

Orchestrating a brighter world

Co-creating social value through human-digital integration

The increasing diversification and globalization of our society is giving rise to a range of complex social issues that are closely intertwined. As we look to address these issues, we must also find ways to respond to a fast-changing market environment.

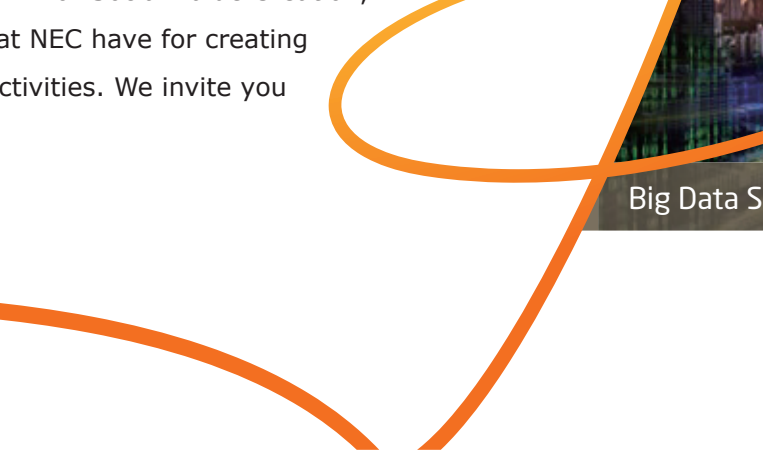
NEC is committed to helping solve the issues that society is facing so that we can realize a society that is brighter and more prosperous for all. We are doing this by bringing the world our cutting-edge Solutions for Society.

These solutions leverage our information and communications technology (ICT) assets to provide our customers with the tools they need to quickly transform their organizations while at the same time creating the important social values of Safety, Security, Efficiency, and Equality. As we develop our Solutions for Society, we are “co-creating” with our customers and partners, as well as governments, local bodies, and international organizations, to devise new business models that will meet the needs of the future.

Going forward, NEC will continue to take on the challenge of creating social value through human-digital integration, from the customer’s perspective and the perspective of society, as a partner who is trusted to the fullest.

This booklet introduces some of the Solutions for Society businesses that NEC is involved in and examples of how we are working with our customers to create value for society.

We have also issued “NEC Vision 2017 for Social Value Creation,” which describes the vision that we at NEC have for creating social value through our business activities. We invite you to read this booklet also.



Big Data Solutions

Highlights 1

Creating value for society through
Marketing × Innovation

▶PAGE 04



Highlights 2

To the world, and to the future:
Taking on the challenge of
creating social value

▶PAGE 10



Highlights 3

Creating new value with
diverse partnerships
across the globe

▶PAGE 14



Case Studies and Highlights of Solutions for Society

Safety (Physical Security/Cyber Security) ▶PAGE 16

Traffic and Urban Infrastructure ▶PAGE 22



Telecommunications ▶PAGE 24

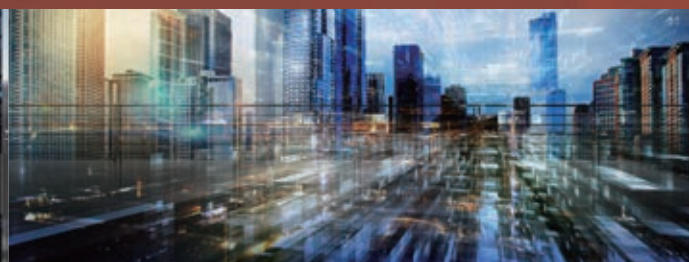
Manufacturing/Logistics/Retail/Services ▶PAGE 28



▶PAGE 32

Cloud Solutions ▶PAGE 34

SDN Solutions ▶PAGE 36



At a Glance ▶PAGE 38

Scan the QR code on each page to watch a video or
find out more about case studies and interviews.



: Video



: More information

Highlights 1

Creating value for society through



Moderator
Think Tank SophiaBank VP

**Kumi
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Executive Vice President and
CTO (Chief Technology Officer), NEC

**Katsumi
Emura**



Executive Vice President and
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**Takaaki
Shimizu**

How will the role of people change with the advance of AI? What kinds of value will be produced when things and people are connected through IoT, providing us with a deeper understanding of contexts? We spoke with NEC's Takaaki Shimizu (CMO), Katsumi Emura (CTO), and Kumi Fujisawa from the think tank SophiaBank, who is involved in international consulting and critique.

What must people do to produce value from AI?

Fujisawa: "Digital" is currently a major theme when speaking of business and technology, from the viewpoint of the "integration of marketing and innovation."

Shimizu: To produce digital value requires understanding of both "digitization," converting to and using data in digital form, and also "digitalization," which is the transformation of business through technology, and engaging in both these activities in the medium-term. It has become possible to solve business issues by creating value from data through the advanced capabilities of computing, networks, and software. Artificial intelligence (AI) is again receiving attention as one form of software. We



Takaaki Shimizu

must note that in earlier AI "booms," AI was misunderstood as something that would take over all human tasks.

Emura: Unless someone decides on something concrete that they want to do, AI won't think of it for them. This is a key point. Humans recursively rethink things in an analog way, which is the antithesis of "digital," and you could say that this is like an Eastern way of looking

at things. NEC is introducing a system to monitor for potential faults in plants by collecting data from several thousand sensors installed in the plant and analyzing the data by using AI. The technology takes an overall view of things and detects potential faults by looking for breakdowns in the interrelations among sensor data. This is similar to how Eastern medicine makes a diagnosis by looking at the whole body. In that sense, AI and the Internet of Things (IoT) solve problems by looking globally at a lot of data, which could be said to be a more like an Eastern medicine approach. In my AI research, I've come to think people's job is to think more deeply about things. That may be because I'm getting older, though.

Fujisawa: AI is expanding into more and more fields, such as factory automation, and self-driving cars, isn't it?

Emura: AI is able to handle an increasing

Marketing × Innovation



Katsumi Emura

more efficiently. In face recognition, advances in analysis of motion can reveal a person's internal state from subtle changes in facial expression.

Fujisawa: Such as nervousness...

Emura: Yes, that's right. When we're talking like this, we can read each others' internal state by watching subtle changes in facial expression. AI is doing the same thing. But people make the final decision on what to do. For example, thinking "My boss might be in a bad mood, so I'd better not talk to him."

Fujisawa: AI makes things easier for people, but people also need creativity and effort to increase their abilities.

Shimizu: Rather than simply having excellent AI, it is a question of how to solve problems using AI for people and enterprises; how to resolve issues by combining information and communications technologies (ICT) and products that incorporate AI. All capabilities, including problem approaches, integration, and consulting, must work together. Supply chains are rapidly getting more complex, so problems cannot be solved individually, and a single company cannot do everything. Each player must cooperate with the others, using the technologies and products that are their strengths.

Fujisawa: NEC's perspective, which transcends the company and the industry, is fundamental for collaboration.

Shimizu: What we can accomplish on our own is limited. Working together with many others, we can co-create and achieve our goal of "Orchestrating a brighter world."

the real world), "Analysis" and "Prescription," and optimizing those processes are features of NEC the WISE.

Fujisawa: The image of a brain is strong with AI, but AI at NEC seems broader, including looking, listening, and determining actions based on the results of analysis. Like using the five human senses...

Emura: Yes, we have technologies such as speech recognition, language understanding, estimation and prediction. For a long time, we have had particularly strong technologies for extracting data from images and interpreting it. About 50 years ago, we commercialized a machine for reading postal codes, and we have been working on biometrics technologies in the form of Fingerprint Identification and Face Recognition for more than 40 years. These are being used in more than 70 countries around the world.



Kumi Fujisawa

number of things that people do normally and regularly. The important issue is not that cars can drive automatically, but to consider what new things people can do when they are freed from driving automobiles. From our interaction with customers, we have learned much, become aware of changes in society, and recognize that people are what is important.

"Five-senses AI" cooperating with humans

Fujisawa: I understand you have established an NEC AI brand.

Emura: Yes, it is "NEC the WISE." "Wise" is an adjective, but "the wise" is a plural noun, meaning "wise people." So we use "NEC the WISE" to refer to NEC's various cutting-edge AI technologies, with the idea that people and AI work together on solutions to complex and advanced problems. Realizing "Visualization" (of

Addressing social issues through AI that explores the interior

Fujisawa: In human evolution, humans thought and made decisions based on visual information before writing. In NEC's areas of technical expertise, AI seems to be doing what humans did at the beginning of their evolution.

Emura: That is true. Most image data is still being analyzed from outward appearance, but we are also working on looking at the interior. For example, internal cracks or cavities in concrete can be found by looking at images of subtle vibrations on the surface. This could be used to diagnose degradation in infrastructure such as bridges and roads

IoT destined to handle unstructured data

Fujisawa: IoT is also an important key word, along with AI. How is NEC handling IoT and what are its main technologies?

Shimizu: IoT goes beyond manufacturing, and is spreading to many fields, such as finance, insurance, healthcare, and logistics. IoT must handle huge amounts of unstructured data. With earlier IT processes, data was structured and organized before it was input and then processed according to rules to produce answers. In contrast, with IoT the various components, products and sensors cannot be connected without first building a standard structure, including architectures and processes. Without such connection, IoT is just pie in the sky. To solve this, NEC decided on

Creating value for society through Marketing × Innovation



a basic architectural approach, standardized and opened it, and provided a framework to facilitate collaboration among enterprises.

Fujisawa: With IoT, the image of connecting things together is strong, but from what you said, organizations and systems are also being connected.

Shimizu: That's right. We tend to think we just connect them together, but actually it's not that simple.

True value in examining "contexts"

Fujisawa: What actual IoT initiatives do you have?

Shimizu: We are working with Kagome Ltd. to implement IoT in the field of AgriTech. Beyond just increasing the harvest, Kagome is working to optimize the overall supply chain, including many surrounding farms and large tomato paste factories. Harvested tomatoes are transported from fields by large trucks but because the harvest peak happens almost all at once, it creates traffic congestion near factories. So if it takes a long time to bring in the tomato harvest, the tomatoes can start to rot... Beyond just increasing the harvest, Kagome is also working to shift the peak harvest of many farms, solving a global just-in-time optimization problem and thereby advancing AgriTech.

Emura: To consider issues in social design, such as household waste and wasteful shelf-life expiry in distribution processes, requires connection among both things and contexts, and thorough investigation of what to do. Things and contexts not connected earlier will be connected and globally optimized through IoT. The key is to see how much value can be created for society by increasing the harvest and eliminating waste. It is really important to take an overall perspective.

Fujisawa: NEC also has expertise in public safety. Can advanced solutions also be found by thoroughly examining contexts in the field of security?

Emura: In one example, we provided a video monitoring solution to the city of

Tigre in Argentina. By linking two-rider motorcycles with purse-snatching events, we contributed to reducing crime rates in the city.

Fujisawa: I think the real value of IoT comes from its ability to transcend social domains and national borders. Its uses are global and unlimited.

Emura: In the city of Wellington in New Zealand, they have a smart city initiative connecting data between government ministries, to improve administrative efficiency. Data that was particular to the earlier vertical organization was connected using IoT, enabling crime reduction and increased efficiency of municipal functions.

Fujisawa: So IoT is also expanding possibilities for resolving limitations of vertical organizations.

Growing industry and solving social issues at the same time

Fujisawa: In 2017 it will be 40 years since NEC's C&C Declaration.

Emura: In 1977, the then-chairman of NEC Corporation, Dr. Koji Kobayashi, expressed the idea that by the turn of the new century it would be possible for people to see and converse with each other at any time and from any place on the earth, and to achieve this he proposed the "C&C" concept of integrating computer and communications technologies. Even now, the idea of creating a better society by using the technologies proposed by C&C is fundamental to NEC.

Fujisawa: Hearing about AI and IoT, it seems that, rather than getting old over 40 years, the C&C vision gives increased assurance of realizing a new society. It will be important for NEC to view society as a whole and collaborate with all stakeholders in producing new value.



Shimizu: It is a perspective of growing the company while finding solutions to social issues. As we solve complex, high-level social issues and study what values need to be realized, we understand the importance of "Safety," "Security," "Efficiency," and "Equality." I am confident that our vision is the correct one, and that our technology plays a major role in achieving it.



Take action while you can

Fujisawa: From a business perspective, speed and a medium-to-long-term perspective are also important, aren't they?

Shimizu: From the outset, if management does not make decisions quickly when asking how to produce value from data and digital technologies, we will quickly lose competitiveness. Drastic changes in where management resources are invested will be needed for the future. In other words, we will need to make a major shift toward digital technologies.

Fujisawa: So digital technologies are key to preparing now for future success.

Shimizu: In leading North American companies, it is becoming common sense to have a Chief Digital Officer (CDO) who promotes digitization and digitalization in cooperation with the CMO and Chief Information Officer (CIO). It is increasingly important to understand digital value correctly, and to nurture human resources that are able to use the technologies. Companies that do not begin investing in this now will regret it later. They will be asking, "Why didn't we invest in digitization?" and "Why don't we have the data that other companies do?" The speed of management decision-making is also important. We must begin immediately, even if we start small.

Fujisawa: People always take time to learn, don't they?

Emura: It is important to look into the future to see what we need to start learning now. What we are taught in school now may well be replaced by AI in the future, so we need to learn more essential things. It seems that communication and proactive decision-making are essential to human nature. When AI has evolved further in 20 or 30 years, what will we need to do? Ultimately we need to consider people as the center.

Fujisawa: When the directors of leading digital enterprises speak of the essence of humanity, it is profound.

Emura: Is that surprising? It seems like that's all we've been talking about lately.



Creating new value and transforming business through digitization and digitalization

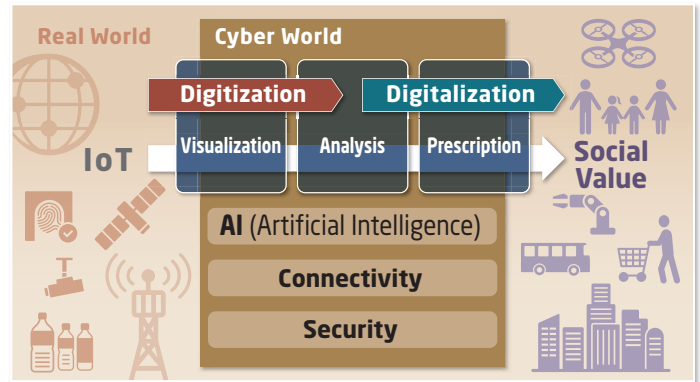
What values will AI and IoT create?

In the era of the Internet of Things (IoT) where everything is connected, we will be able to extract data from people, things, and contexts and apply technology such as artificial intelligence (AI) to easily create new, never-seen-before value. By analyzing real-world data, we will be able to understand it, forecast from it, and use it to take both proactive and retroactive measures, allowing us to solve a broad range of social issues more quickly and easily. These new technologies have the potential to impact diverse fields from urban transit, aviation, transportation, energy, environment/resources, and manufacturing/engineering to communications, defense, space, and advanced medical care by exponentially improving operational efficiency and increasing productivity. It is also likely that in the near future, new business models will appear that will have a profound impact on our industrial structures. Many corporate executives have already recognized the importance of overhauling their businesses to assure that they will be well adapted to the era of IoT. Connecting every single object and every single context to the network will accelerate the digitization of the physical world, generating massive amounts of data that can be converted into new knowledge. This knowledge will become a common social asset accessible to all. The incredible speed and efficiency that the application of AI will bring to the analysis and processing of this

information will lead to new discoveries that will amplify and accelerate the new values this technology brings to society and business.

