Local 5G to Accelerate Digital Transformation in Industry for a Prosperous Society

ARAI Masayuki, WATANUKI Ryu, KOYA Momoha

Abstract

Today Japanese industries are facing the problems of labor shortages and difficulty in transferring specialized skills. With an expectation of being a solution for these problems, local 5G is attracting more and more attention as a key technology in advancing industrial digital transformation (DX). Based on NEC's accumulated experience in network engineering provided to telecom carriers as well as our knowledge of information technology (IT) and operational technology (OT) provided to the industrial markets, we now provide our customers with an array of local 5G services as DX offerings. We are strengthening our commitment to making the most of local 5G to promote industrial DX and to producing social value through co-creation with our customers. This paper introduces local 5G, which will accelerate industrial DX and help achieve a prosperous society.

Keywords
local 5G, NEC Smart Connectivity, managed services, heavy machinery remote control, NEC Local 5G Lab, NEC Abiko Testing Field

1. Introduction

In Japanese industry, in addition to the issues of labor shortages caused by the decline of the working population and difficulty in transferring specialized skills due to an aging population with a declining birthrate, the issue of restrictions affecting on-site work has surfaced because of the novel coronavirus infection (COVID-19) pandemic. To address these social issues, the benefits that industrial digital transformation (DX) has to offer must be leveraged to connect all kinds of information and fully utilize information technology (IT) and operational technology (OT). By fundamentally revolutionizing business processes in pursuit of improvement of operational efficiency, industrial DX calls for remote operations and automation as major key drivers (**Fig. 1**).

To achieve remote operations and automation, networks need to have high reliability, high security, high speeds, low latency, device connectivity, easy installation, and stable mobile communications. By taking advantage of local 5G — which can meet these needs that are difficult to meet with Wi-Fi, we will help create new social value.

Remote operation and automation as key drivers to reform operations for greater efficiency and labor savings

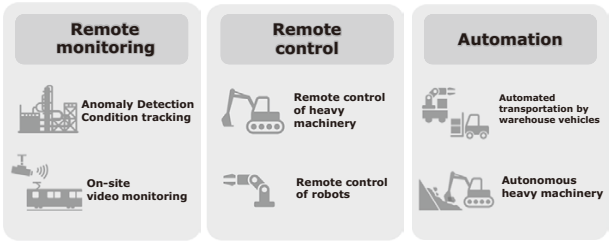

Fig. 1 Key drivers to achieve industrial DX.

This paper introduces NEC's DX offerings for local 5G[1)]; their features, and cases in which local 5G was adopted through co-creation with customers.

2. Local 5G DX Offerings and Services

We offer our customers services that leverage network strengths under the brand NEC Smart Connectivity[2)], which — as support for the realization of industrial DX — "wisely" connects everything they need to create new

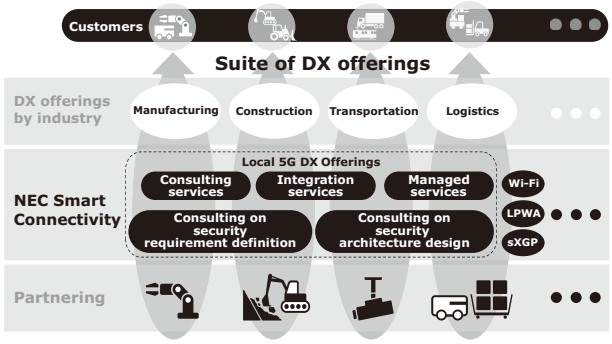

Fig. 2 Positioning of local 5G DX offerings.

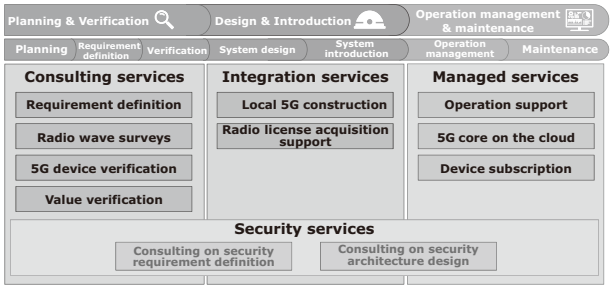

Fig. 3 Local 5G services.

value. Local 5G is one of the components of these services along with Wi-Fi and more. We also provide industry-specific DX offerings. By combining them with our partner companies' excellent technologies, products, and other assets, a suite of DX offerings can be tailored to each industry and customer (**Fig. 2**). This enables our customers achieve highly reliable DX in a short period of time.

