

# Start-up of Data Utilization-type Smart Cities

Efforts to create smart cities, aimed at solving social issues through digital transformation, have entered a new era. While the early smart cities focused on laying out the systems for each field, such as energy and traffic, and on data utilization within each of these fields, the smart cities to come will primarily deal with cross-domain data utilization to address social issues with a view to total optimization. This paper gives an overview of the development state of data utilization-type smart cities by discussing the trends in smart cities headed in a new direction and some solution examples NEC is working on in Japan and abroad, as well as introducing the city management technologies which form the foundation of the solutions.

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## 1. Introduction

International efforts aimed at attaining the Sustainable Development Goals (SDGs) adopted by the United Nations in 2015 are gaining momentum in individual countries. The Japanese government is also promoting the Society 5.0 concept for the attainment of the SDGs in order to realize a smart society that brings a richer life to people by highly integrating cyberspace and physical space.

Cities have a variety of issues. Smart cities are initiatives to solve social issues, such as energy supply, traffic congestion, disaster preparedness, and healthy longevity, through digital transformation. It is not simply about introducing AI, IoT, and other digital technologies to social infrastructure, but aims to induce a digital transformation and solve social issues.

The early smart cities had specialized ICT systems in individual fields and used data separately. While this significantly contributed to the resolution of issues in the specific areas, it rendered cross-domain data utilization and coordination difficult. On the other hand, as social issues have a composite impact, cross-domain data linkage to create new services and values are increasingly

in demand. Europe, where the development of smart cities first started, developed FIWARE as a data utilization platform to solve such issues and is promoting it for worldwide proliferation. Cross-domain data utilization is promoted to realize a data-centric society.

Once multifaceted data accumulation is achieved, the circumstances in cities can be visualized with a centralized

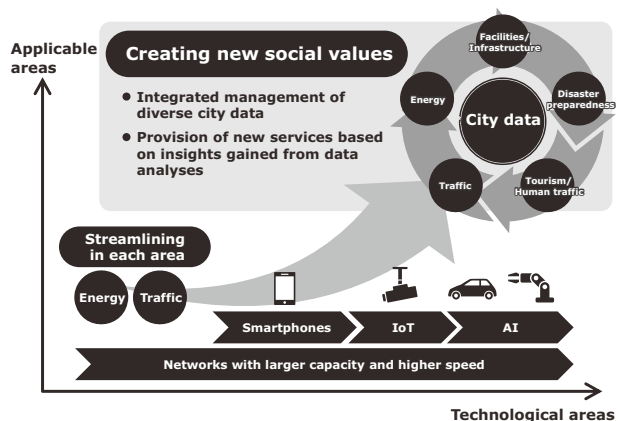


Fig. 1 Transition of smart cities.

system. Supporting city management undertaken by city leaders from a data utilization aspect can contribute to the resolution of social issues in an efficient and sophisticated manner as well as the creation of social values, such as safety, security, efficiency, and equality. Ultimately, the smart cities in the new era aim for the creation of such social values from a total optimization perspective (Fig. 1).

## 2. Smart Cities in the World

Smart city initiatives are spreading out all over the world. Cities are building their own hypothesis and verifying values toward the creation of social values. This section introduces some successful overseas cases of social value creation through digital transformation. NEC was involved in all of these projects (Fig. 2).

The first implementation project is in Tigre, Argentina, an early smart city that resolved social issues by utilizing digital technologies. Tigre established a public monitoring center for centralized monitoring of security camera images installed throughout the city. At this center, images are automatically analyzed by AI to readily detect wanted criminals and stolen cars. As a result, monthly auto thefts recorded in 2008, which was about 120 cases, dropped by almost 80% by the year 2013. The transformation into a safer city has had a positive impact on tourism as well. In 2016, the city's major industry recorded a three-fold increase in tourism-related sales (including sales from restaurants and hotels) over the last decade. NEC not only built the system, but also launched a co-creation project with the city officials and formulated a city vision for 2030, contributing to defining the city's issues<sup>1)</sup>.

The second smart city project is the implementation in Santander, Spain, where we achieved cross-domain data utilization. In Santander, 12,000 sensors were installed throughout the city, which were consolidated on FIWARE—the data utilization platform—and used in applications for

a variety of areas, including waterworks, parking, and energy. One of these applications is the use in the garbage collection business. Conventionally, garbage collection trucks ran their fixed routes regardless of whether there was an actual accumulation of garbage. Considering this matter, the project set up, on garbage bins, sensors that measure the amount of garbage in order to streamline the collection routes, which resulted in a 15% cost reduction. This data utilization platform aims to publicize the Application Programming Interface (API) so that private firms can offer their services. Furthermore, the project works to make data visible to citizens while also collecting opinions from citizens to be reflected in urban planning. The project intends to reinforce the engagement with citizens through such bidirectional communication.