Digitization and digitalization

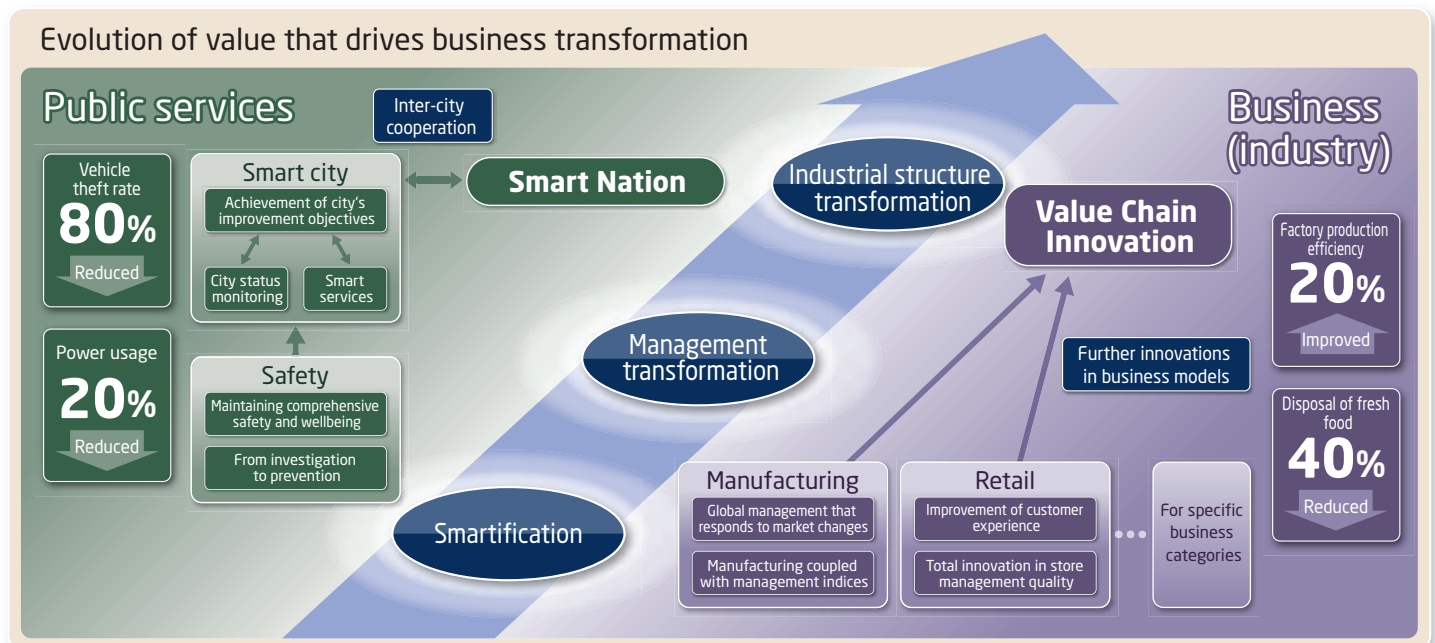
Two concepts are critical in the new era of IoT: *digitization*, which simply means the conversion of analog source data into a digital format; and *digitalization*, which is the process of using digital technologies to change business models and create new social value.



A future of collaboration between business and public services

The expansion of IoT is creating dramatic new possibilities. We now have the unprecedented ability to monitor and protect human life with vital signs sensors, prevent damage to structures and facilities with distortion and vibration sensors, and to minimize criminal activity with video and image data (surveillance cameras). Thanks to the enhanced processing capabilities of computers and networks, new AI systems are dramatically accelerating the applicability of data science. Today we stand on the brink of a new world where technology is able to function autonomously in the real world, revolutionizing the way we live, work, and do business. Among NEC's projects that actually utilize AI and IoT, we are already seeing some significant results, including a 20% improvement in factory production efficiency in the manufacturing

field and a 40% reduction in disposal of fresh food in the distribution field. Moreover, by making it possible for various value chains—ranging from manufacturing to retail and logistics—to collaborate with each other, these new technologies will help promote Value Chain Innovation that will spur the advancement of products and services, as well as the evolution of provided value. In the public sector, meanwhile, we have been successfully producing significant results—such as an 80% reduction in the vehicle theft rate, as well as a 20% reduction in power usage. Now we are expanding our focus from smart cities to the achievement of a "Smart Nation." Going forward, we will continue to create greater social value by integrating the concepts of "Value Chain Innovation" and "Smart Nation."



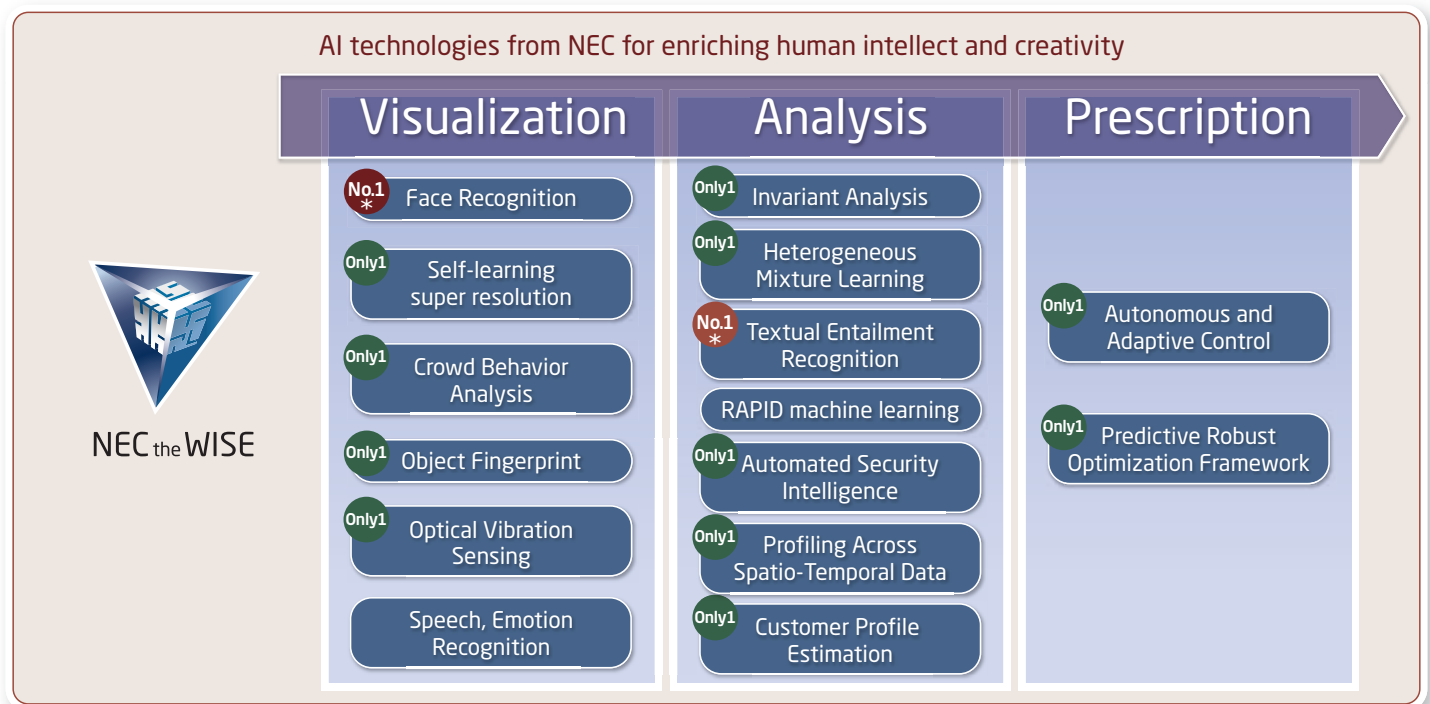


Cutting-edge AI technologies support social value creation and business transformation

What is the key to achieving new value creation and business transformation using IoT? In a world where people, things, and contexts are all connected and digitized, so much random data is collected that processing and analysis take an extraordinary amount of time, making real-time utilization impossible. Making sense of this data requires a more discriminating system. Using various sensor technologies that replicate the five human senses, as well as image and video recognition technology, NEC collects only the information needed from the real world, using AI to "Visualize" (*digitize*) that information. More sophisticated and flexible AI is then used to perform "Analysis" and "Prescription" of the digitized data, thereby creating new value—a process known as *digitalization*. More than 50 years ago, NEC recognized the critical role that AI was going to play in the future of our society and has long been developing technologies and bringing products to market that feature ever more refined and flexible capabilities, such as image recognition technology. NEC's Fingerprint Identification and Face Recognition technologies, for instance, boast the world's highest accuracy* and have been introduced throughout

the world, providing an invaluable contribution to security and crime detection.

NEC has a rich portfolio of No.1 and Only 1 AI technologies which we have unified under the brand name "NEC the WISE." These technologies are used in a broad range of solutions, including detection of anomalies in factories and other critical facilities, analysis of human behavior, and highly accurate product demand forecasting, as well as in various fields such as speech recognition, image and video recognition, language and semantic understanding, machine learning, prediction and detection, and optimal planning and control. By fully utilizing the "NEC the WISE" portfolio—which covers all aspects of Visualization, Analysis, and Prescription—NEC can offer advanced solutions that will give us the power to assess a given situation from a variety of perspectives. AI will also support human decision-making on complex issues where there is no single, clear answer by providing suggestions from multiple viewpoints. Applications could range from management to new product development.



High-reliability platform and versatile sensing technologies that support IoT utilization

By 2020, as IoT continues to progress, the amount of data in the world is expected to swell to about ten times that of 2013. To effectively handle this data, IoT platforms will need to feature excellent real-time, dynamic, and remote capabilities. The scale and complexity of the system environment itself will also increase as more and more things and contexts are connected to the network. The sheer scale, complexity, and criticality of the system and its data make it imperative to prevent security violations such as spoofing or hacking and to develop effective means to assure the validity of information. NEC is one of the few information and communications technology (ICT) vendors in the world to possess advanced proprietary technology in all the associated domains of computing, networks, and software. We also boast advanced ICT

assets in the fields of Big Data, Cloud, and Software-Defined Networking (SDN). This comprehensive technology base combined with our expertise in vertical and horizontal technological integration allows us to develop optimized IoT platforms using our own and other companies' technologies and products.

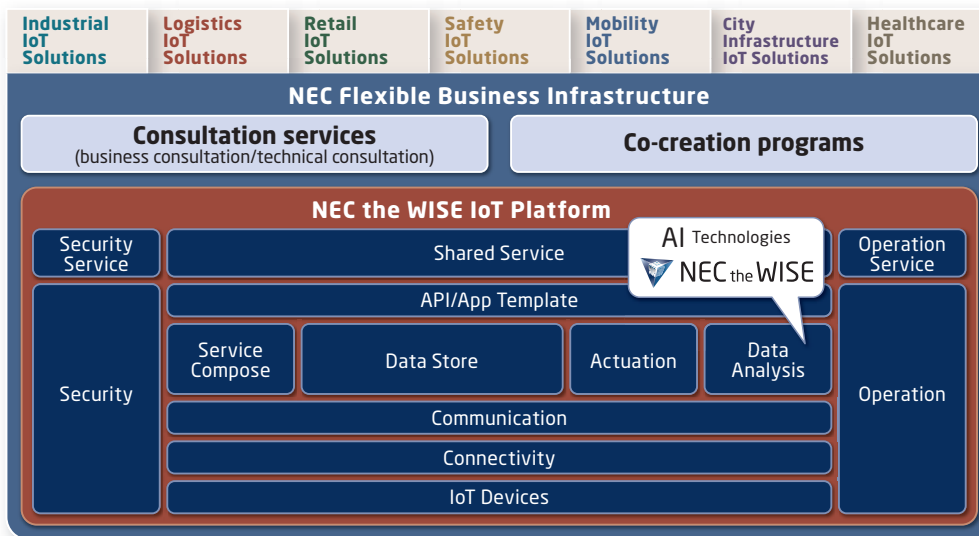
NEC is also a leader in the field of data collection, where a wide variety of sensors are used to collect different kinds of data. With sensor technologies designed to operate everywhere from the ocean floor to outer space, we capture essential data from the ever-changing real world in real time. Going forward, our goal is to aggressively support new value creation and business transformation by providing high-reliability, safe, secure IoT platforms and versatile connectivity.

“NEC the WISE IoT Platform” for co-creating business transformation

Our vast experience in AI and IoT projects has taught us a lot. Extreme care is required when introducing AI and IoT systems. There are many pitfalls that companies planning to introduce AI and IoT systems, as well as their IT partners, are likely to encounter. We can help them avoid those pitfalls. The key points to ensure a successful project are the ability to incorporate business outcomes into system requirements as clear models; technologies that capture things and contexts as data and convert them into knowledge and intellect; fast launch of

validation systems and efficient transition to operation of actual systems; flexible scaling as business grows and the environment changes; and stable maintenance of digital business.

Now, with a view to increasing business and IT capabilities (infrastructure and human), while ensuring that our customers are able to operate their digital businesses smoothly, NEC has developed the “NEC Flexible Business Infrastructure,” a platform that combines the “NEC the WISE IoT Platform” with co-creation programs and consulting services.



- ### Main features of the “NEC the WISE IoT Platform”
- 01 Utilization of AI and data science**
Provision of required functions ranging from data collection to analysis using AI
 - 02 Cloud combination**
Ability to flexibly combine on-premises and public clouds
 - 03 Multi-connectivity**
Ability to connect various non-IT devices to systems
 - 04 Scalability**
Flexible expandability of systems according to changes in environment
 - 05 Security**
Total assurance of security from devices to clouds

Taking the lead in business transformation as our customers’ partner of choice

The shortcut to success in the era of IoT is the ability to quickly materialize a business idea and start immediately, no matter how small the scale. To support businesses in today’s volatile environment, we offer co-creation programs that will help identify business and system requirements, supported by specialized technical consultants with extensive experience in various AI and IoT projects. Our co-creation programs support business launches with fast-response validation environments, while our specialized personnel such as system architects, data scientists, and security consultants provide in-depth, on-site help in the initial phases of business launch and

system construction.

In cooperation with our partners—all of whom are leaders in their respective fields—NEC has provided a variety of solutions that fully utilize AI and IoT. We are committed to expanding these IoT solutions to cover an even wider range of fields, including manufacturing, retail and logistics, safety, traffic and urban infrastructure, and healthcare. Building on our own strengths and leveraging the power of our partner network, we are able to provide total support for today’s businesses, helping them to take full advantage of the enormous potential of AI and IoT to create new value.

Supporting industry with AI and IoT — Connecting people, things, and processes to provide new social value and create a world where people live in prosperity —

Industrial IoT Solutions <ul style="list-style-type: none"> • Manufacturing management • Technical management • Maintenance services 	Logistics IoT Solutions <ul style="list-style-type: none"> • Supply chain integrated management • Warehouse management • Transportation/delivery management 	Retail IoT Solutions <ul style="list-style-type: none"> • Store management • Marketing • Customer support 	Safety IoT Solutions <ul style="list-style-type: none"> • Behavior analysis
Mobility IoT Solutions <ul style="list-style-type: none"> • Transit monitoring • Payment solutions 	City Infrastructure IoT Solutions <ul style="list-style-type: none"> • Infrastructure monitoring • Urban infrastructure • Disaster monitoring • Smart energy • Knowhow acquisition support • Resident services 	Healthcare IoT Solutions <ul style="list-style-type: none"> • Preventive healthcare 	

To the world, and to the future: Taking on the challenge of creating social value

To solve the many different problems facing our world and realize a prosperous society, NEC is co-creating new value through collaboration with its customers and partners, by looking at the world and the future from the perspective of social value creation.

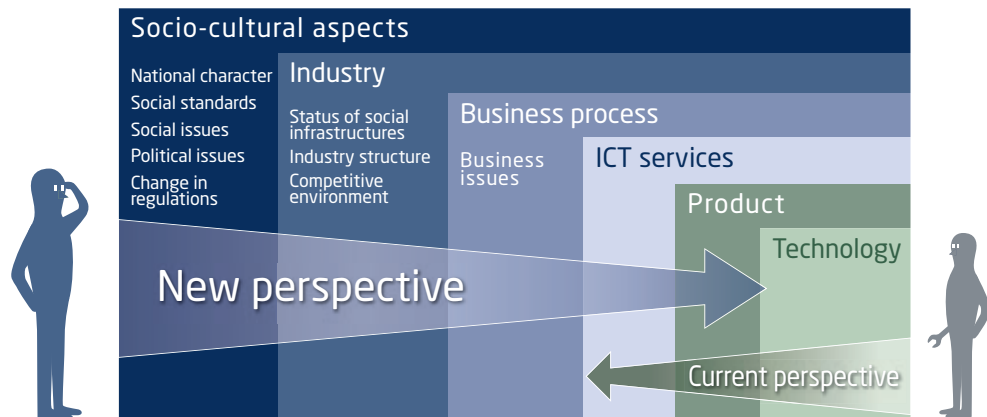


Solving complex social problems together with our customers and partners

Cities, nations, and individual lifestyles are becoming more diversified amidst rapidly changing global economies and societies. Aiming to transform itself into a Social Value Innovator, NEC is fully leveraging its strengths in advanced information and communications technologies (ICT) to create new value. In creating this value, NEC believes that it is important to consider socio-cultural, industrial, and other social perspectives, and to have deep insight into customers' lifestyles and potentially complex

underlying problems.