2.1 Overview of NEC's local 5G DX offerings

While the introduction of local 5G is underway in various markets, many challenges have been found for the introduction of local 5G such as the complexity of networks, the difficulty of securing IT talent, and the costliness of purchasing devices. To help our customers solve these issues, we offer local 5G products as one of our service packages — including a menu of these services to use NEC's asset equipment on a monthly subscription basis — by leveraging the knowledge of 5G technology that we have gained in the telecom carrier business (**Fig. 3**). We are standardizing these services and building a system so DX offerings can be promptly offered in accordance with the needs of each customer. The local 5G DX offerings consist of five services: local 5G consulting services, local 5G integration services, local 5G managed services, consulting on security requirement definitions for local 5G, and support in local 5G security architecture design.

2.2 NEC's local 5G DX offerings

The consulting category of NEC's local 5G DX offerings includes four services; 1) support in requirement definition in which network requirements are defined through on-site surveys, 2) radio wave surveys that confirm the existence of radio waves before applying for the license, 3) 5G terminal verification that confirms the connectivity between the customer's 5G devices and local 5G system in advance, and 4) value verification in which NEC's local 5G devices are rented out on a short-term basis to let the customer confirm the expected effectiveness of local 5G with our services. These four services make it possible to carry out preliminary verification before full-scale introduction.

The integration services category combines two services; 1) local 5G construction in which our experts work together with customers to define requirements, design fundamentals and details, and then build and evaluate networks; and 2) support in radio license acquisition in which our engineers who are experienced in licensing procedures aid our customers with the acquisition of a radio license.

Three services are available in the managed services category: 1) 5G core on the cloud, 2) operation support, and 3) device subscriptions. The 5G core on the cloud service enables customers to reduce initial costs thanks to the 5G core functions being available from the cloud, and this makes it possible to flexibly increase or decrease resources in accordance with their operational plans. NEC's customer-centric operation support service provides support in two main areas: i) network recovery support where NEC takes charge of network operations on behalf of the customer in the event of a failure and provides support for the recovery of the network by remotely isolating the sections where the failure occurred; and ii) network management support where NEC offers both configuration management and operation management that includes monitoring of the customer's network operations in addition to isolation in the event of a failure. Lastly, the device subscription service offers a package of device rentals and maintenance for a monthly fee. As a result, the initial costs for the introduction of the devices and the costs of fixed assets can be reduced.

The security services category offers consultation services by which security requirements that are needed for each system are defined. Also, these services can be used to clarify how the security requirements are attained in the system and provides support in designing system architecture to improve the overall security design.

3. Features of NEC's Local 5G Systems

Some features of 5G are the technical characteristics that include ultra high speed, ultra low latency, and multiple simultaneous connections. Local 5G, however, is attracting attention because it can be used to build optimal networks in accordance with customer needs.

3.1 NEC's local 5G systems

Local 5G consists of three major components: (1) a 5G core, (2) RAN (radio access network), and (3) a local 5G dedicated device (**Fig. 4**). The 5G core manages mobility and access, sessions, and subscription information. As a base station system to which the 5G devices are connected, the RAN controls communications and manages user traffic. It is divided into three sections with different functions: a central unit (CU), a distributed unit (DU), and a radio unit (RU).

To meet diverse needs, NEC offers a wide range of local 5G products and services. In this section, we will introduce two types of base stations — separate and integrated (**Fig. 5**).

The separate type of base station consists of different pieces of hardware for the CU, DU, and RU. This type is excellent in scalability. For example, the number of the RUs to be introduced can be determined according to the customer's requirements, and even after their introduction, the number of RUs can be increased or decreased according to the modified requirements.

