

NEC's IoT Operations That Support Digital Businesses

Building on its experience in IoT and related projects, NEC is working to develop ICT-based Solutions for Society targeted at solving public policy issues with a view to helping achieve a more functional and sustainable society. In this paper, we will look at trends in digital business and highlight the core features that define a digital business based on our own extensive experience across a broad range of IoT projects. We will also provide an overview of our own industry-leading IoT platform - NEC the WISE IoT Platform - and look at representative co-creation programs where we have worked together with our clients to create new value using AI and IoT.

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1. Introduction

Rapid urbanization on a global scale together with a trend toward increasingly porous borders means that today humans are on the move in greater numbers than ever before. And where humans go, so too do the things they use to sustain and enjoy their lives. Resource consumption - energy, water, and food - is on the rise, leading some to fear that we will eventually deplete the planet of its resources. At the same time, the international community faces many social and political challenges - such as climate change and natural disasters, population problems, and terrorism.

To build a sustainable society while coexisting with the earth, we must adapt our social systems and lifestyles so that we can use the earth's resources more efficiently. Today the ability of ICT to help meet these challenges is expanding dramatically, as is the scope of its capabilities. As a Social Value Innovator, NEC is dedicated to directing its technical and innovative prowess to helping solve these issues.

Digital technology is critical to helping ameliorate some of the issues that plague modern society. A study con-

ducted by Japan's Ministry of Internal Affairs and Communications found that the number of IoT devices connected to the Internet was 15.4 billion as of 2015. The study estimates that by 2020 that number will have almost doubled to 30.4 billion¹⁾. As IoT permeates society, an increasingly wide range of people and things will be connected to the Internet, generating massive amounts of data, all of which will be closely analyzed, deepening our understanding in "contexts" that take place in the real world (physical world) and cyberworld. At NEC, we are convinced that we will make good use of the understanding of the "contexts" produced by ICT and enabling us to refine and strengthen the tools we need to build a society that is more responsive and more flexible.

NEC's experience in this burgeoning field is unparalleled. Leveraging our know-how in both IT and networking as well as our original leading-edge AI technology, NEC has worked closely with our clients to develop innovative IoT projects that are providing a blueprint for the future. That extensive experience has enabled us to build a core suite of IT and AI systems that provide an essential foundation for any type of IoT project - whether it's strictly commercial or is designed to support more

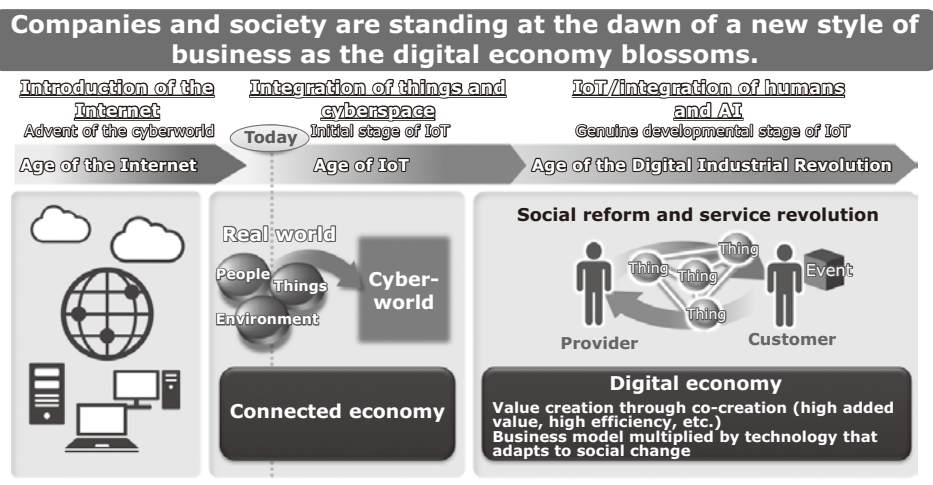


Fig. 1 Business model reform towards the digital economy.

overarching public policy goals or social initiatives. We call this NEC the WISE IoT Platform.