In addition to adopting business methods such as open innovation and lean startup, NEC proactively incorporates design methods for creating visions of society and the future from the upstream layer. Through this, NEC is exploring social and market problems together with its customers and partners, and taking on the challenge of providing value for solving those problems.



Business-focused perspective: Add social and customer perspectives to current technological perspective

Accelerating new business creation with open innovation

The creation of social values requires integrating a wide variety of knowledge and experience. NEC pursues with an open mind the co-creation of new business by forging partnerships with diverse companies across different industries.

In 2014, NEC established the Co-Creation Workshop Space—a space where we could explore with our customers solutions to social issues from both the micro perspective of human lifestyles and behavior patterns and the macro perspective of urban, national, and global-scale issues. By fiscal 2015, NEC had attracted more than 100 companies and 600 individuals from both inside and outside NEC to

this co-creation space.

NEC has also been able to connect new projects with venture capital from areas of the world that are leading the way in innovation, such as Silicon Valley, and help project members verify new business concepts by introducing experts who can give investment advice based on the potential for social value creation. NEC also considers the vision that our customers want to realize and works together with them to conceptualize ideas for business by applying design methodologies. One example of this process is the vision for a city of the future that we created together with the city of Tigre in Argentina.



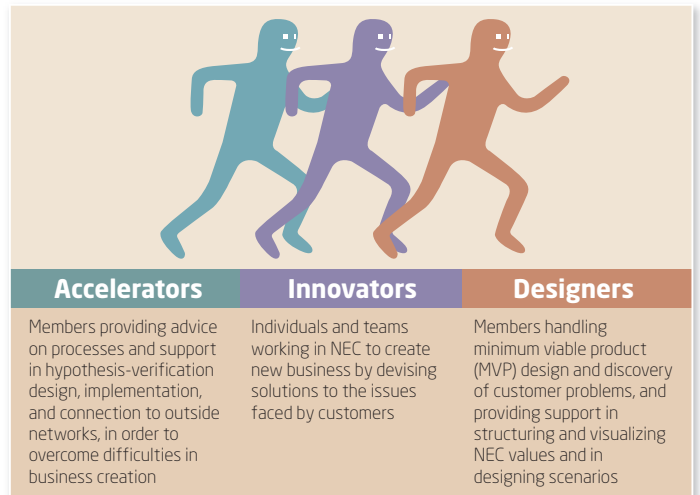
In fiscal 2016, NEC launched a campaign to generate ideas from outside the company through an idea contest called "Creating the Future with NEC." The contest was born out of the desire to incorporate ideas from as many stakeholders as possible in business creation, as a company that works with its stakeholders to solve social issues.



Internal frameworks that help employees tackle social issues

NEC has established an internal acceleration program to drive new business creation in conjunction with human resource development. With this program, NEC is driving new business creation in various areas, including our focus areas of AgriTech (agriculture x technology), HealthTech (healthcare x technology), and FinTech (finance x technology).

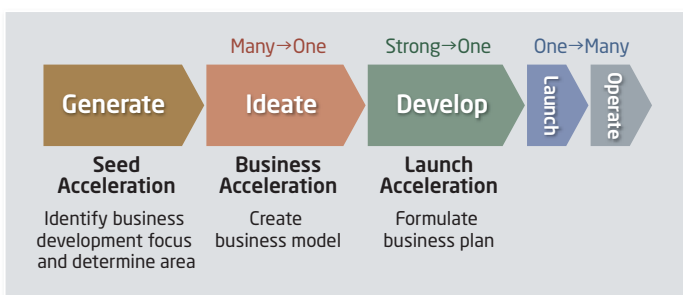
Within these different initiatives aimed at new business creation, NEC is in particular reinforcing activities to incorporate "design thinking." Aimed at creating new social value and new businesses—as well as supporting NEC's own innovators—NEC established the Design Center in 2015, bringing together more than 50 business designers under one roof. The Center is engaged in exploring social issues, creating concepts, prototyping, and otherwise formulating processes for concretizing solutions based on creativity and flexible thinking and through the use of technical design methods. In 2015, NEC's new business creation frameworks led to the creation of seeds for 120 new commercialization projects.



Making a passion for innovation part of our culture

The key to creating new business is to instill business development processes, such as lean startup and design, and a culture of wanting to innovate in each and every employee. In fiscal 2015, 24,000 NEC employees took part in innovation training. NEC employees apply the common processes and mindset required to produce innovations to every aspect of their work. By challenging themselves to come up with proposals for new business, more and more employees are learning the practical skills they need to innovate successfully. In 2015, three members from NEC were selected out of more than 300 applicants for the Ministry of

Economy, Trade and Industry's "Sido (Start) Next Innovator" program for fostering innovators capable of creating new global business. One of the three was further included among the 20 members chosen to join the training program at Silicon Valley. Several members were also selected in the fiscal 2016 program and together with other entrepreneurs are now learning the practical skills and mindset necessary to become leaders in business creation and innovation. NEC is actively involved in developing human resources with strong connections outside the company through initiatives such as dispatching employees to venture capitals.





Co-creation with customers by leveraging X-tech

For more than 50 years now NEC has been engaged in various co-creation initiatives with customers in many different fields such as NUA (the NEC C&C system users association). Going forward, we will strive to further expand our advanced initiatives for integrating ICT in a variety of areas, such as AgriTech (agriculture), HealthTech (healthcare), FinTech (finance), EdTech (education), and MediTech (medicine).

Case Study >> KAGOME



Development of solutions for expanding the possibilities of agriculture by leveraging AI and IoT

Today, tomato is the most widely consumed vegetable around the world. How to cope with the increase in demand for tomatoes due to the world's rapidly growing population is a major challenge among producers and processed food manufacturers. Also, the increasing uncertainty of climates has made it difficult to predict yields.

To address these issues, NEC collaborated with Kagome in utilizing AI and IoT to develop an agricultural ICT solution that can predict yield and other indices based on data from farm sensors and satellites. Through field tests in Portugal, it was shown that the solution enables advising farmers of the most appropriate cultivation method for

each field and accurately predicting yields and proper timing for harvests.

NEC's cutting edge solutions that can also be applied to areas other than tomato will contribute to realizing a sustainable agriculture that takes into account social issues, such as global-scale climate changes and food shortages.



Testing at a tomato farm in Portugal

Case Study >> GUNZE



NEC helps develop a simple wearable system that measures bioinformation while you go about your daily life

"Is it possible to create a new business that will allow people to improve their health effortlessly and comfortably while engaging in daily life and work routines?" Gunze, an apparel maker, used the latest ICT and knowhow on manufacturing a fabric that combines high functionality and comfort to conceptualize a new service that contributes to improving people's quality of life (QOL). They developed smart clothing that incorporates wearable technology to measure a person's posture, calorie consumption, heartbeat, and other vital signs.

NEC was actively involved from the service conceptualization stage and collaborated in the development of Gunze's smart clothing. In this way, NEC is contributing to the creation of new, first-of-its-kind values, such as developing new services for sports clubs and better managing the health of employees, by providing technologies and knowhow on IoT.



Smart clothing

Case Study >> bree's corporation

Creating new value by a FinTech joint venture with SMBC

Sumitomo Mitsui Banking Corporation (SMBC) and NEC have established a joint venture company "brees corporation" that will offer a new Convenience Store Payment service that allows customers to pay utility bills and online shopping purchases at convenience stores using their smartphones rather than conventional payment slips. Users of the new service, available from March of 2017, will be able to upload barcodes on payment slips to their smartphones and make payments by scanning the screens at convenience stores. This not only contributes to improving the efficiency of payment processing for convenience stores, but also reduces the costs involved in printing and transporting payment slips for merchants. Users of the service also enjoy the benefit of not having to carry around slips of paper, which, if forgotten, could lead to late payments. Going forward, bree's aims to collaborate with major



convenience stores and other retail companies, as well as venture startups, to continue creating new value.

Delivering innovations through the integration of technology and finance

Masamitsu Ikezawa (Director of bree's corporation) * Photo center Senior Vice President Transaction Business Planning Dept Sumitomo Mitsui Banking Corporation

Our new FinTech Service, achieved through the integration of "Finance" and "Technology," is a new form of Convenience Store Payment managed by an app. This is a groundbreaking new service, and, due to security issues related to this field, must not only be convenient, but also totally safe and secure. We chose NEC as our partner because they have both an entrepreneurial spirit and a proven track record of creating robust and highly reliable products and services. There really was no other choice for us. Looking ahead, we plan to continue delivering innovations by bridging traditional industry boundaries and deepening collaborations between ICT and Finance.

Highlights 3

Creating new value with diverse partnerships across the globe

Takayuki Morita

Executive Vice President and
CGO (Chief Global Officer), NEC

Working with people from countries and regions all over the world, NEC is helping to solve wide-ranging issues and co-create social value. NEC's CGO, Takayuki Morita, gives his thoughts on deploying Solutions for Society across the globe.

Delivering four social values

— Safety, Security, Efficiency and Equality
— to people all over the world

Would you start by telling us about NEC's global business journey so far?

Morita: As Japan's first joint venture company with foreign capital, NEC has enjoyed a long and close relationship with global markets. We started exporting equipment for communications infrastructure in 1956, and ever since then NEC had been expanding business operations across the globe, exporting mainly broadcasting and communications equipment including microwave transmission equipment, to countries such as India, Taiwan and Mexico.

Before long NEC's business interests expanded into the areas of computers, semiconductors and software with the increased digitalization of communication network devices. Just as the challenges facing our customers and society in general have changed, our global business has also undertaken a major shift towards the provision of solutions to address these wide-ranging issues.

What value does NEC deliver to customers through its global business?

Morita: As an information and communications technology (ICT) vendor with the three advanced technological assets of computing, networks, and software, NEC is contributing to the creation of four important social values, "Safety," "Security," "Efficiency" and

"Equality," through the activities of our Solutions for Society business. When he made the C&C Declaration in the 1970s, NEC's then-chairman Koji Kobayashi stated that he wished to use the integration of communications and computer technologies to improve the lives of people. NEC's stance has not wavered since—we remain genuinely committed to providing solutions for society that create value for everyone, and this will not change in the future.

What do overseas customers or government organizations expect from NEC and what is their assessment of your performance?

Morita: Our customers, including the global carriers that deliver our products and services, see NEC as a highly trusted partner. In the area of

Initiatives with partners

Singapore Economic Development Board (EDB)

NEC is helping to make Singapore safer and more secure

NEC has been an important partner in Singapore's ambition to becoming a Smart Nation. Since 2014, NEC's collaboration in research for cyber security and IoT has been essential to the realization of a safe and secure society. We are glad to also partner NEC, through its collaboration with local technology companies, to address the needs of an ageing population with the use of leading-edge technology and data.

We welcome NEC to continue to harness Singapore's sophisticated demand base to develop value-adding products, solutions and services across industries, and to promote and capture growth through talent development, research and innovation collaborations in Singapore for the region.



Thien Kwee Eng
Assistant Managing Director,
Singapore Economic Development
Board

national-interest level communications infrastructure, we have earned a solid reputation among governments and international organizations for long-standing reliability and trouble-free operation of our fixed and wireless networks, which NEC provides to a number of countries. Our business partners also have high expectations of us, which we always try to exceed.



My role as CGO is to grow our three focus global business areas and strengthen relations with customers

What global ventures is NEC developing at the moment?

Morita: NEC is presently developing business in a wide range of fields related to public safety, including communications infrastructure, manufacturing, logistics and retail services, and transport and urban infrastructure. Our managed service business for public facilities, in which we combine a number of systems to deliver integrated services, is also growing rapidly.

Of our global activities, we are currently focusing on three business areas: global carrier networks, safety, and retail IT services. We are looking to expand operations in global carrier networks by offering technologies such as TOMS (Telecom Operations and Management Solutions) and network virtualization systems employing SDN (Software-Defined Networking) or NFV (Network Functions Virtualization), in addition to existing fixed and wireless technologies. In the retail IT services arena, we are making use of our domestic experience and best practices to focus on the global promotion of a store concept that adopts IoT (Internet of Things) technology to maintain continuous 24-hour, 365 days-a-year operation. In the field of safety, we are working to deliver safety and security systems to the world market from both the physical and cyber perspectives leveraging technologies such as Face Recognition, Fingerprint Identification and Video Surveillance.

Please tell us about the fields you have been working in until now, and your role as CGO.

Morita: Until now, I have mainly been working to grow our global communications, semiconductor and computer businesses by building partnerships and alliances with other companies and by obtaining licenses. I feel that my most important mission as

CGO is to support global business expansion and speed up business promotion. My ultimate goal is to use my previous experience to build alliances with partners and further strengthen relationships with customers and international organizations. In addition to introducing overseas customers and international organizations to NEC's track record in Solutions for Society and our broad range of offerings in areas such as advanced artificial intelligence (AI) technologies, I want to take the opportunity to actively offer innovative recommendations and proposals.

Maximizing the use of AI and IoT to create value for society and for our future

What is NEC's area of strength in the creation of value through its global business?

Morita: At NEC we have highly reliable system construction technologies supported by high-quality network technologies and OMCS (Open Mission Critical Systems) perfected over many years of experience in the construction of large-scale domestic and international communication systems.

We also offer a large array of No.1*1 /Only 1** in the world AI technologies in the fields of Visualization, Analysis and Prescription. We hold high hopes for these world-renowned AI technologies to make significant contributions to the creation of new social value.

What are the future prospects for NEC's global business?

Morita: It is important that we increase the number of cutting-edge success stories in the three focus areas I discussed earlier. There are presently a stream of new examples emerging where NEC is providing advanced support all over the world, including in Singapore, Wellington in New Zealand and Santander in Spain. Along with

expanding on examples of our cutting-edge technologies, we are looking to enhance both our businesses and branding at the same time by maximizing NEC Group assets throughout the world under the One NEC banner.


What things do you personally think are important as CGO?

Morita: For CGOs a mid-to-long term view is vital as it is our job to oversee all global business operations. I am required to make judgment calls and execute actions on the contributions we make to the company as a business unit, but I must also determine how we can continue to deliver value to customers and society as a whole on behalf of NEC. When building partnerships I think it is important to meet people in person, face-to-face, to consider the deal from the other party's position and ascertain what they see as its value and/or merits. Also people make a point of keeping their word when it comes straight from their own mouth. This is how it has always been for me and it remains the same now that I am CGO.

What kind of company is NEC aspiring to be through its global business?

Morita: I have always thought NEC should be more than just a provider of the ICT and network infrastructures that create new social values. It should be a company that is involved in the actual creation of these new values. We are looking to contribute to various countries and regions and offer a better future for our society through ICT that creates the values of "Safety," "Security," "Efficiency" and "Equality."

*1 Biometrics technologies ranked No.1 in National Institute of Standards and Technology (NIST) benchmark testing.
*2 Including Heterogeneous Mixture Learning, Crowd Behavior Analysis and other technologies. Source: NEC.

 Please visit the wisdom website.



Initiatives with international organizations

Working together with foreign governments and international organizations to solve social problems

Countries around the world are looking to ICT to help them address social issues and make their societies safer and more secure.

The public-private partnership 'Global Supply Chain For Pandemic Preparedness & Response Initiative,' facilitated by World Food Programme (WFP), was established in 2015 to prepare for the next pandemic break out. NEC joined the initiative to effectively respond and help tackle these challenges with innovative ICT-based solutions.

NEC also participated in the economic mission at the Tokyo International Conference on African Development (TICAD) held in August 2016. Through NEC's exhibits, as well as its participation in the conference itself and its subcommittees, NEC was able to

demonstrate to various heads of state how its biometrics technologies and other public safety solutions could contribute to realizing a safer and more secure society. NEC subsequently signed an MOU with the federal police in Côte d'Ivoire.

Building on their excellent track record of deploying biometrics and other new technologies, NEC will continue to work closely with the governments of Africa to improve regional security and thwart terrorism.