The third example is a project aimed at realizing next-generation smart cities. Drawing on the aforementioned FIWARE, NEC developed the Cloud City Operation Center (CCOC) as a common platform that supports the data utilization aspect of city management. The CCOC has been introduced at integrated management centers in Bristol, UK, and Lisbon, Portugal, and we are currently verifying the effects.

## 3. Smart Cities in Japan

Smart city initiatives are also growing in Japan. The Japanese government has upheld Society 5.0 to promote the creation of social values by means of digital implementations. This section introduces some projects that are creating social values through digital transformation in Japan. NEC was involved in all of these projects (Fig. 2).

The first example is a project in Toshima Ward in Tokyo, where digital technologies solved issues in the area of disaster preparedness. Toshima Ward incorporated a crowd behavior analysis technology that analyzes security camera images with AI into its comprehensive disaster preparedness system. The ability to automatically cal-

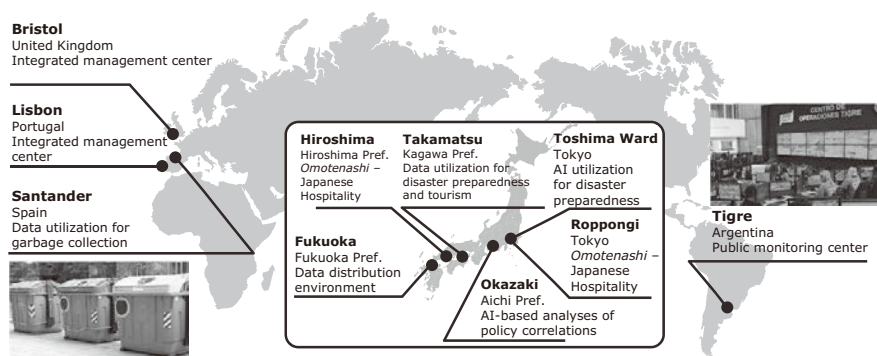


Fig. 2 NEC's smart city projects (listing only the cities introduced herein).

culate the number of retained people and the direction of traffic in the event of a disaster was useful in taking measures, including quick guidance of people having difficulty getting home. NEC also conducted demonstration experiments for understanding the local state by analyzing SNS, etc. using natural language processing technology. These implementations are contributing to the creation of the safe, secure city that the ward envisions.

The second example is a smart city project currently in an experimental phase, aiming to contribute to inter-industrial data utilization. In Roppongi and Toranomon, Tokyo, and Hiroshima, NEC tested the *omotenashi* (“Japanese hospitality”) service that uses personal data and the tour promotion service with a focus on public transportation as services for foreigners visiting Japan. Using public transportation IC cards, multiple local industries, including airports, bus systems, hotels, and tax-free businesses, collaborated for the verification project aimed at regional vitalization.

The third example of smart city implementation is in Takamatsu, Kagawa Prefecture, where we achieved cross-domain data utilization. In Takamatsu, we collected real-world data by means of IoT in the fields of disaster preparedness and tourism, both of which are high priority areas, and developed a system that visualizes data and a FIWARE-based data utilization platform that can also be utilized by other industries. Previously, city officials visited the actual rivers to study the flood risks; since the introduction of this system, officials at the city hall can quickly learn of the approach of dangerous water levels, in the case of heavy rain, based on the information provided by the system. This has led to an actual advantage in terms of taking early action. In relation to the above, Partnership for Smart City Takamatsu was founded in Takamatsu to work on solutions to regional issues through collaborative data utilization by the private and public sectors and academia.

The fourth example concerns demonstration experiments for accelerating data distribution. In March 2018, SAKURA Internet, Inc. and NEC jointly built a data distribution environment compliant with FIWARE specifications in Fukuoka, Fukuoka Prefecture. Releasing this environment to experiment participants, which include venture businesses, SMEs, and other organizations and individuals, will not only allow the participants to use it for their own business purposes, but also allow them to share amongst themselves the needs and issues related to data distribution. We will develop an ecosystem in the data distribution market and promote the creation of smart applications that create new value.

The fifth example is the experimental phase of a project that supports city leaders in city management

from a data utilization aspect. In Okazaki, Aichi Prefecture, AI performs correlation analyses using open data. To operate administrative policies efficiently and in a planned manner, the city uses various data—finance, childcare, regional promotion, and more—and applies it to their policy-making approach, such as predicting the relationship between the implementation of policies and the expected effects. Such efforts can ultimately lead to a reform in city management, for example, a revision in the allocation of budgets spent on social infrastructure.

As mentioned previously, smart city initiatives are shifting from the early design of digital use that only tend to the solution of individual social issues towards the creation of new values via cross-domain data utilization and the direction of supporting city leaders’ city management from the data utilization aspect, both in Japan and abroad.