In this special issue, we will introduce some of the IoT-based solutions built around our core technologies that support digital businesses.

2. New Value Creation and Business Evolution

2.1 Strengthening Digital Businesses

We stand on the cusp of a new era, in which the old era of bricks and mortar is swept aside by the new digital economy. To stay relevant, companies must adapt to this rapidly evolving new style of business. The Internet introduced us to the new cyberworld and gave us a glimpse of what was to come. Now, as the age of IoT begins, we can step right into that world and interact with it. It is a world where people, things, and information in the real world will all be interconnected and integrated with the cyberworld, creating a new "connected" economy.

Very soon, the development of IoT will begin to accelerate even more rapidly as we enter a new stage of evolution where humans and artificial intelligence will become even more closely integrated. Within a few years, the digital economy will permeate all aspects of society. To ensure that our client companies and society in general obtain real value from their investment, NEC will offer business models and technologies optimized for the new digital economy (Fig. 1).

2.2 A Future Where Businesses and Public Services will Collaborate with Each Other

Various types of IoT data are expanding into vital sen-

sors (humans), strain and vibration sensors (structures and facilities), and video images and image information (cameras). Moreover, dramatic improvement in the processing capabilities of computers and networks is driving an exponential increase in practical applications of data science using AI. We are now entering an era where technology is being implemented by businesses and public organizations that operates autonomously and exerts direct control over significant aspects of the real world.

In fact, NEC's AI and IoT projects have spurred increases in production efficiency in the manufacturing sector of up to 20% and a 40% reduction in the disposal volume of food products in the retail sector. What's more, we are working hand in hand with our customers to achieve Value Chain Innovation — which will promote the advancement of products and services and evolution of delivered value through efficient cooperation of various value chains in manufacturing, logistics, and retail.

At the same time, we have helped improve social value. In public sector fields such as urban infrastructure, our smart surveillance systems have slashed vehicle thefts by a staggering 80%, while smart energy optimization systems have reduced electric power consumption by 20%. Now we are focusing on our commitment to help achieve the Smart Nation - a concept even broader than a Smart City. By integrating Value Chain Innovation with Smart Nation, we will create even greater social value (Fig. 2).

2.3 As a Business Partner of Our Customers

Through co-creation with our partners - industry leaders from a wide range of fields - NEC has developed and implemented an impressive array of AI and IoT solutions in fields as diverse as manufacturing, logistics, retail,

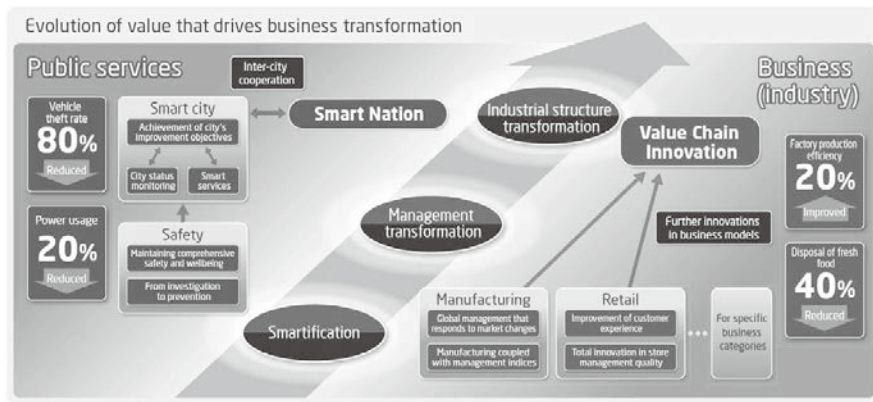


Fig. 2 Evolution of value that drives business transformation.