Providing safety and security for daily life and society in both the physical world and the cyber world

Globalization and advancement of IoT have led to the rise of various kinds of threats to daily life and society. NEC supports safety and security through cutting-edge, world-class AI and biometrics technologies.

Case Studies and Highlights of Solutions for Society

Safety Cyber Security Solutions

Leveraging AI, biometrics, and other cutting-edge technologies to deliver advanced safety

Increasing threats from crime, natural disasters, and cyber attacks

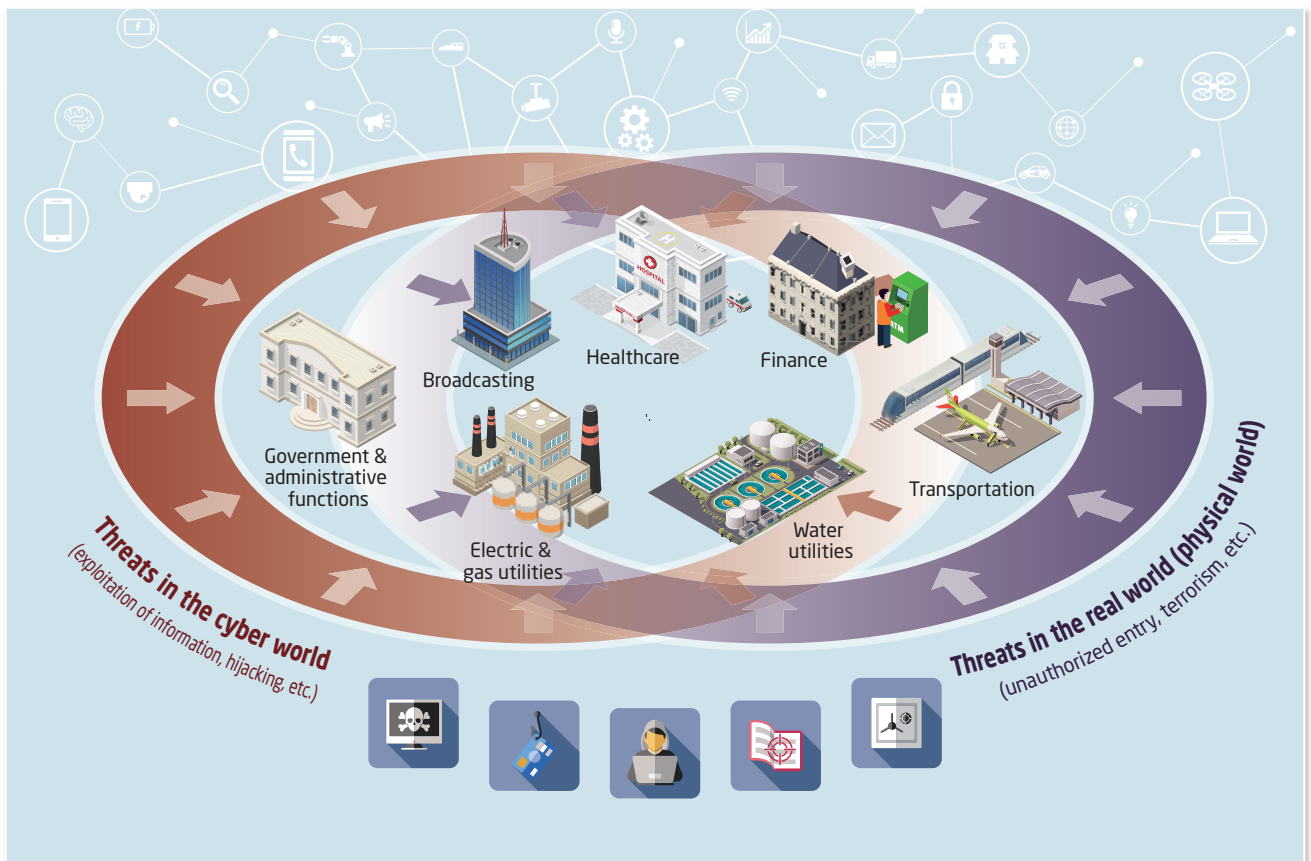
The world today faces many challenges: threats to society from crimes and terrorist acts, threats from natural disasters such as earthquakes and tsunamis, and threats from cyber attacks that are becoming increasingly stealthier and more sophisticated. Global population and urbanization will continue to increase, and by 2050, it is forecasted that 70% of the world's population will be living in cities. As national and regional borders fade with the advancement of urbanization and globalization, maintaining public order and ensuring the safety and security of infrastructures will become more critical than ever. Moreover, the need for measures to protect cities and lives from natural disasters caused by global warming and from large-scale earthquakes and tsunamis will become more pronounced. Meanwhile, as new social values are generated through the "connectivity" brought about by the advancement of Internet of Things (IoT) that links people and things of all sorts, allowing us to more deeply understand contexts, this connectivity also brings with it an increase in security risks. Today, we are seeing an uptick in cyber attacks and organized crimes perpetrated by specialized groups. These attacks not only cause damage in the cyber world through the infiltration of information and communications technology (ICT) systems, such as data loss or falsification and theft of information assets, but also bring threats of physical damage into the real world (physical world) as seen by increasing incidents of unauthorized entry into facilities and acts of terrorism. As the advancement of IoT continues, it is clearer than ever that we will need both physical and cyber safety measures to protect our social infrastructure and ensure that it runs stably.

Making people and society safer and more secure through a physical-cyber security approach

NEC leverages its sensing and surveillance technologies to visualize people, things, and environmental changes in the real world and then analyzes the collected data by using artificial intelligence (AI). This data is converted into information from which new knowledge can be obtained and applied to the real world to prescribe actions there. NEC has a unique array of technologies for detecting abnormalities in social infrastructures and predicting failures in critical facilities, as well as for quickly detecting suspicious behavior, congestion states and unusual phenomena in public spaces. These technologies make cities safer by preventing incidents and accidents before they happen. NEC also offers the world's most accurate* biometrics technologies that are deployed in many countries and regions around the world, delivering reliable results for their users.

In the field of cyber security, NEC carries out advanced initiatives in developing security measures for preempting cyber attacks, detecting system abnormalities, and automatically detecting unknown cyber attacks using AI technologies. NEC is also reinforcing cyber security measures through the establishment of a core facility specializing in cyber security and through the global deployment of safety solutions catering to worldwide needs. Going forward, through alliances with cyber security vendors and collaborations with international agencies and partners worldwide, we will continue to strengthen our cyber security operation frameworks, develop human resources, and enhance our solutions and services.

* Ranked No.1 in National Institute of Standards and Technology (NIST) benchmark testing.



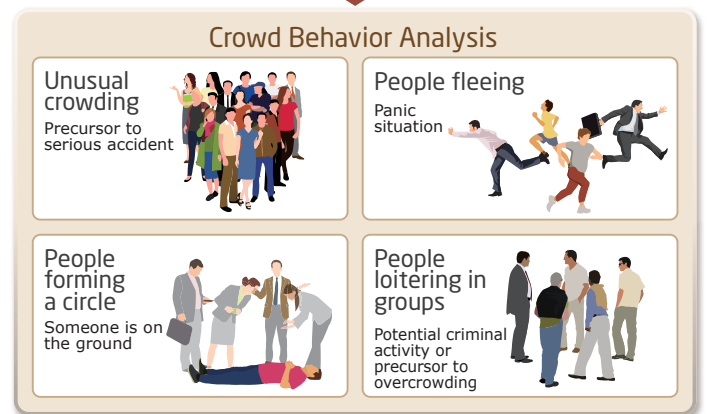
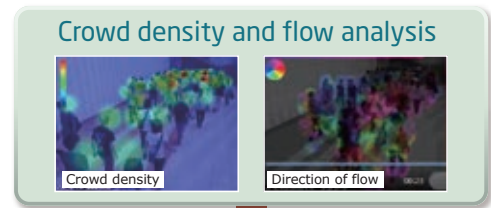
Thorough detection of suspicious persons and behavior, including threats to social infrastructures and critical facilities

NEC reinforces physical security for protecting people and social infrastructures from accidents, incidents, and natural disasters through AI and biometrics technologies, and technologies for detecting earthquakes and tsunamis.

Protecting people and society through advanced AI and biometrics technologies

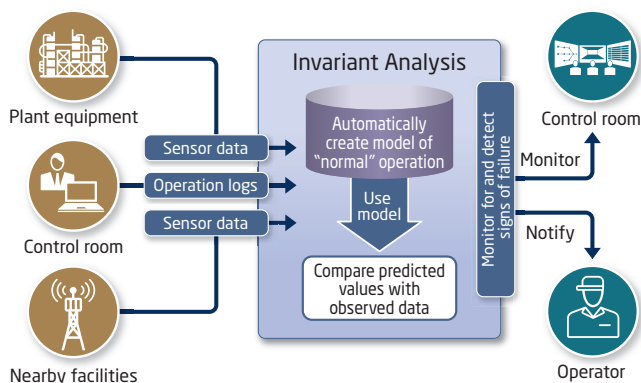
Through its world-leading AI technologies, NEC is continually pursuing the evolution of its advanced and diverse physical security solutions. For public spaces, such as cities, airports, and stadiums, NEC prevents the occurrence of accidents and incidents through early detection of dangerous behavior and suspicious vehicles from video surveillance images. One of NEC's solutions is Crowd Behavior Analysis, a technology that detects congestion and unusual phenomena from surveillance videos in real time, while maintaining personal privacy. Crowd Behavior Analysis can be used to prevent crime, and also to respond quickly and guide residents to safety in an emergency or disaster.

Further, NEC's Fingerprint Identification, Face Recognition, and other biometrics technologies, which are ranked as the world's most accurate*, are widely used in many countries around the world in applications ranging from national level security, such as national ID systems and airport immigration systems, to personal identification in enterprises and facilities. NEC is also establishing a global framework for providing its safety solutions to all regions around the world to enhance its safety business.



Protecting social infrastructures and critical facilities through advanced AI and encryption technologies

In the area of physical security of power stations and plants, combining NEC's sensing and AI technologies enables detection of abnormalities from system behavior that is "not normal." Our solutions use Invariant Analysis to analyze large volumes of time-series data collected from multiple sensors and create models of inter-sensor correlations, which are then used to discover signs of failure before they occur, enabling preventive maintenance. NEC will expand the areas of application for these solutions in the monitoring and maintenance of various infrastructures, such as roads, bridges, tunnels, and airports. Also, the Symmetric-Key Cryptographic Algorithm developed by NEC—which has the highest encryption strength level in the world—is now being applied in a number of highly public infrastructures. With the advancement of IoT, it is expected that its applications will further expand to a broader range of equipment and systems.



Protecting people from natural disasters through reliable earthquake and tsunami observation systems

NEC has more than 20 years experience in developing systems for the Japan Meteorological Agency that provide immediate information on earthquakes and tsunamis. These cutting-edge systems instantaneously process and analyze the epicenter and scale (magnitude) of an earthquake based on data received from measuring instruments to allow authorities to issue earthquake early warnings, earthquake-related information, and tsunami warnings. We also provide total support for laying down deep-sea cables and constructing earthquake and tsunami observation systems, including the provision of optical submarine cables, seismometers/tsunami meters, repeaters, and other equipment.



* Ranked No.1 in National Institute of Standards and Technology (NIST) benchmark testing.

Case Study Smart City Solutions



NEC deploys Smart City Solutions

Rapid urbanization is a global phenomenon that is producing traffic congestion, environmental damage, worsening security, and a host of other problems. Efforts are underway in countries around the world to make life safer and more secure for urban residents.

For example, the cities of Tigre in Argentina and Surat in India have recently deployed the urban surveillance systems based on NEC's Face Recognition technology to improve the safety and security of these cities. In Tigre, these systems use highly accurate Face Recognition to help police track down criminals and investigate crimes, Behavior Analysis to identify suspicious vehicles and dangerous driving that could lead to accidents and Number Plate Identification to swiftly identify fleeing cars. By quickly detecting potential risks and problems, these systems are designed to prevent crimes.

NEC is planning to offer its Smart City solutions to cities around the globe, and promises to provide a range of services from operations planning to actual solution implementation. These initiatives contribute to the evolution of cities, make cities more agreeable and attractive places to live and help provide a better quality of life for everyone.



Case Study Unique Identification Authority System in India



Supporting a national project in India through advanced recognition technologies

India continues to exhibit rapid development spurred by its high economic growth. In order to equally provide education, healthcare, social welfare, and other social services to all residents, a Unique Identification Authority System for identifying each and every citizen has been launched in this country with a population of more than 1.2 billion.

Central to this initiative is an unprecedented, large-scale biometrics system for distinguishing 1.2 billion people, which is equivalent to approximately one-sixth of the world's population.

The system collects biometric data, including fingerprint, face and iris data, and combines it to match and identify individuals. This enables issuing a unique ID to each and every citizen throughout India.

NEC built a highly reliable system by utilizing the latest technologies in the continuously evolving field of biometrics, such as Face Recognition and Fingerprint Identification. NEC strongly supports the building of societies where people around the world can receive equal treatment and live in prosperity.



Why

- ▶ More than 40 years experience in providing biometrics technologies through 700-plus systems in over 70 countries around the world
- ▶ Media processing technologies possessing the highest level of accuracy in the world, such as Face Recognition and Crowd Behavior Analysis
- ▶ Global operation framework for delivering safety solutions catering to needs around the world

Preempting increasingly stealthy cyber attacks and detecting even unknown attacks

NEC contributes to strengthening cyber security by leveraging its unique AI technologies and specialist organizations for cyber security, through collaborations with partners worldwide, and through its global operation framework.

Detecting unknown cyber attacks through advanced AI technologies and automatically minimizing system damage

NEC developed the world's first* Automated Security Intelligence technology, which identifies unknown cyber attacks previously not possible to detect. This unique AI-based technology uses autonomous learning to detect unknown cyber attacks in real time from in-house network behavior that is "not normal." Once an attack is detected, the technology automatically identifies the scope of damage and quarantines affected devices. In an unlikely event that systems and facilities sustain an attack, NEC's advanced AI technologies for automatically detecting abnormalities in currently operating systems enable a rapid response and a means to minimize damage.

Strengthening security by working together with worldwide partners from inside and outside the company

NEC established a specialized organization to handle cyber security (CSIRT: Computer Security Incident Response Team) in 2000, through which it has carried out organizational cyber security initiatives, including the monitoring of cyber attacks, analysis of attack methods, investigation of causes, and resolution of incidents. Building on the experience and knowhow gained from these initiatives, NEC offers the NEC Cyber Security Platform that realizes "proactive cyber security" by preempting cyber attack patterns and implementing countermeasures in advance. The platform "visualizes" security risks in servers, PCs, and devices across



Security Operation Center (SOC)

the entire in-house ICT system in real time. NEC has also established the Cyber Security Factory (CSF), which gathers experts in cyber security from inside and outside the company. CSF serves as the core facility for collaborations between the NEC Group and partner companies to provide total support, improve technologies, train human resources, and carry out leading initiatives in cyber security. Also, as part of its cyber security business infrastructure in the APAC region, NEC has established a Security Operation Center (SOC) and forged collaborations with INTERPOL, in order to further strengthen its global operation framework for handling cyber security. Going forward, NEC will combine "information/knowledge," "technology", and "human resources," and collaborate with its partners worldwide to contribute to building a safe and secure society.

* Source: NEC

Case Study >> INTERPOL

NEC partners with INTERPOL to strengthen worldwide security against cyber crime.

In a bid to strengthen the global fight against cyber crime, NEC signed a partnership agreement with INTERPOL in 2012 to help establish a Digital Crime Centre in the INTERPOL Global Complex for Innovation (IGCI) in Singapore.

NEC delivered a digital forensic platform and various other technical resources for the Centre, which began full operations in 2015. A driving force in the IGCI, the Centre offers essential assistance for national authorities in terms of investigating and identifying cyber crimes and criminals, research and development in the area of digital crime, and digital security. NEC is keen to participate in further collaborations between law enforcement and the internet security industry to contribute to the stability of security for businesses and communities throughout the world.