#### 4. City Management Technologies

Data utilization platforms are at the core of a cross-domain data utilization-type smart city. FIWARE is a data utilization platform developed by the Future Internet-Public Private Partnership (FI-PPP) in Europe over five years, starting in 2011. FIWARE Foundation was established in 2016 and carries out promotional efforts to make FIWARE the de facto standard in Europe. It is characterized by the adoption of OMA NGSI-9/10 as API as well as its provision of modules as open source software (OSS). Being an open architecture, it can prevent vendor lock-ins.

However, the initial version developed in Europe focused on openness and requires reinforcement in aspects of security, AI, and analytics. The risk of interruption of urban functionality by a cyberattack is higher in

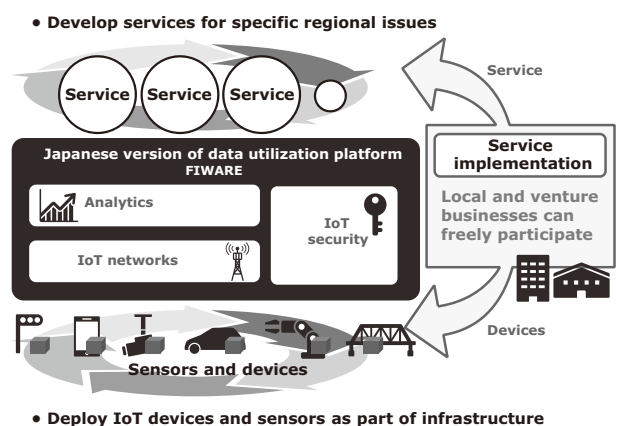


Fig. 3 Reinforcements in the Japanese version of the data utilization platform.

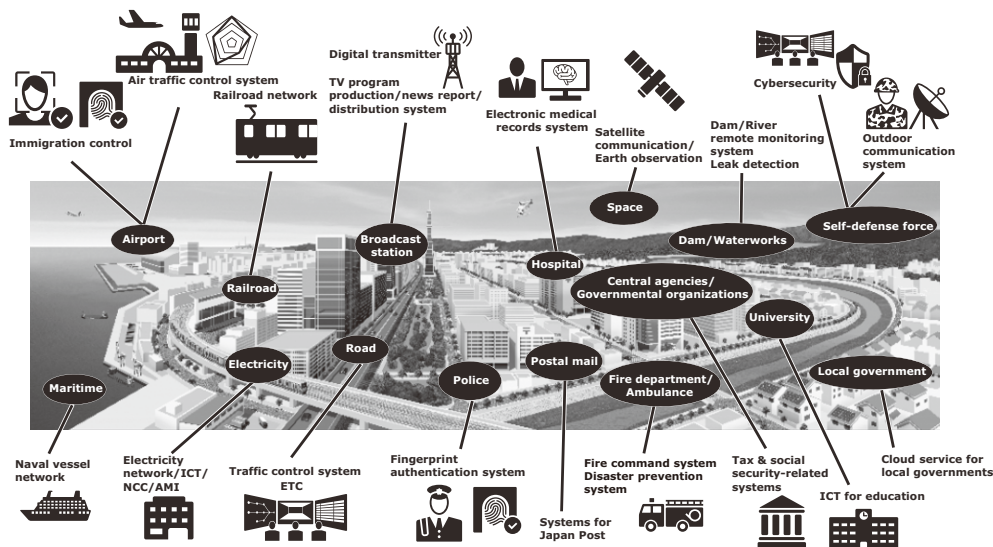


Fig.4 NEC's public-domain solution business.

smart cities, where diverse social infrastructure systems are digitized. Additionally, if systems handle personal data, measures against information leaks must be further strengthened. Furthermore, as the circulation of real data from IoT progresses, the processing capacity of networks connecting devices and the cloud will become an issue. As a solution to this, reinforcement in edge computing areas, such as the development of Fog-Flow technology, must be sought. NEC is developing a Japanese version of the data utilization platform for this end to accommodate these particular concerns prevalent in Japan (**Fig. 3**).

On the other hand, the process toward the standardization of smart cities is also progressing at the management level in parallel with the technical developments. Standardization is under review by the International Organization for Standardization (ISO) and the International Telecommunication Union (ITU). Some standard key performance indicators (KPI) for city management are also released. Being aware of this trend, NEC engages in technical development conducive to social values.

## 5. Conclusion

As described earlier, NEC is working on smart cities aiming for digital transformation in cities. NEC also has a history of being deeply involved with the establishment of public-domain ICT systems, such as that represented by the development of local government systems and the proliferation of the My Number System in Japan (**Fig. 4**). Nevertheless, new initiatives such as cross-domain smart cities often lack an established scheme by city opera-

tors—simply building an ICT system is not the end of the story. NEC is focused on regional co-creation and working hand-in-hand with the locals in these new smart city efforts. NEC is in the progress of transitioning from an enterprise that provides things to an enterprise that delivers new value to society.

\* OMA is a registered trademark of Open Mobile Alliance Ltd.

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## Reference

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Special Issue TOP