measures for use when sending and receiving information including encryption and clarification of responsibility, and the monitoring of information systems.

Each domestic company in the Group has established a personal information protection system in line with its business and based on the Protection of Personal Information. We are consistently pursuing initiatives to protect information, including stringent measures on the physical and systems aspects of security and appropriate supervision of outsourcing contractors. Management of information is being further enhanced, as personal information acquired by group companies in Japan via individual or household services like cell phones and internet access will be retained and accessed from within Japan after May 2021.

Main Initiatives of Domestic Group Companies
- Establishment of internal rules and regulations
- Employee training to ensure appropriate implementation of the above rules and regulations
- Establishment of an organization to promote information security management
- Establishment of a security management system for preventing illegal access to information or the loss, alteration, or information leakage as well as managing antivirus measures and the physical transfer of information

Establishment of Contact Points on Personal Information

NTT has set up the Customer Contact Point on Personal Information, and similar contact points for services related to personal information have been set up at each NTT Group company. Since NTT is a holding company that does not directly provide telecommunications services, inquiries regarding personal information related to services are redirected to the contact points of the operating companies concerned.

Additionally, inquiries regarding the handling of personal information under laws and regulations are redirected to the person responsible for information security at the operating companies concerned.

Nippon Telegraph and Telephone Corporation Customer Contact Point on Personal Information
Email: ntt_kojin@ntt.com
https://group.ntt/en/protection/customers.html

Business Activity 21

Promoting a decentralized society based on remote work

Our commitment

Shifting toward new work styles centered on remote work, by upgrading IT environments and reviewing systems, in addition to advancing DX projects and work reforms with an eye on the post-pandemic world

Our objective

0

Major personal data leaks (annual)

Policies and Concepts

The NTT Group recognizes that remote work will play a key role in society even after COVID-19 subsides. Based on this recognition, we will make active efforts as an ICT company to improve DX and other environments that allow for more opportunities for remote work. We believe these initiatives ensure the Group's sustainable growth, enhance its corporate value, and eventually help find solutions to social issues.

In light of this background, the NTT Group is currently rolling out various specific initiatives such as (1) Making "general improvements" by rolling out cloud based systems/zero-trust systems, (2) "Promoting DX" to enable remote work for automating and making operations more efficient, and (3) Re-examination of systems for promoting work styles based on remote work. Remote work systems and remote work allowances will be established as part of promoting work styles required for remote work, and thereby offering a greater choice of "work time" and "work location" for employees.

Different to "work-life balance" that aims to separate and create a balance between work and private life, we are considering the promotion of "work-in-life (health management)" where employees can select and design their own work style by viewing work as part of the lifestyle of each and every employee. In addition to flexibility with "work time" and "work location," flexibility with regard to "residence" is also considered important, so remote work systems are being revised to develop work styles centered around remote work.

Decentralization of the Organization (Including Head Offices and Back-Offices)

The NTT Group began initiatives for decentralizing the organization from metropolitan areas to regional areas, or core cities.

<Specific Initiatives>
- Trial run for dispersing the organization across regions to begin at the holding company (starting in October 2022)
- From the standpoint of resilience, we will aim for sustainable business operations by opening offices in Takasaki City and Kyoto City and promoting split shifts The first step will involve a trial of certain organizations (with approx. 200 employees) of the holding company
- The trial will be used to test for issues or measures related to business operations and communications with split shifts, with a view to applying it to actual operations
- Introduce a working style based on telework in which employees engage in head office operations while residing in a distant location
- Introduce a "hometown double work" program to contribute to the revitalization of local communities and areas associated with the Company while continuing current assignments

Promotion of a decentralized society and work-in-life (health management) through the workplace-residence proximity

The NTT Group is taking initiatives to shift to new work styles premised on remote work.
- Remote work ratio: 70.8% (conducted from October to December, 2021)
- Creating an environment that offers greater choice of work location
- Remote work that does not require approval on a case-by-case basis, elimination of restrictions on residential areas for employees who can work remotely, and sharing costs and other expenses associated with commuting to work from remote locations (FY2022 onward)
- No Need for Relocations and Unaccompanied Assignments Recruitment of Remote-Based Employess (From FY2022)
- Expand the number of organizations that support remote work through DX (establish security requirements at major contact centers, begin introducing tools to prevent peeping)
- Satellite offices: 249 sites (end of January, 2022, target of 260 sites or more during FY2022)
- Re-Examination of the Office Environment
  Increase the amount of space per person in the office by 1.5x, and enhance the space for idea creation and co-creation (From FY2022)

Business Activity

Rolling out zero-trust security and increasing the remote work ratio

In this day and age, IT has become an essential part of our lives and work, but this also increases the amount of threats from cyberattacks. As a company that handles sensitive customer information, implementing measures to protect against these threats is of the utmost importance. In many cases, the way employees work must be restricted to ensure security.

We came up with the "Work from Anywhere" slogan as a way of reforming working styles, and developed an IT environment that allows employees to work from anywhere in the same way as working in the office. This is a work style that has a greater degree of flexibility thanks to advancements in IT. This requires a high level of security to ensure work is performed in the same way from any location. To achieve this, the "zero-trust" concept has been adopted.
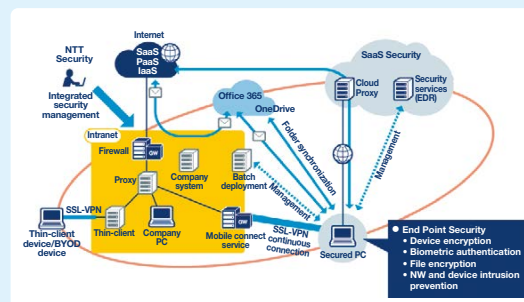
"Until now, the approach to ensure security had been to complete all work within the company intranet, and to make sure the connection was closed securely. Yet with cyberattacks becoming more advanced in recent years, we need to factor in the possibility of unauthorized access to the intranet. A new approach was established, with the entire system designed not to trust any type of access, whether it is from within the intranet or from external sources. This is the basic approach to zero-trust security."

Whether employees are working from home, a satellite office or any other location, the concept of "Work from Anywhere" is a great way to boost their motivation.

Generating value as new regional communities created by "another workplace" —Maintaining employee health, while developing environments equivalent to the office to ensure business continuity—

When the state of emergency was declared, we needed to quickly develop an environment that employees could work with. A long-term vision has emerged in recent years, covering the COVID-19 and post COVID-19 stages, and the role of these satellite offices are shifting to providing an environment where each and every employee can work in a lively manner. The value created by satellite office communities is being recognized once again.

Some 330,000 employees working at more than 900 companies support the NTT Group worldwide. And each employee has its own household and its own environment. This approach was neither a conventional office, nor is it quite, home. We needed to provide an area suitable for remote work as quickly as possible. To allow each employee to select their own workplace where they could work in the most lively manner, we embarked on a project to open satellite offices for employees of the NTT Group.

The NTT Group owns some 7,000 "office buildings" around the country that are equipped with communications facilities. They are located in many areas around Japan—not only in cities, but also residential areas and almost every other type of area. This project aimed to turn those buildings into suburban satellite offices for use by employees of the NTT Group. Every building that would become a satellite office needed to be planned carefully. The project team aimed to open its first such building in October 2020, around half a year after the state of emergency was declared—the team worked at an unprecedented pace at preparing the buildings, and ended up opening 10 satellite offices during fiscal 2020, and 50 during fiscal 2021. The number of these satellite offices continued to grow throughout the NTT Group, and today around 5,000 employees are registered to use them.