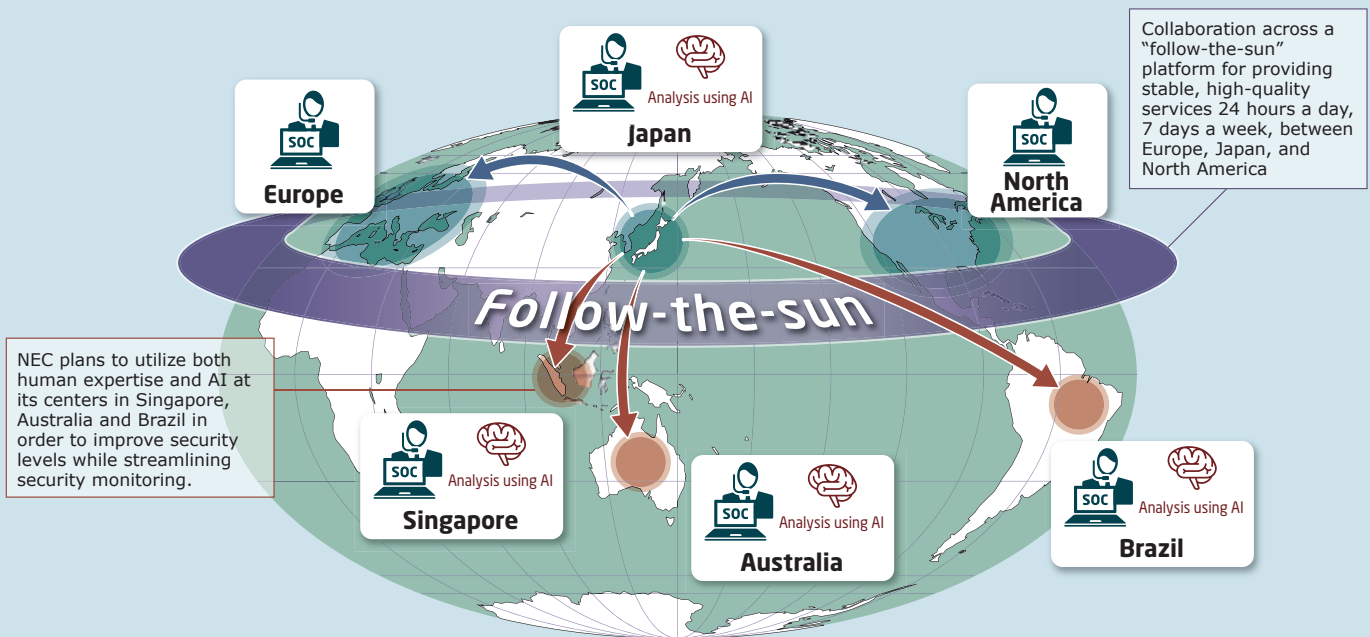
Case Study Security Operation Center (SOC)



Global deployment of SOC

Understanding the need for protecting customers' diverse ICT platforms and the different critical infrastructures within Japan from cyber attacks, the NEC Group has promoted the establishment of an SOC. NEC currently operates a Cyber Security Factory, the core facility for SOC, in Japan as well as in Singapore, and shares intelligence on cyber attack threats. NEC endeavors to deliver high-quality safety and security solutions globally. The NEC Group's SOC provides security operations and

monitoring services 24 hours a day, 7 days a week, as well as advanced security intelligence, incident response support, and other security services for handling a wide range of cyber security risks. In addition, these centers offer network surveillance and help desk services and are equipped with the facilities and operational frameworks that can support the stable and reliable operations of customer's ICT systems.



Value Creator Interview



Kenji Yoshifu

Senior Manager
Cyber Security Strategy Division
NEC

Keeping society safe from security risks in the IoT era

In the era of IoT, many different things and contexts will be seamlessly connected via networks. A vulnerability discovered in any one of the devices, parts, services and systems that we deliver to our customers could have a disastrous consequence. It is vital that we maintain the highest degree of quality right from the development stage, which is why we have established a Secure Development and Operations Promotion System.

Twenty years ago, I was seconded to an ISO/IEC 15408 evaluation organization for about four years. I was involved in evaluating whether companies had implemented an appropriate system for preventing future problems with products or systems from an

information security perspective. This experience has helped me tremendously as I work to ensure the secure development and operation of NEC's IoT products. At NEC, we consider security for not just our ICT systems but also our IoT products from the design stage, so that we can maintain the highest possible quality. We call this "Security by Design." We have also invested considerable resources in staff training so that we can help our customers by providing them with both state-of-the-art technologies and expertise in secure development and operations. This is just one of the ways we are contributing as a company to creating a safer and more secure society.

Why NEC

- ▶ Cutting-edge AI technologies that automatically detect unknown cyber attacks and system abnormalities
- ▶ Development of human resources through diverse collaborations with industry, government and academia both in Japan and around the world
- ▶ Established a Security by Design framework for ensuring that security is considered from the IoT product design phase

Harnessing ICT to help solve infrastructure challenges in countries and regions all over the globe

All regions in the world are facing problems of traffic congestion, deteriorating social infrastructure and critical facilities, and a host of other infrastructure challenges.

NEC is using AI, IoT and other ICT to address these problems and deliver convenient and efficient, as well as safe and secure, traffic and urban infrastructure.

Case Studies and Highlights of Solutions for Society

Public Solutions Traffic and Urban Infrastructure

Emerging and developed nations—we are all committed to solving each and every infrastructure challenge.

The challenges in traffic and urban infrastructure facing our world differ significantly from country to country and region to region. Traffic congestion is becoming a serious issue in emerging countries due to traffic infrastructure not keeping pace with exploding population growth in urban areas. Traffic congestion not only invites considerable economic damage in the form of gridlocked distribution systems and increased energy consumption, but is also a source of environmentally damaging air pollution. On the other hand, developed countries are searching for ways to prevent incidents of failure and accidents at critical infrastructure and facilities and ensure their safe operation as social infrastructure such as roads, bridges and tunnels, as well as power plants, factories and other critical facilities built many years ago continue to age. Information and communications technologies (ICT) are making a great contribution to efforts to solve these traffic and urban infrastructure challenges affecting both emerging and developed countries.



Transforming traffic systems and infrastructure operations using AI and IoT technologies

NEC is leveraging its advanced ICT to solve the diverse challenges facing each country and region. In Singapore, NEC is using artificial intelligence (AI) and Internet of Things (IoT) to make Singapore's bus operations safer, more secure, and more efficient. The system provided by NEC optimizes bus management by tracking the locations of all buses on the road, and uses AI to analyze driver behaviors such as rapid acceleration or deceleration to provide visual cues for safer driving. In Bangladesh, NEC has introduced a transit smart card system that covers multiple transportation operators and improves the efficiency of transport system management as well as bringing greater convenience to passengers.

In Thailand, NEC is conducting a proof of concept (PoC) for a traffic signal control system based on traffic demand that is calculated by collecting and analyzing traffic volumes at major intersections. NEC is also conducting a PoC in France for a system to monitor vehicle occupancy in real-time with the aim of popularizing car-pooling. Through these and other efforts, NEC is leveraging its advanced image recognition and AI technologies to alleviate traffic congestion and reduce CO₂ emissions.

NEC is also delivering cutting-edge solutions to support the safe and smooth operation of airports. These include outstandingly reliable air traffic control systems for airports struggling to keep pace with exploding demand for air transportation and overcrowded airways, and immigration systems that use NEC's world-leading biometrics technologies. In the area of social infrastructure and critical facility monitoring, NEC is using sensor technologies to monitor operating conditions in a range of different facilities. Collected data is analyzed using NEC's original AI technologies to identify potential problems from "not normal" behavior in real time, making it possible to carry out quick repairs and implement preventative maintenance.

NEC maintains its commitment to utilizing the company's outstanding AI and IoT assets to create the core values of Safety, Security and Efficiency for traffic and urban infrastructure in every country and region in the world.

Case Study >> City of Pune, India

A safe and reliable bus service that provides better visual control for managers and is user-friendly for passengers

Huge concentrations of people and rapidly increasing numbers of vehicles on the roads cause traffic congestion that makes it almost impossible to move people and goods smoothly across town. To solve this problem, the city of Pune in the State of Maharashtra in the western region of India has committed to using Smart City technologies and commissioned NEC to build a bus rapid transit (BRT) system with a special lane for buses. Needless to add, this system requires efficient ICT-based operating systems. NEC installed a smart location information system in Pune that gives managers a comprehensive visual overview of the operating status and location of all buses in the system, so they can constantly monitor status of the service from

the bus control center. With the ability to send instructions to drivers and alert passengers with smartphones when the next bus will arrive, the transportation infrastructure was completed and has been well received for providing smooth unobstructed travel over Pune's arterial roads and timely information and enhanced services for passengers. Smart City solutions are currently being considered in over 100 cities throughout India. By leveraging its cutting-edge ICT system and service knowhow, NEC is making a significant contribution to the deployment of efficient transportation infrastructure on the subcontinent that is safe, secure, and gives passengers peace of mind.



Case Study >> Plant Failure Sign Detection Solution



A combination of cutting-edge technology and feature-rich solutions stops threats and crime before they occur

Airports, ports and harbors, power plants, gas facilities, factories, water treatment plants, stadiums, and other critical facilities require advanced security measures. If any one of these facilities is shut down, it would have an enormous impact on people's lives. Key infrastructure facilities are thus placed under the most rigorous protection using ICT to ensure that threats and criminal activity are prevented before they can be carried out. A case in point is the Plant Failure Sign Detection Solution that is designed to quickly and accurately identify and isolate potential plant abnormalities and failures. This system collects a vast amount of data from sensors installed throughout the plant or other facility, and this data is then analyzed using NEC's proprietary Invariant Analysis technology to detect abnormalities or anything out of the ordinary. This early detection system quickly identifies vulnerabilities that could potentially cause the plant to fail, thus enabling timely repairs even before the breakdown occurs. NEC provides a range of feature-rich solutions for area

surveillance and electronic security. Working together with our partners who manage their own plants and have extensive operations and maintenance expertise, NEC is committed to help create a society that is safe and secure.



Why NEC

- ▶ Largest share* of the market in Japan for network systems for road and rail infrastructure
- ▶ Track record of deploying airport solutions to more than 50 countries and regions worldwide
- ▶ Track record of deploying monitoring systems for social infrastructure and critical facilities using NEC-developed AI technologies

* Source: NEC

Supporting diverse communication services with advanced SDN/NFV solutions

Data traffic is surging globally. NEC is capitalizing on its world-class achievements in providing extensive solutions to advance communication services, build communication infrastructure, and realize rich social value creation.

Case Studies and Highlights of Solutions for Society

Telecommunications

NEC is providing next-generation communication networks to support advanced technologies such as SDN/NFV and 5G

Building social infrastructure for diverse and enhanced communication services

As data traffic around the world surges due to the proliferation of smartphones and migration of data to the cloud, telecom carriers face major business challenges in maintaining capital investment, reducing operational costs, and improving profits. To meet telecom carriers' diverse needs and business challenges, NEC is providing solutions in areas such as wireless broadband access, mobile backhaul, core and metro networks (optical, IP), submarine cable systems, Telecom Operations and Management Solutions (TOMS), and SDN (Software-Defined Networking)/NFV (Network Functions Virtualization). NEC's high-quality, highly trusted microwave communication system PASOLINK, which has long been used as a mobile backhaul solution for wireless applications, has now been adopted in more than 150 countries. NEC is also a top-class vendor of submarine cable systems, and has established a stable supply system to support the production, installation, and laying of all system elements, from terminal equipment for cable stations to submarine cables and optical repeaters. NEC has a track record of laying more than 250,000 km of submarine cable—enough to circle the earth six times.

In the area of TOMS, NEC is providing management and operations support to telecom carriers around the world together with its U.S. subsidiary Netcracker Technology Corp. ("Netcracker"). In the last 20 years, Netcracker has provided services to more than 250 customer companies. NEC is supporting the diversification and sophistication of communication services with SDN/NFV—which will revolutionize network virtualization and control—and the development of 5G next-generation mobile networks.

Actively engaged in development of advanced solution offerings for SDN/NFV

NEC is expanding globally in the SDN/NFV market in collaboration with Netcracker. SDN/NFV technologies are drawing attention as solutions to meet the needs of diversifying communications services and higher traffic volumes and speeds. NEC leads the competition in providing commercial SDN/NFV solutions. Its virtualization technologies are being applied not only to networks but also to service control nodes. This allows optimal resources to be flexibly allocated across the entire network to cope with increases and changes in traffic volume. Meanwhile, Netcracker, with its Management and Network Orchestration (MANO) development expertise, is providing solutions such as TOMS-linked integrated operations of SDN/NFV.

In May 2016, NEC and Netcracker launched the AVP (Agile Virtualization Platform and Practice) solution suite to support SDN/NFV deployment. Included are solutions for developing SDN/NFV systems and integrating existing systems. This solution is being highly anticipated by a wide range of customers, and has already been adopted by a top global carrier.

Besides actively participating in SDN standardization activities, NEC has also established a partnership program, "NEC SDN Partner Space," that seeks to provide optimal network applications and solutions utilizing SDN/NFV. This program has already attracted more than 40 participating companies. Going forward, NEC will continue working together with its customers to create new business models in this field.

Value Creator Interview



Nozomu Watanabe

General Manager
Mobile Radio Access Network Division
NEC

Developing 5G technologies that will bring value to our customers

The number of people using wireless communications has exploded in the last 20 years or so. Wireless networks also have to meet a much more diverse range of requirements. 5G will make it possible to autonomously optimize networks according to traffic demand and user purpose and maximize service quality. I think that this will allow us to provide more diverse solutions than ever before, through which we can create new value for society.

NEC has been researching and developing essential elements that will improve the effectiveness of 5G, such as MEC (Mobile Edge Computing), NFV C-RAN (RAN virtualization), and Massive MIMO (multiple input/multiple output). By combining and optimizing these

mobile network technologies, NEC is creating new technologies that will drive the advancement of our information and communications technology (ICT) society. I have been working in the field of mobile radio access technologies since I joined NEC. Mobile technologies are the vital thread connecting network infrastructure and people, and play an essential role in creating connections between people, between things, and between people and things. My goal going forward is to develop 5G technologies that will contribute to society by anticipating how such technologies will lead to real services and applications that will bring value to our customers.

Why NEC

- ▶ Track record of commercial SDN/NFV solutions such as vEPC and industry leader in technological developments and global deployments
- ▶ Track record of providing TOMS solutions to more than 250 global telecom carriers
- ▶ Experience of providing proven, reliable solutions for telecom carrier infrastructure in more than 170 countries worldwide

Case Study >> Ultra-compact microwave radio system "PASOLINK"



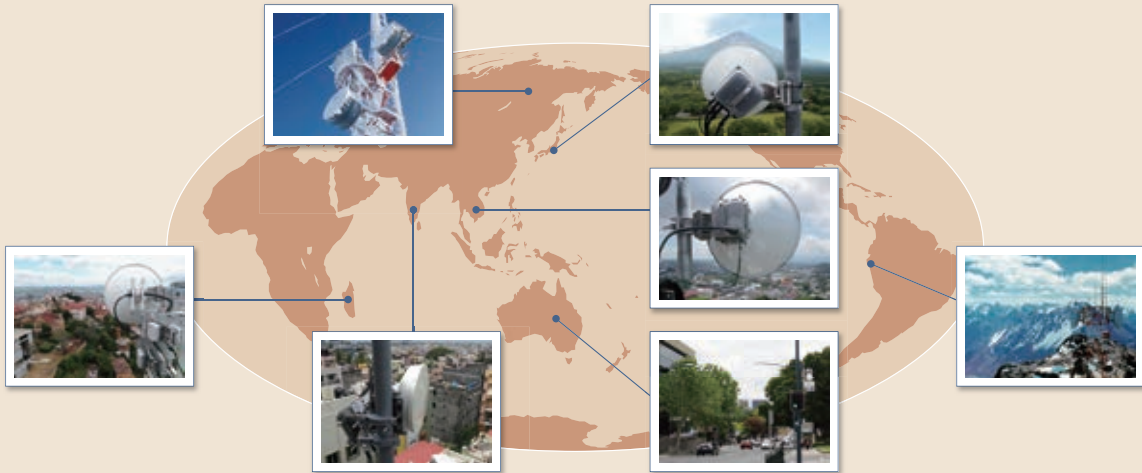
The simplified build-out of highly reliable and durable networks

NEC's ultra-compact microwave radio system, "PASOLINK," takes up only limited space and simplifies the build-out of highly reliable and durable networks for inter-base station communications. Moreover, the system is ideal for environments where fiber installations are difficult to perform, including mountainous regions, deserts and wetlands.