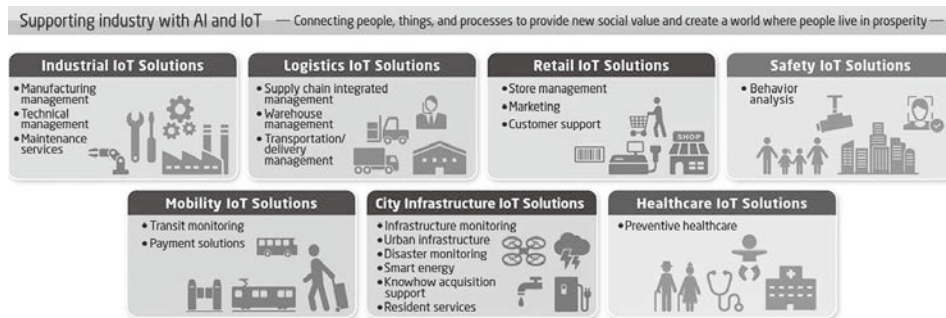


Fig. 3 Various solutions that utilize AI and IoT.

security, traffic, urban infrastructure, and healthcare. Through such partnerships, we are able to draw on the strengths of our business partners to provide total support to our clients’ businesses by utilizing AI and IoT to create new value (Fig. 3).

3. Digital Business in the IoT Age

3.1 How IoT is Transforming Business

In the years to come, a vast and ever-growing number of “things” will be connected to networks. This Internet of Things will generate an infinite treasure trove of data that can be acquired and analyzed in real time. It is no exaggeration to say that this will radically change the way we do business. This transformation will manifest in three primary forms.

First, existing business operations will be rendered vastly more efficient. By performing visualization which is key tool for enhancing operational efficiency, staff and managers will be able to see and understand current operation conditions and make adjustments as required, streamlining procedures and increasing overall efficiency. For in-

stance, if you can see the actual condition of facilities of a shop or factory, then you will have an opportunity to better manage air conditioners and assembly lines, but also to optimize power consumption costs and improve safety.

Second, new services will be created in existing operations - particularly in product marketing operations. Usage conditions and wear rates, for example, will be immediately accessible. This in turn will create demand for new services that can prevent problems before they happen by predicting maintenance requirements and malfunctions.

Third, opportunities will be generated that will encourage the birth of new businesses. Even if data has been gathered for some specific purpose, it can be correlated with other data for different purposes. This could lead to the discovery of ways to use the data in different applications. In other words, it can help create business opportunities that could lead to creation of new businesses.

3.2 Five Stages of Future Digital Business Development

NEC has been actively engaged with numerous IoT-related projects over the past several years and built up

an impressive repertoire of expert knowledge that we have used to define the five stages of digital business and to distill the essence of each of those stages.

Stage 1: Hypothesis proposal

To build a system used for a particular business, a waterfall-type development methodology - in which the requirements of the proposed system are clearly defined - has been used so far. However, contemporary business environments change so rapidly, it is necessary that the cycle of the system's development, verification, launch, and improvement be swiftly rotated. Therefore, it is essential that the hypothesis proposal be capable of incorporating business outcomes in system requirements as defined models.

Stage 2: Hypothesis verification

To verify the hypothesis established in Stage 1, it is necessary that things and "phenomena" be captured as data and visualized. It is also necessary to make full use of technology that can be converted into knowledge and wisdom.

Stage 3: Start small

Once the hypothesis has been verified, a demonstration system needs to be quickly launched and immediately applied. It should be incorporated into the operation of an actual system as is.

Stage 4: Business growth

When a business that was initially launched as a small startup has grown or when the business environment has changed, operation policies and strategies need to be reviewed and revised. The system that handles the business also needs to be revised accordingly. For this reason, it must be possible to easily expand and modify the system whenever necessary.