Developed ahead of the competition, the integrated type of base station[3] is an all-in-one (AIO) model that contains the CU, DU, and RU in a single housing. The compact housing enables more freedom in selecting the installation location. Moreover, thanks to a simple network configuration, fewer man-hours are required for the construction of local 5G infrastructure. Although the radio output is lower than the separate type, an integrated base station is ideal for use indoors where installation can be complicated. We expect that integrated base stations will expand the scope of applications to push forward the introduction of local 5G in many companies and thereby lead to solving the issues of our customers.

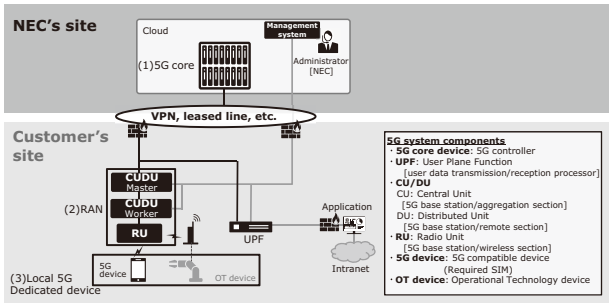

Fig. 4 Basic configuration of NEC's local 5G networks.

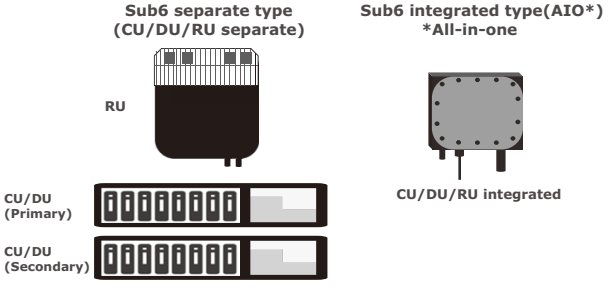

Fig. 5 NEC's separate/integrated base stations.

3.2 Total and seamlessly linked networks

Not only does NEC offer local 5G solutions that are individually tailored, we can also achieve an end-to-end network specifically designed for each application by seamlessly connecting 5G slicing with the virtual tenant network (VTN) for the software-defined network (SDN) architecture. What is more, we also visualize and automate the entire network including the radio access network (RAN) in addition to the conventional local area network (LAN) and the wireless area network (WAN) by integrated management of the SDN and the RAN intelligent controller (RIC), thereby ensuring safe network operation.

4. Case Studies — Introduction of Local 5G towards Social Implementation

The use cases of local 5G in which industrial DX is achieved include real-time monitoring and analysis using high-definition images in production lines and construction sites. By delivering on-site video images to a remote monitoring room at ultra low latency using local 5G, it is expected that value can be created and possible include value such as the improved efficiency of monitoring operations, labor savings, ensured safety with quick anomaly detection, remote technical support from experts, and improved productivity (**Fig. 6**).

4.1 Case study in the manufacturing and construction industries

While sharing NEC's vision with some early adopters of local 5G, we are endeavoring to help them achieve industrial DX and making innovation a reality. For in-

stance, our commitment to local 5G is apparent in the following scenario.

In the field of manufacturing, the development of solutions for remote control and automation in factory operations is underway. Those solutions have actually been introduced in some factories to verify their effectiveness[4]. For example, Ricoh has introduced standalone (SA) local 5G in the Ricoh Industry Tohoku Plant. This will bring benefits such as technical support and equipment control by seamless connections from a remote location to on-site personnel and total visualization of intra-factory data. In addition, it will also make possible a new customer experience of touring the factory through the use of HD live video images[5].

In the construction industry, skilled workers are aging and retiring while the number of young workers is decreasing. There is an urgent need to dispel the conventional image of these sites as dangerous and harsh places to work so that a stable workforce can be secured. By taking utilizing the features of 5G, our efforts in remote as well as autonomous operation of heavy machinery aim to achieve a safe, secure, and pleasant work environment in addition to labor savings. NEC offers the heavy machinery remote control service[6][7] that achieves smooth remote operations in a wireless network environment. We are also making a commitment to co-creation with our partner companies for the further dissemination of remote operations[8].