PASOLINK has been adopted in 153 countries worldwide, boasting approximately 2.8 million shipments.* In recent years, PASOLINK is being used for urban security systems by enabling high-resolution surveillance video to be transmitted. Furthermore,

in the future, wireless transmission radio systems will require even greater bandwidth to support 5G communication networks. To meet this demand, NEC's latest PASOLINK achieves transmission capacity of 10Gbps. This transmission capacity is equivalent to that of optical fibers enabled by millimeter wave bands and expanding radio channels. NEC aims to continuously respond to the evolving needs of society by providing communication infrastructure products, such as PASOLINK, that are essential for supporting the Safety, Security, Efficiency, and Equality of society.

* As of September 2016



Case Study >> Indonesia Global Gateway (IGG) Submarine Cable



100Gb/s submarine cable links Indonesia with Singapore

NEC is engaged in the Indonesia Global Gateway (IGG) project, a large-capacity optical submarine cable connecting nine cities of Indonesia with Singapore. NEC signed a contract with PT Telekomunikasi Indonesia, the country's largest telecommunications carrier, to lay cables totaling 5,300 km in length. The cable which is expected to be ready-for-service in the first half of 2018, features the latest 100Gb/s DWDM (Dense wavelength Division Multiplexing) technology and it has an initial design transmission capacity of 32Tb/s.

Once IGG is completed, this cable system will not only enhance connectivity between the major cities of Indonesia but it will bridge two other International submarine cables being built by NEC, namely the SEA-US submarine cable system connecting Indonesia to the U.S. and SEA-ME-WE5 submarine cable system connecting Singapore to Europe through the Middle-East. The IGG will empower Indonesia's domestic communication networks, while transforming Indonesia into an international communication hub.



Case Study >> Industrial Technology Research Institute (ITRI)

NEC/Netcracker's vEPC contributes to compatibility testing of small-cell LTE base stations in Taiwan

The period for trialing SDN/NFV is coming to an end as the technologies begin to be adopted across broader markets. In an effort to drive the market forward, NEC and Netcracker Technology provided a virtualized Evolved Packet Core (vEPC) solution to the Industrial Technology Research Institute (ITRI), a non-profit research institute working under the Ministry of Economic Affairs in Taiwan.

The vEPC was adopted by ITRI for an experimental network established for the Small Cell LTE Plugfest compatibility testing event. Ten Taiwanese small-cell LTE base station manufacturers participated in this event, seeking to verify functions for their

base stations, enhance the competitiveness of their systems and explore new business opportunities.

The NEC/Netcracker vEPC solution has a proven global track record of virtualizing network functions, such as the Mobility Management Entity (MME) that accommodates LTE handset authentication and handover controls and the Serving Gateway (S-GW)/PDN Gateway (P-GW) for audio and packet processing, and enables them to run on a general-purpose IA server. NEC and Netcracker will continue to provide SDN/NFV solutions around the world in order to enable the more efficient delivery of sophisticated services.



Value Creator Interview



Shigeru Okuya
General Manager
SDN/NFV Division
NEC



Frank DeTraglia
Vice President,
Chief Customer Officer (CCO)
Netcracker Technology

NEC/Netcracker's virtualization solutions enable real business transformation

In 2015, NEC and Netcracker combined efforts to tackle one of the most significant challenges that telecom carriers have ever faced: Reimagining traditional network services and infrastructure as dynamic cloud services that are used, provisioned and orchestrated from data centers filled with general-purpose servers.

While virtualization has been a recent focus for many telecom carriers, we have come to the realization that our customers' pain points go beyond the complexities of implementing new technology; they need to change their business culture and how they operate.

NEC and Netcracker have been providing commercial SDN/NFV solutions including vEPC and residential vCPE since 2013, and the launch of NEC/Netcracker's Agile Virtualization Platform and Practice (AVP) underscores our commitment to address our customers' challenges by giving them a set of unique tools, platforms and services they can use to deploy SDN/NFV more quickly and with less risk. This commitment was validated when Current Analysis, a leading analyst firm, named Netcracker a "Leader" in management and orchestration (MANO/virtualization), ranking our solution ahead of Cisco, Ericsson, Huawei, Nokia and Oracle among others. TMC, an integrated media company, also honored NEC/Netcracker SDN/NFV Solutions with two awards: the SDN Excellence Award for our innovative Transport SDN solution and the NFV Pioneer Award for our unique End-to-End Orchestration solution.

The challenges facing telecom carriers in an on-demand, digital world are formidable. They have to be more responsive to change and be able to design and deliver new services to both new and existing customers at a lower cost and greater speed than ever before.

NEC/Netcracker's AVP will help telecom carriers with these critical transformations because it addresses more than just technology, targeting operational, commercial and organizational challenges. A top global telecom carrier is already using AVP to become more agile, enable the faster delivery of business services and reduce network operating costs by as much as 30 percent. Going forward, we will expand our virtualized solution portfolio and are aiming to launch several new solutions, including T-SDN, SD-WAN/SD-LAN and enterprise vCPE. It's going to be a good year for NEC/Netcracker's virtualization solutions.

Linking MAKE, CARRY, and SELL to offer new values across the entire value chain

At a time of increasingly diversified consumer needs and rapidly changing market environments, NEC drives Value Chain Innovation that revolutionizes the entire value chain of MAKE, CARRY, and SELL to provide a better life for everyone.



Case Studies and Highlights of
Solutions for Society

Value Chain Innovation

Realizing Value Chain Innovation that connects people, things, and processes through ICT driven by IoT and AI

Innovation of the entire value chain through linkage of manufacturing, logistics, retail, and services

The environment encompassing the manufacturing, logistics, retail and service industries is undergoing significant changes as production operations become more globalized, the working population declines, and consumer needs diversify. Responding to these changes requires innovations in the fields of enterprise and industry; namely, transformation of the production process, improvements in logistics services, and prompt provision of products that meet customer needs. In addition, there is a need to generate new values across the entire value chain of MAKE (manufacturing), CARRY (logistics), and SELL (retail and services). Artificial intelligence (AI), the Internet of Things (IoT) and other advanced information and communications technologies (ICT) will play a big role in bringing about the necessary innovation and reconstruction of the value chain. A vital element in linking people, things, and processes across the entire value chain will be “efficient connections” via ICT and “safe connections” that minimize security risks arising from the use of IoT.

■ Innovation of MAKE through production process visualization and preventative maintenance

The manufacturing industry is currently engaged in remarkable efforts to streamline production processes and build smart factories. Ahead of the field, NEC offers a Manufacturing Visualization Solution that uses the AI technology Object Fingerprint to identify individual products and provide manufacturers with real-time information on their production lines using data supplied by IoT. This solution allows manufacturers to visualize, in an integrated way, the operating states of their global production sites, product quality, the movement of people and things, and other vitally important data that they can use to improve productivity. NEC is also contributing to innovations in production processes and stable operations of manufacturing systems through the realization of Process Innovation (for networked plants) and Product Innovation (for networked products) linked via IoT and networks and through the preventative maintenance of production equipment and facilities using world-class AI technologies.

■ Innovation of CARRY through logistics visualization and streamlined transportation

Globalization of production has also led to the globalization of logistics. In particular, for transport that involves long lead time and long distance, incorrect monitoring of shipping status results

in overproduction and overstocking. NEC helps customers improve the quality of their logistics services end-to-end by using IoT to visualize shipping status and location of goods along land and sea routes, and streamlining onsite logistics operations by providing shipment inspection equipment that utilizes image recognition technologies. NEC also provides highly efficient last-mile support that uses AI-leveraged demand and shipment forecasts to deploy people and vehicles optimized for each delivery.

■ Innovation of SELL through non-stop store operations and precision demand forecasts

The retail industry is undergoing a major transformation in response to the personalization of needs and the shift to omni-channel commerce. NEC offers solutions that connect all components of the store—POS systems, servers, fixtures, and equipment—to the network by using IoT. Monitoring the status of store system operations and detecting anomalies before failures occur enables non-stop and stable store operations, 24 hours a day, 7 days a week. NEC’s unique AI technologies for accurately forecasting demand based on Big Data collected on climate, temperature, and events also enable optimization of systems for ordering merchandise and reduce losses from having to discard food.

Realizing an efficient, safe, and secure value chain by linking MAKE, CARRY, and SELL

NEC constructs systems for Japan’s leading companies in the manufacturing, logistics, retail, and service industries. Leveraging its deep industry knowhow and cutting-edge AI, IoT, cloud, networking, and security technologies—as well as the system integration capabilities needed to implement these technologies in actual systems—NEC is able to help customers realize true Value Chain Innovation. By efficiently connecting people, things, and processes along the MAKE, CARRY, and SELL value chains, NEC brings new customer value in the form of streamlined processes, sustainable transformation that is responsive to change, and growth that exceeds all previous models.

At NEC, we work together with our customers to create new value through ground-breaking new product development and IoT-driven Service-Oriented Hardware. At the same time, these partnerships are producing Value Chain Innovation in the form of more visible global logistics infrastructure, optimized merchandise ordering, non-stop store operations, and other values that are key to the future of these industries.



Why NEC

- ▶ Experience and knowhow in manufacturing and supply chain innovations as a manufacturer
- ▶ IT service lifecycle management (LCM) model offering non-stop store operations and services
- ▶ Partnering with more than 1,100 companies through the NEC Manufacturing Co-Creation Program

Case Study >> Mitsubishi Electric



Utilizing IoT to provide remote diagnostic functions for production facilities and other functions to realize next-generation manufacturing

With growing awareness of the importance of the value chain in corporate activities, it has become imperative for manufacturing sites to be capable of multiproduct variable-quantity production and to further improve productivity and availability of factory equipment. To address these issues, Mitsubishi Electric applied IoT to their main product—laser processing machines—to create a mechanism to provide new values to their corporate clients in the form of improved availability, timely maintenance advice, and other customer-oriented services. They utilized NEC's next-generation manufacturing solution, "NEC Industrial IoT," to enable dashboard functions for quantitatively visualizing production status and remote

diagnostic functions that allow maintenance personnel to remotely diagnose processing machines. Mitsubishi Electric offers these functions as IoT cloud services to companies using their laser processing machines to enable better equipment availability and factory productivity.

To strengthen the competitiveness of Japan's manufacturing industry, NEC is providing both Process Innovation through which IoT is applied to production facilities to eliminate unnecessary waste and stagnation of processes, and Product Innovation that increases the added value of products through failure detection and other services.



Case Study >> Delhi Mumbai Industrial Corridor Development Corporation Limited (DMICDC)

Bringing visibility to logistics infrastructure to enable real-time tracking of containers in transit

The joint venture company DMICDC Logistics Data Services Limited established by NEC Corporation and DMIC Trust for providing logistics visualization services in India rolled out its services in July 2016. As part of these services, the new company affixes RFID tags to shipping containers starting their import journey and detaches the ones going out of the country through ports in Mumbai. Positional information about containers in transit along the 1,500 km stretch between Delhi and Mumbai is obtained by RFID reader/writers installed at locations such as port entrances and exits, toll plazas on the expressway, and inland container depots where customs inspections are carried out and cargo reloaded. This information is uploaded to the cloud and

shared with other logistics systems such as port management systems. Consignors and freight forwarders only need to input the container number to pinpoint the location of their containers on a near real time basis.

In addition to providing its globally acclaimed "Logistics Visualization System," NEC is also developing and operating the necessary platforms to enable total visibility of logistics infrastructure from start to finish. By making transport container information visible, NEC is helping logistics operators identify issues in their infrastructure and is contributing to the advancement of logistics services through value added services such as transport time prediction based on Big Data analytics.



Case Study >> Mac's Affiliates Stores (Alimentation Couche-Tard Inc.)

NEC's IT service LCM model brings efficiency and cost effectiveness to store operations

Alimentation Couche-Tard, Inc. (Couche-Tard) is one of the largest company-owned convenience store operators in the world. Couche-Tard is the Canadian parent company over 16,000 convenience stores worldwide, many operating as corporate owned, some as franchise stores, others as affiliate stores, under multiple brand names, primarily Mac's Convenience Stores and Circle K.

Mac's Affiliates Program includes nearly 1,300 privately owned stores, licensed with Mac's Convenience Stores; these locations receive Mac's mentoring and marketing assistance, however, each operates autonomously.

These convenience store owners have been working with outdated retail equipment from a variety of manufacturers. Managing IT support was difficult, and there was no way for Mac's Affiliates to see sales information, analyze sales data, or help owners with inventory ordering and product placement within these stores. Mac's Affiliates worked with NEC and Gexin Inc., to offer the affiliate owners a customized retail solution. In October 2015,

NEC installed a full lifecycle management (LCM) retail solution which includes the NEC point-of-sale system (POS), Stanchion® software and services. Together with Gexin, NEC standardized ten affiliate stores' equipment and operational capabilities. Integration and store installations were completed in 3 months and were fully integrated with Gexin's security system and reporting system to provide stores with sales information and metrics for smart product ordering and operational efficiency. NEC's Stanchion Store software transmits sales data in real time and allows dashboard sales visibility and reporting, thus empowering store owners as well as Mac's corporate by enabling monitoring and customized support to the affiliate stores to increase sales. The single source technical support provided by NEC makes system maintenance simple, efficient, and cost effective.

With 10 Mac's affiliate stores currently deployed, and 150+ more expected store conversions by September 2017, this growing relationship indicates a bright future for NEC retail solutions in the Canadian market and U.S. market in the coming years.



Value Creator Interview



Hiroshi Kodama

Senior Vice President
NEC

Producing things of value from the value chain that links all of society

We have now entered the era of IoT when a new value chain will be created through the synergy of the strengths and values of each item making up the chain. One of the drivers of this Digital Transformation is the "NEC the WISE IoT Platform." The business platforms of tomorrow will feature a virtual space in which the real world blends seamlessly with the cyber world, AI technologies that maximize human potential, micro-services that accelerate the creation of value chains, open and secure environments, lean startup processes that quickly turn ideas into reality, and highly streamlined operations.

These business platforms will serve to draw out the potential of society as a whole. I believe that the driving force behind the creation of these platforms will be NEC's profound

expertise and proven track record, our extensive ICT asset portfolio, our cutting-edge technologies, and the relationships of trust we have built with our customers.

I have a long history in the retail field. I strongly believe that by seeing things from our customers' perspective and responding quickly to change and by increasing the value of our offerings through repeated hypothesis creation and verification, our customers will always understand the value of the things we produce, and select our products.

In this new IoT era, we must unite our strengths and establish the strong leadership we need to create a new value chain that will bring prosperity to all of society. That is our mission at NEC.

Big Data Solutions

Creating new value through advanced analytics services in the era of skyrocketing Big Data utilization driven by AI

As AI and IoT drives the utilization of Big Data across a wide array of fields, NEC supports the continuous creation of new customer value through advanced analytics services.

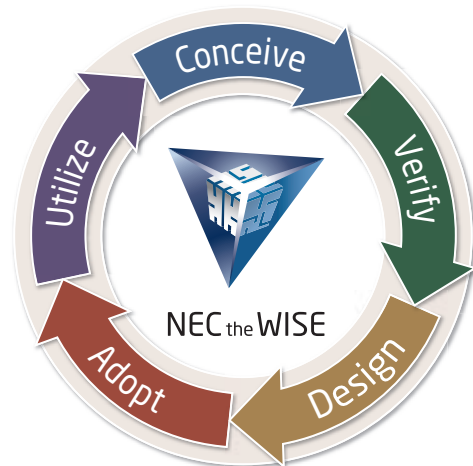
Challenges in utilizing Big Data

The scope of Big Data utilization is expanding due to advancements in artificial intelligence (AI) and the Internet of Things (IoT). Governments, enterprises and organizations are already using AI technologies to optimize their operations, detect abnormalities, predict crime, raise the value of products and services, and implement more focused marketing. However, the rapid advancement of AI technologies is causing some confusion as to what, and how much, can really be achieved through AI. Customers who have adopted analytics systems have encountered problems such as drops in prediction accuracy and unstable performance. They have discovered that simply adopting a system will not solve all their problems—they need someone with knowledge of AI and advanced analysis skills to make sure the system is maintained and continuously improved after it is deployed.