Stage 5: Consolidation

Nothing is more important than stability. Any business that has grown organically through these five stages must be able to continue to operate in a reliable and stable manner. Here the word "consolidation" has two meanings: one is that the security of the system is carefully thought-out; and the other that operation stability and mission criticality are ensured.

4. NEC the WISE IoT Platform - a Suite of Functions That Facilitate the Construction of IoT Systems

In the age of AI and IoT, a shortcut to success is quick formation of business ideas and immediate launch - even on a small scale. With a view to letting our custom-

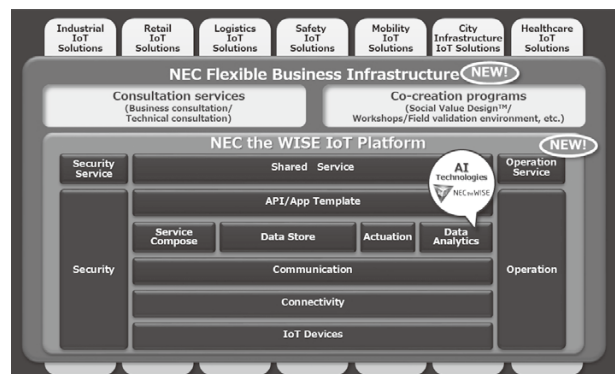


Fig. 4 NEC Flexible Business Infrastructure.

ers proceed with digital business while enhancing their business and IT capabilities, NEC has systematized a suite of functions called NEC the WISE IoT Platform that makes it easy to quickly build an IoT system and scale it up as required. We also offer a set of human-oriented services called NEC Flexible Business Infrastructure that combines co-creation and consulting services (Fig. 4).

4.1 NEC Flexible Business Infrastructure

To achieve the five key elements of digital business, you need people with superior business and technical knowledge and experience together with an IT infrastructure optimized for digital business. The NEC Flexible Business Infrastructure is a framework that serves as a foundation for activity that ranges from discovery of issues to creation of value, while supporting creation of solutions in manufacturing, logistics, retail, and public sectors.

Specifically, we offer systemized menus designed to enable NEC and its clients to collaboratively execute each phase from hypothesis proposal to consolidation. In the initial phase, activities such as business consultation and user experience design take place. System architects are involved in that phase to build a field system for verification of the hypothesis. That in turn leads to an actual environment ready for practical use.

The NEC Flexible Business Infrastructure is comprised of various consulting services and co-creation programs that address both business and technical aspects and of the NEC the WISE IoT Platform, which is a suite of functions that achieve IoT systems.

4.2 NEC the WISE IoT Platform

Based on the five-layer model of IoT architecture NEC announced in 2015, NEC the WISE IoT Platform has

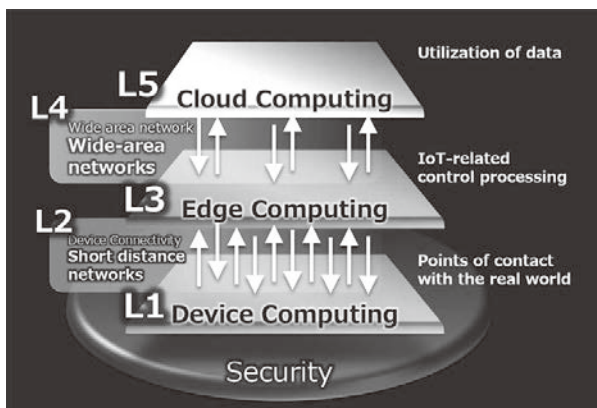


Fig. 5 Five-layer model of IoT architecture.

been designed so that NEC the WISE²⁾ - a portfolio of cutting-edge AI technologies developed by NEC - can be easily implemented in a variety of situations. The main features of NEC the WISE IoT Platform are listed below (Fig. 5).

(1) Highly efficient data collection platform and cutting-edge AI technologies

An IoT data collection platform efficiently collects data from various sensors and devices. The data, collected in various formats, is analyzed and visualized by the AI engine of NEC's cutting-edge AI technologies "NEC the WISE." AI makes it possible to collect and process data efficiently at high speed.