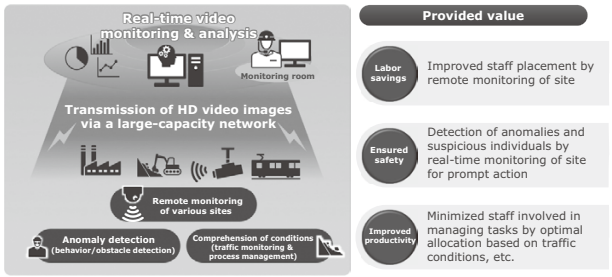

Fig. 6 Use case example: HD video monitoring.

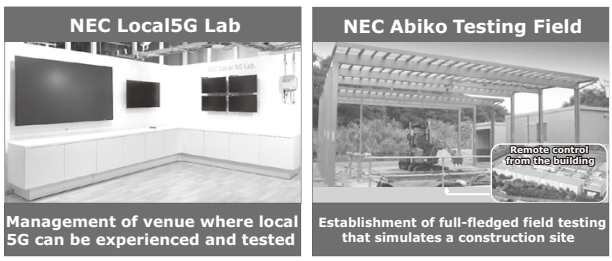

Fig. 7 Innovative through co-creation.

4.2 Innovative through co-creation with customers

To expedite these efforts of co-creation, we operate the NEC Local 5G Lab. We have created an environment where our customers and partner companies can bring in their devices and try solutions and where use cases can be demonstrated. Simulating a construction site, the testing site at NEC's Abiko plant was established to provide a venue to verify the effectiveness of the remote control of heavy machinery in a wireless network environment (**Fig. 7**).

5. Conclusion

This paper has discussed the features, services, and use cases of local 5G to realize the digital transformation of industry. As industrial DX advances, the demands on networks are increasing, and local 5G is attracting a lot of attention from various industries. By leveraging NEC's expertise in local 5G and digital technology accumulated over decades in communication technologies, we will provide our cutting-edge technologies to achieve local 5G implementation in society. NEC will promote activities that focus on co-creation with our customers and partner companies as we pursue advanced initiatives to create new social value.

* Wi-Fi is a registered trademark of the Wi-Fi Alliance.
* All other company names and product names that appear in this paper are trademarks or registered trademarks of their respective companies.

References

1) NEC: Local 5G (Japanese)
https://jpn.nec.com/nsp/5g/local5g/index.html
2) NEC: NEC Smart Connectivity (Japanese)
https://jpn.nec.com/solution/smart_connectivity/
3) NEC Press Release: NEC launches two new UNIVERGE RV1000 series private 5G base station models in Japan, January 2022
https://www.nec.com/en/press/202201/global_20220120_02.html
4) NEC Press Release: NEC conducts demonstration tests at its own factory using local 5G to implement remote operation and automation at manufacturing sites, April 2021 (Japanese)
https://jpn.nec.com/press/202104/20210405_02.html
5) NEC Press Release: Ricoh and NEC accelerate the manufacturing industry DX through local 5G, October 2020 (Japanese)
https://jpn.nec.com/press/202010/20201022_03.html
6) NEC: Remote control systems for construction machinery (Japanese)
https://jpn.nec.com/nsp/juki_enkakujiritsu/index.html
7) NEC Press Release: NEC begins offering a service that enables smooth remote control of heavy machinery in a wireless network environment, September 2021 (Japanese)
https://jpn.nec.com/press/202109/20210907_01.html
8) NEC Press Release: Conclusion of an agreement to develop technology to promote the remote operation of construction machinery, November 2021 (Japanese)
https://jpn.nec.com/press/202111/20211130_02.html

Authors' Profiles

ARAI Masayuki
Senior Manager
Business Development Division

WATANUKI Ryu
Manager
Digital Network Division

KOYA Momoha
Digital Network Division

Information about the NEC Technical Journal

Thank you for reading the paper.
If you are interested in the NEC Technical Journal, you can also read other papers on our website.

Link to NEC Technical Journal website

Japanese

English

Vol.16 No.2 Special Issue on DX Offerings to Accelerate the Digital Transformation of Society

Papers for Special Issue

NEC Information

Vol.16 No.2
June 2022

Special Issue TOP