Continuous support for utilizing Big Data

NEC has been an industry leader in creating analytics services that provide ongoing support for customer value creation processes. For customers thinking about utilizing Big Data by leveraging AI technologies, NEC offers an analytics consulting service called the AI Discovery Program. With this program, NEC works together with customers to identify issues and create scenarios that will help them start utilizing Big Data more quickly and efficiently. NEC also follows up by helping customers implement continuous improvement cycles. If customers encounter any problems with prediction accuracy after they deploy their analytics systems, NEC data scientists will

End-to-end analytics services supporting the value creation process driven by Big Data



check for changes in daily data, periodically update prediction models, investigate the root cause of accuracy drops, and implement other measures to ensure that the system runs as expected. NEC's advanced and unique analytics services provide customers with value not just today, but well into the future. NEC has years of experience in researching and developing AI technologies that are some of the best in the world. Going forward, by further promoting the development of AI technologies and strengthening and nurturing globally ready data scientists, NEC will continue to contribute to the creation of more customer value through Big Data utilization.

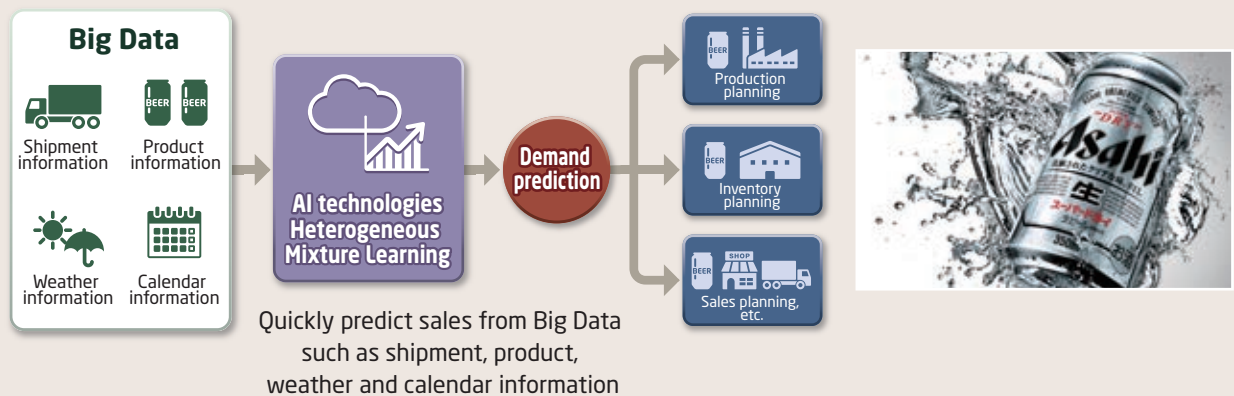
Case Study >> Asahi Breweries



Using AI technology to accurately predict new product demand

The beer industry is currently experiencing revitalization, as shown by an upturn in shipments not seen in the last 19 years. As companies are enhancing their regular product lineups and focusing on the introduction of new beverages, sales forecasting and management of production and inventory have become increasingly important. To address this issue, Asahi Breweries has adopted an AI solution from NEC—Heterogeneous Mixture Learning. The goal of this solution is to accelerate the formulation of production plans and reduce stockouts and dead stock by optimizing inventory management. The Heterogeneous Mixture Learning system automatically

identifies multiple regularities from the data of each product sold in the past such as shipment volume, season, date and weather to predict future product demands. This eventually makes it possible to optimize production and stock planning without having to rely solely on the experience and intuition of seasoned personnel. Use of the system has already resulted in highly accurate demand forecasts for some new products, with less than one percent error rates between predicted and actual values. Going forward, the company also plans to utilize AI technology in sales forecasting and marketing to further improve sales productivity and maximize profits.



Value Creator Interview

Ryohei Fujimaki
Research Fellow
Data Science Research Laboratories
NEC

Using prescriptive analytics to provide substantial business benefits

Companies must continually find ways to resolve the new challenges thrown up by a constantly changing social environment. At NEC, we are helping our customers achieve better business outcomes by providing services that support their Big Data analytics processes. Analytics is of course vital to the effective utilization of Big Data, but for all the buzz, we are still not seeing the kinds of success stories on the ground that we would expect. To change this, we not only need to “visualize” data and make predictions from it; we also need to apply

prescriptive analytics to suggest decision options on how to use these predictions to gain benefits in business. As I see it, our job as data scientists is to connect prescriptive analytics with our customers’ business and create a process that will bring about successful business outcomes. We are also looking to drive the automation of analytics to allow our customers to respond more flexibly to business changes, and create mechanisms to enable autonomy in utilizing analytics systems.

Why NEC

- ▶ Analytics services that provide ongoing support for customer value creation
- ▶ Extensive array of solutions and track record in utilization of world-class AI technologies and strong support system that includes consultants and data scientists
- ▶ Provision of AI Discovery Program to support Big Data utilization driven by AI technologies

Case Studies and Highlights of Solutions for Society

Cloud Solutions

Creation of new values by linking SoR and SoE in hybrid clouds

NEC provides optimal hybrid clouds and service integration to realize SoE, SoR and their flexible linkage, and create new businesses and services that leverage the cloud.

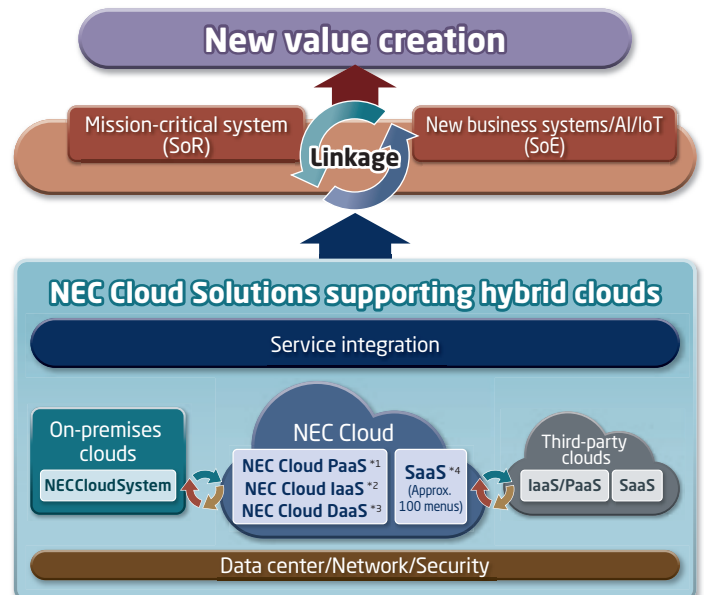
Enhancing relationships with customers and boosting competitiveness by building and linking SoR and SoE

To continue to grow, enterprises must devise innovations to strengthen competitiveness and have the capability to create new businesses ahead of other companies. Meanwhile, there is an increasing demand for convenience, promptness, and high quality of service for citizens and users in the government, finance, and healthcare domains. Generating these values calls for the creation of systems that utilize the Internet of Things (IoT) and strengthen relationships with customers and users (Systems of Engagement: SoE), while improving the efficiency of mission-critical systems (Systems of Record: SoR). These two systems also need to be flexibly linked. Cloud solutions are increasingly being used to achieve these goals.

Total support for building SoR and SoE based on hybrid clouds

Mission-critical and other SoR must be highly reliable while remaining cost effective and efficient to operate. NEC leverages its track record in the integration and operation of safe and highly reliable mission-critical systems gained through many years of involvement in system integration and the development of open mission critical systems (OMCS) to help its customers create the SoR they need.

For SoE on the other hand, it is necessary to have a development and operation environment that can be quickly provisioned, flexibly modified or expanded as needed. In building their SoE, NEC's customers receive the benefit of NEC's knowhow and extensive track record in building and providing hybrid clouds that include not only NEC's cloud services but also housing, on-premises, and third-party cloud options. They also have access to NEC's expertise in IoT and open source software (OSS). NEC provides consulting services covering cloud



*1 PaaS: Platform as a Service *2 IaaS: Infrastructure as a Service *3 DaaS: Desktop as a Service
*4 SaaS: Software as a Service

introduction to auditing, and "service integration" to optimize building and operating systems and services. This enables the creation of a cloud environment that flexibly meets the diverse needs of each customer. By utilizing the cloud, NEC can build the ideal cloud, link the customer's SoR and SoE, and allow them both to be operated with maximum efficiency. In this way, NEC is supporting rapid creation and timely implementation of new businesses and services for enterprises, government, finance, healthcare, and a broad range of domains.

Case Study **Seiko Epson**

Support for mission-critical and enterprise systems in a hybrid cloud that satisfies diverse requirements

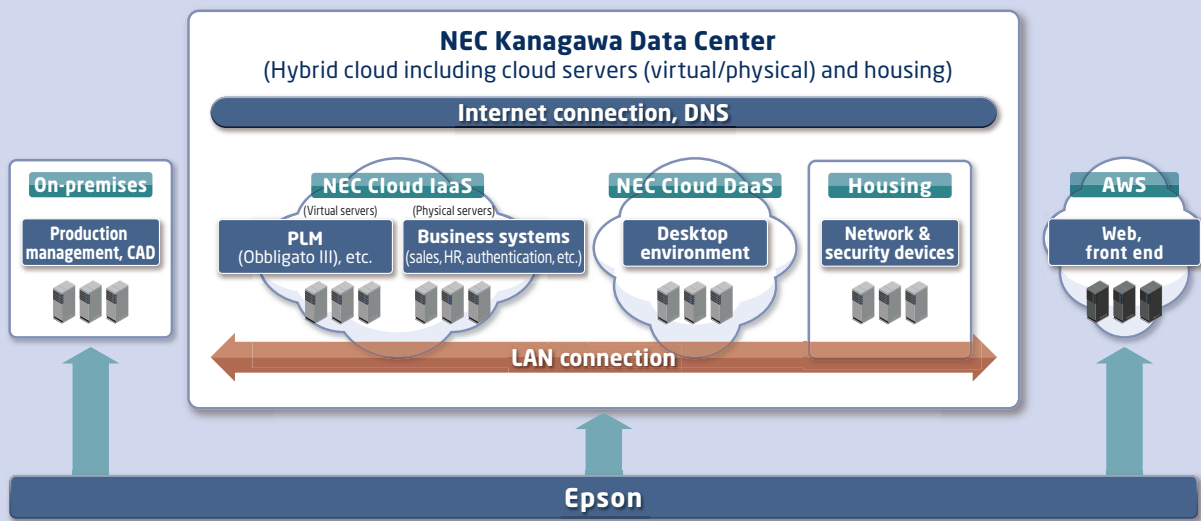
Epson continues to offer a wide range of innovative products and services including printers, projectors, wearable devices, industrial equipment, and much more. Recently the company decided to harness the cloud to deploy an IT infrastructure for rapid procurement in creating innovative new services, while at the same time driving down IT costs.

Epson has a diverse range of over 100 systems, which makes it exceedingly difficult to migrate all of the company's systems to a single cloud. To solve this problem, Epson worked with NEC to develop a hybrid cloud that integrates the NEC Cloud IaaS virtual and physical server services, NEC Cloud DaaS, and NEC's housing

service. This environment enabled a very large system migration of up to 300 servers. The Epson systems deployed in NEC Kanagawa Data Center are interconnected by a LAN.

As a result of this migration, it is now possible to add servers in a single day—a task that previously could take up to a couple of months—thus making it possible to develop and release new services very quickly. This move also reduced operations management costs by about 20%.

As Epson is currently embarking on a major project to integrate its global IT infrastructure, this migration initiative leveraging NEC's cloud will undoubtedly serve as an effective reference.



Value Creator Interview



Hisashi Shimamura

Deputy General Manager
Platform Services Division
NEC

Delivering platforms that provide ongoing safety and security

The biggest feature of the NEC Cloud is that it is perfectly transparent—a “white box.” Our goal is to provide our customers with as much cloud configuration information as possible, and bring visibility to all processes related to how the cloud is built and operated. Because the cloud is so transparent, it provides the same peace of mind as an on-premises environment; that is, it can be flexibly adapted to meet the individual needs of each customer, and failures can be handled quickly and easily. This “white-box” cloud is unique to NEC, as is the total support—from building to operation—that only we can provide.

I have been involved in the IT service business

since joining NEC. This experience made me fully aware of how important it is to provide our customers with information and communications technology (ICT) services that continue to deliver safety and security—much like train operators making sure that their trains run on time. I truly believe that our job is to deliver—quickly and at low cost—cloud solutions that provide the requisite safety and security while responding flexibly to our customers’ changing business environments. Building on the NEC Kobe Data Center launched in 2016, we at NEC will continue to work on enhancing both our cloud offerings and the data centers that support them.

Why **NEC**

- ▶ Realization of hybrid clouds that include on-premises, NEC, and third-party clouds
- ▶ Service integration solutions providing total support from consulting for cloud introduction to design, building, and operation
- ▶ Provision of the latest data centers to support the cloud. Network and security support also provided.

SDN Solutions

Leveraging our extensive track record and partnerships to take the lead in SDN-based network operations

As communication traffic rapidly expands due to IoT and mobile communications, NEC provides the world with cutting-edge ICT systems that leverage advanced technological capabilities and an impressive track record as a leading vendor of SDN technologies.

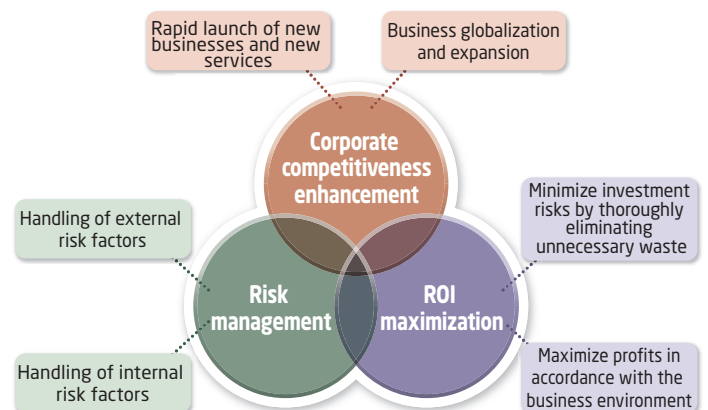
Enabling networks that are highly reliable, agile, and flexible

The diversification of user terminals and applications, and the spread of mobile networks are creating a new market for high added-value service offerings that leverage advanced information and communications technologies (ICT). However, the fixed and rigid networks in use today are creating a barrier to the advancement of ICT systems just as corporations are looking to virtualize their information systems and migrate them to the cloud. The networks of tomorrow will therefore require not only high reliability, but also even higher levels of agility and flexibility. Moreover, the network platforms underpinning new service offerings and enterprise management will need to provide support for the Internet of Things (IoT) as well as implement robust security measures to counter the increasing threat posed by sophisticated cyber attacks. It is here that Software-Defined Networking (SDN), which revolutionizes the concept of networks and their construction, will play a vital role.

NEC offers advanced solutions and services via global partnerships











SDN, which enables flexible and dynamic control of networks by using software, is already being applied in enterprise, government, and many other fields and is playing an important role in enabling the rapid deployment of new services, simplification of network operations, and strengthening of measures against cyber attacks. In 2011, NEC became one of the first companies in the world to develop and market SDN products. As a leading vendor of SDN, NEC offers SDN solutions that realize the three values of corporate competitiveness enhancement (for rapid deployment of new businesses and services, and business globalization and expansion), risk management (for controlling external and internal risk factors), and ROI (return on investment) maximization (for minimizing investment risks and maximizing profits). NEC has a proven track record of deploying SDN solutions around the world, having deployed more than 600 systems in the finance, telecom carrier, and other industries where reliability and security are vital. Also, NEC has launched "NEC SDN Partner Space," a program for promoting the development of applications and solutions utilizing SDN in collaboration with various domestic and overseas partners. The program aims to consolidate knowhow and technologies from partners to grow and invigorate the SDN market. NEC, which has been involved from the beginning in the OpenDaylight project, an initiative aimed at promoting the development of open-source SDN controllers, will continue to drive SDN adoption, expand its application areas and create new values through SDN.