(2) A building block structure that enables seamless system construction and transition from testing to production

This simple architecture can flexibly adapt to additions or changes to the system in line with the customer's business growth, whether they are starting small or scaling out. The IoT system provides the functions as building blocks (software, AI engine, services, API, etc.). These blocks can be freely chosen to meet customer needs and placed in layers L1, L3, or L5. It is also possible to link with services over multiple platforms such as a partner cloud.

(3) Secure and robust system construction

NEC can implement a highly robust system by applying our extensive experience in mission critical system construction to IoT systems. NEC securely coordinates the entire system from L1 to L5 and provides cyber security measures, including vulnerability management and measures against malware. We also provide a secure environment for partner companies that develop equipment connected to the IoT system.



Fig. 6 NEC Co-creation Programs.

4.3 NEC Co-creation Programs

NEC has developed Co-creation Programs aimed at solving our clients' problems. Co-creation at NEC is a comprehensive approach that covers each step in the co-creation process - from identifying social issues to introducing solutions. Because our divisions co-create in a very tight-knit way, we can create highly innovative value that supports the establishment of strong businesses.

Once a problem or issue has been identified, we try to find new value by using an NEC-original design methodology called Social Value Design. To verify hypotheses, we leverage a ready-to-use verification environment (startup lab environment) to support launch of new businesses. Our specialized personnel - including system architects, data scientists, and security consultants - support the launch of operations and construction of systems (Fig. 6).

4.4 Co-creation Workshop Space

The Co-creation Workshop Space is a place where we get together with customers and other stakeholders to find solutions to issues and create value for society. When a new concept is created in this space, we work out how to use IoT and AI to put the new concept into practical use.

Located on the top floor of the NEC headquarters building, the Co-creation Workshop Space is an open space with a casual atmosphere. It is a place where people can enjoy a sense of experiencing something "out of the ordinary" while participating in brain-storming sessions - in fact it is designed to feel a little like the "NEC attic." When holding sessions in the space, we utilize NEC's unique processes to create value for society.

5. Conclusion

Building on the five-layer model of IoT architecture announced in July 2015, NEC has created NEC the WISE

IoT Platform - a versatile suit of functions designed to facilitate rapid construction of scalable IoT systems for businesses and public organizations.

To allow our customers to transition quickly from establishment of a verification environment to a fully functional actual environment, NEC the WISE IoT Platform makes it possible to: (1) utilize efficient data collection platforms and advanced analysis engines such as AI, (2) swiftly construct systems using a building block structure, and (3) build highly secure and robust systems.

We have also expanded our portfolio of IoT solutions so that it can be utilized in a wide range of businesses and under a wide range of conditions.

NEC continues to focus on social solutions and is committed to developing advanced social and public infrastructure that benefits from the power of IoT, while leveraging the strengths of SDN, big data, clouds, and cybersecurity.

Reference

- 1) Ministry of Internal Affairs and Communications, 2016 White Paper on Information and Communications in Japan (in Japanese)
- 2) NEC's cutting-edge AI technologies, "NEC the WISE"
http://www.nec.com/en/global/ad/ai/campaign_v/

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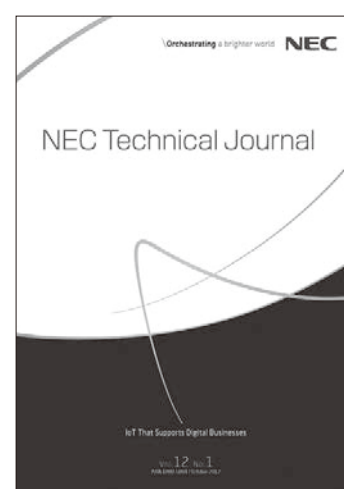
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