Three values provided by NEC SDN Solutions



management (for controlling external and internal risk factors), and ROI (return on investment) maximization (for minimizing investment risks and maximizing profits). NEC has a proven track record of deploying SDN solutions around the world, having deployed more than 600 systems in the finance, telecom carrier, and other industries where reliability and security are vital. Also, NEC has launched "NEC SDN Partner Space," a program for promoting the development of applications and solutions utilizing SDN in collaboration with various domestic and overseas partners. The program aims to consolidate knowhow and technologies from partners to grow and invigorate the SDN market. NEC, which has been involved from the beginning in the OpenDaylight project, an initiative aimed at promoting the development of open-source SDN controllers, will continue to drive SDN adoption, expand its application areas and create new values through SDN.

Rapid global deployment of SDN/NFV *1 in many different fields

Government & Public  <ul style="list-style-type: none"> • Shinagawa City • Nishihara-cho, Okinawa Prefecture 	Wholesale, Retail & Hospitality  <ul style="list-style-type: none"> • Co-op Sapporo
Education & Science  <ul style="list-style-type: none"> • Ryukoku University · Stanford University (USA) • Minato City Board of Education • Marist College (USA) 	Information & Communications Services  <ul style="list-style-type: none"> • NTT Communications Corporation (“Biz Hosting”) • Nippon Jimuki Co., Ltd. • Fukushima Central Computing Center • JAL Information Technology Co., Ltd. • BIGLOBE Inc. · NS Solutions Corporation • NDDI (USA) • Minaminihon Information Processing Center Co., Ltd.
Medicine & Healthcare  <ul style="list-style-type: none"> • National Center for Global Health and Medicine • Nagoya City University Hospital • Kanazawa University Hospital 	Telecom Carriers  <ul style="list-style-type: none"> • NTT DOCOMO, INC. • Industrial Technology Research Institute (Taiwan) • Myanma Posts and Telecommunications (Myanmar) • Cricket Communications (USA)*2 • Telekom Austria Group (Austria)*2 • Portugal Telecom (Portugal)*2 • Telefónica Brasil (Brazil) • Telefónica (Spain) • Etisalat (UAE)*2
Traffic, Transport & Service Industry  <ul style="list-style-type: none"> • West Nippon Expressway Company Limited • East Japan Railway Company • Nippon Express Co., Ltd. 	
Finance  <ul style="list-style-type: none"> • EHIME BANK, LTD. 	
Broadcasting & Media  <ul style="list-style-type: none"> • Kitanihon Broadcasting 	
Manufacturing  <ul style="list-style-type: none"> • Takeuchi Mfg. Co., Ltd. • Toyo Seikan Group Holdings, Ltd. 	

*1 NFV : Network Functions Virtualization *2 Proof of Concept

Case Study >> Takeuchi Mfg. Co., Ltd.



Using SDN to innovate the company network and enhance IoT-based capabilities

Takeuchi Mfg.'s core products are compact excavators, track loaders, and other compact construction equipment used to build homes and other buildings. IoT utilization has recently become a major topic in the manufacturing industry, and Takeuchi Mfg. has set its sights on leveraging IoT as it continues to push reforms, implement a wide variety of IT systems, and build new factory buildings. Toward that end, the company has also dramatically redesigned its network.

Takeuchi Mfg. made the decision to implement NEC's SDN-based

Next Generation Factory Network Solution. This solution supports companies in the manufacturing industry that are using IoT to reform their value chains. It provides a network that offers automation, autonomous control, and optimization to realize factories that are connected, uninterrupted, and manageable. Takeuchi Mfg. is also looking to implement SDN in their parts factories and other remote sites, as well as centrally managing all of their networks over a WAN.

Value Creator Interview



Teruyuki Nakajima

Senior Manager
Smart Networks Division
NEC

NEC must take the lead and drive the development of an open SDN

NEC has been involved in SDN from the very beginning as a founding member of Stanford University's joint development initiative and is a pioneer in the SDN field.

I have also been involved in this field for a long time, serving as a board member of the OpenDaylight Project—a community-led project founded by major industry vendors with the goal of developing an open-source SDN controller—since its launch.

In my years working in Silicon Valley, I was extremely fortunate to have contact with major industry players and other people engaged in constructing the SDN ecosystem, as well as

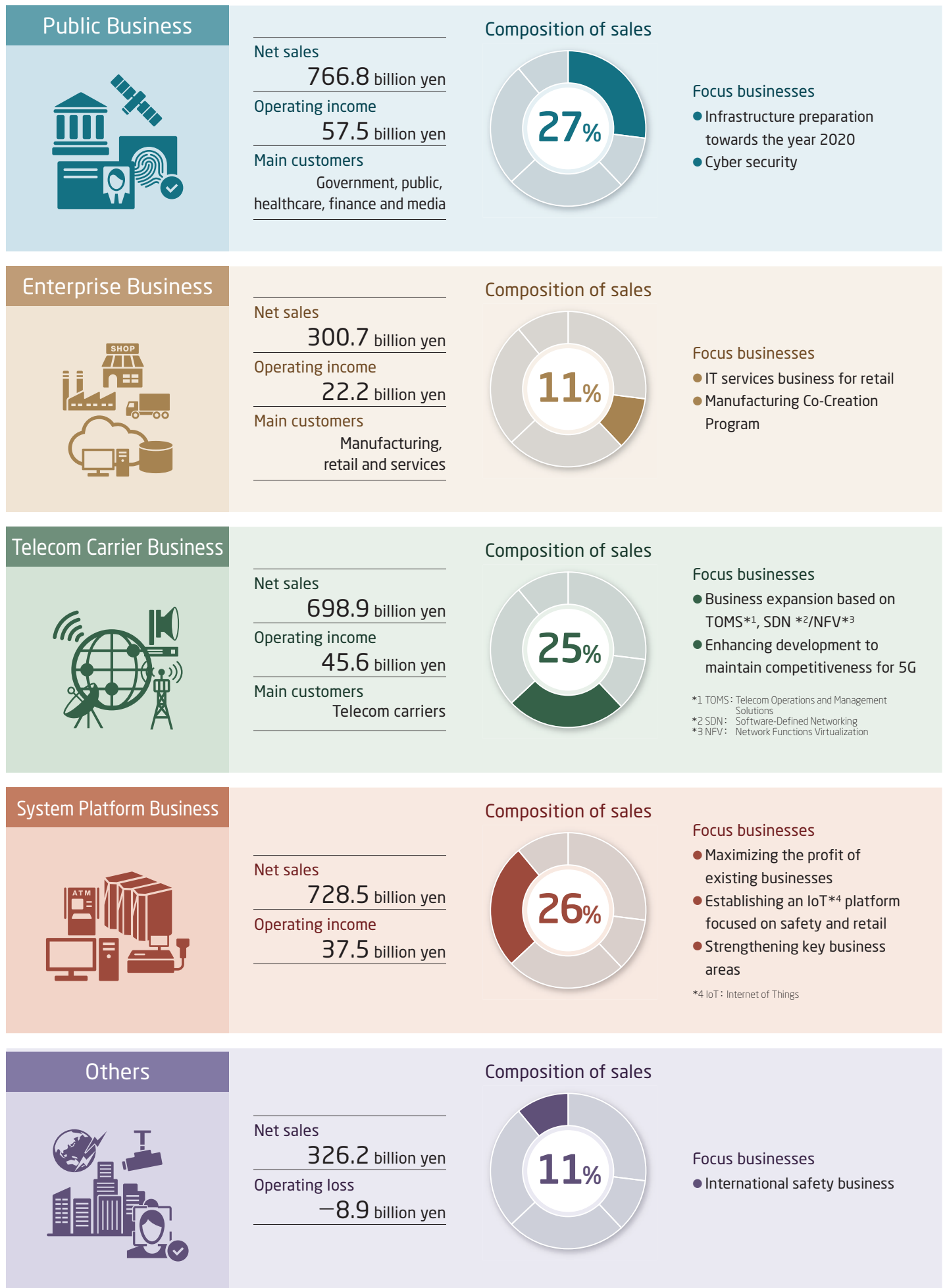
key people working this field outside of NEC. More than anything else, users will benefit most from SDN being open. I think that we have a responsibility as a leading SDN vendor to work together with our customers and partners and find ways to develop more open networks. SDN should not be something that only experts can use. We must work on making it a truly global infrastructure that customers can adapt themselves for their own strategic purposes. It is my personal goal to continue working hard to develop this kind of SDN network.

Why NEC

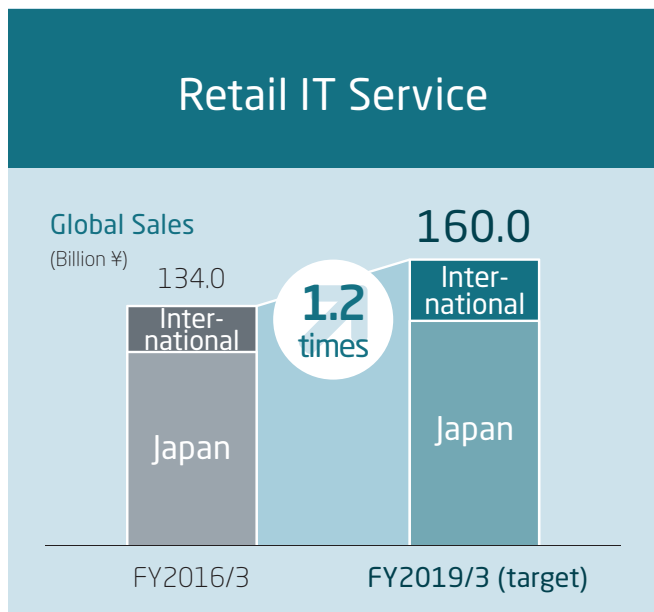
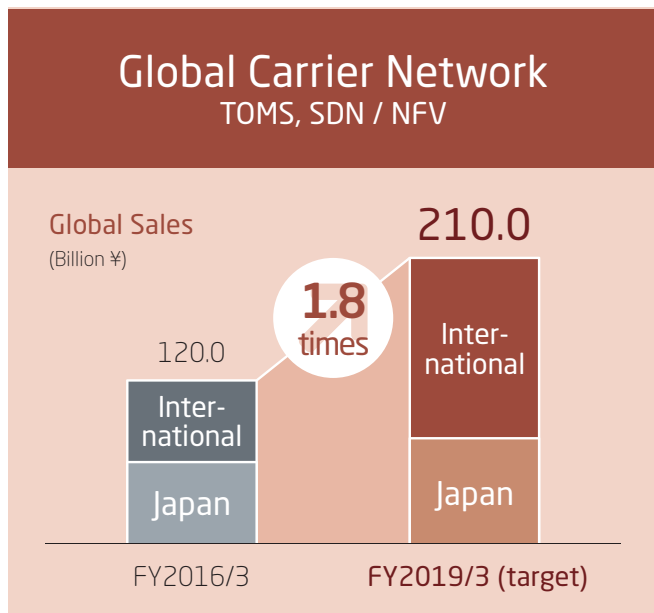
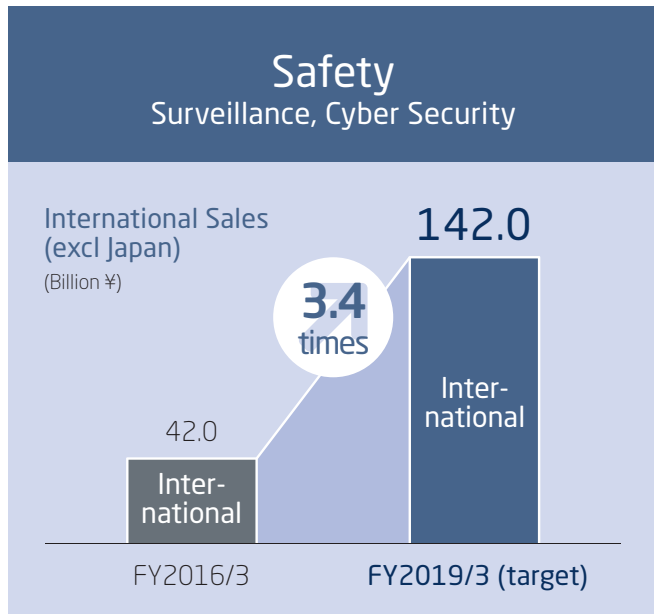
- ▶ Track record of delivering more than 600 SDN systems to enterprises, governments and municipal offices, and telecom carriers around the world
- ▶ Collaboration with global partners in promoting de-facto standardization and in creating new value through SDN
- ▶ Leveraging extensive experience and expertise in expansion of SDN application areas and co-creation of value with customers

At a Glance

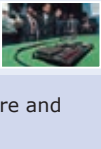

NEC Corporation and Consolidated Subsidiaries
 Net sales, operating income (loss), and composition of sales are financial results for the fiscal year ended March 31, 2016 (Japanese GAAP).

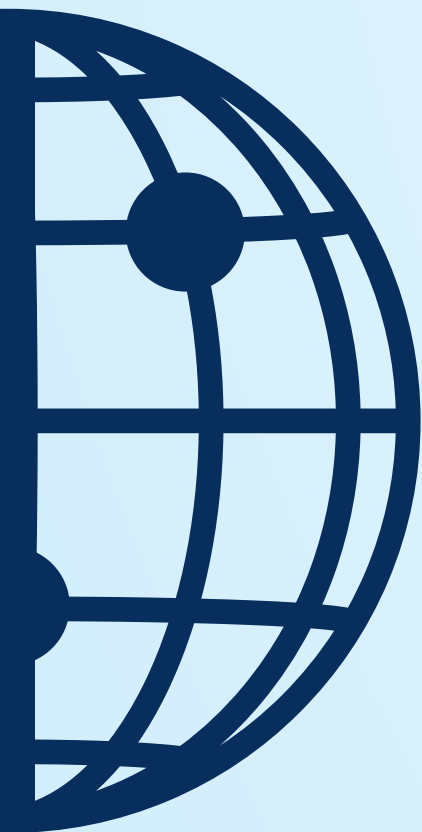


Globalization of Solutions for Society



NEC's History of Innovation

1899	Nippon Electric Company, Limited is established. (July 17)	
1928	NE-Type phototelegraphic equipment transmits Emperor Hirohito's Imperial Accession Ceremony from Kyoto to Tokyo.	
1964	Trans-Pacific TV broadcasts of the Tokyo 1964 Olympics using NEC-supplied ground facilities for satellite communications.	
1970	Japan's first experimental satellite, Osumi, is developed (for the Institute of Space and Astronautical Science of Tokyo University).	
1974	The ACOS Series 77 mainframe computer family is announced.	
1977	C&C, the integration of computers and communications, is first announced at INTELCOM '77. <small>Koji Kobayashi, then-chairman of NEC, giving a lecture at INTELCOM 77</small>	
1979	The PC-8001 personal computer is announced. <small>Demonstration at Bit-INN</small>	
1991	NEC discovers a unique graphite crystal structure and names it "carbon-nanotubes."	
1995	The world's first 1G bit DRAM is developed. (The world's first 4G bit DRAM is developed in 1997.)	
2002	The world's fastest supercomputer, the Earth Simulator, is completed (for evaluating global environmental issues).	
2007	The PASOLINK ultra-compact microwave communications system achieves the world's top share.	
2008	Trans-Pacific (Japan - US) demonstration of programmable flow switch succeeds.	
2010	Asteroid explorer "HAYABUSA" returns to Earth.	
2014	NEC's Solutions for Society brand message "Orchestrating a brighter world" is released. NEC's Face Recognition technology ranks first in NIST testing for the third consecutive time. Asteroid explorer "Hayabusa2" is launched.	
2015	NEC's Face Recognition technology wins the Education, Culture, Sports, Science and Technology Minister's Award at the 3rd Technology Management & Innovation Awards. NEC develops world's first interface supporting the ONF's Real Time Media NBI REST Specification. <small>ONF: Open Networking Foundation</small>	
2016	NEC's artificial intelligence (AI) technology brand "NEC the WISE" is established. Construction on Angola Cables' South Atlantic Cable System (SACS) commences. World-first development and verification of SDN technologies to provide a stable telecommunications environment within a wide area network.	
2020	Asteroid explorer "Hayabusa2" scheduled to return to Earth.	



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This material includes forward-looking statements of NEC Corporation and its affiliated companies concerning strategies, financial goals, technologies, products, services, and track records.

For details, please refer to the following URL.

<http://www.nec.com/en/global/about/vision/notice.html>



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<http://www.nec.com/en/global/about/vision/>

NEC Vision Website

Introduces NEC's vision for social value creation and our initiatives for realizing this vision.

