NTT DOCOMO R&D Activities Toward the Future

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Social problems in Japan are becoming increasingly diverse and serious as reflected by a shrinking labor force in an aging society, the occurrence of natural disasters, a drop in industrial competitiveness, and the transition to a remote society to prevent the spread of COVID-19. To solve these problems, the Digital Transformation (DX)*1 of society has been moving forward at a rapid pace, and to support this transformation, NTT has proposed the concept of an Innovative Optical and Wireless Network (IOWN) [1]. With a view to promoting DX and making IOWN a reality, NTT DOCOMO R&D Innovation Division is stepping up its research and development efforts centered on a framework called "cyber-physical fusion [2]." This framework is essentially a continuous loop that converts humans, things, and events in the real world (physical space) into information, accumulates that information as data in cyber space, creates value by analyzing that data and applying analysis results to future predictions, knowledge discovery, etc., and feeds that value back to physical space. However, achieving such a cyber-physical fusion will require the evolution of (1) AI, (2) the network, and (3) devices as core technologies and the close coordination of these technologies, as summarized below.

(1) AI is being used to make predictions about the future and drive knowledge discovery by analyzing collected and stored data in cyber space. NTT DOCOMO, for its part, has been applying AI to mobile spatial statistics prepared from operations data of the mobile phone network for use in initiatives such as "AI congestion prediction," which predicts the occurrence of traffic congestion, the scale and time period of such congestion, etc., and optimization of bike relocation in a bike share service.

(2) The network provides connectivity between cyber space and physical space. At NTT DOCOMO, the evolution of the mobile communications network continues with further development of the fifth-generation mobile communications system (5G) known as 5G Evolution and the development of the sixth-generation mobile communications system (6G) beyond 5G. At the same time, we seek to accelerate the process toward a "mobile-fixed integrated network" that merges the fixed and mobile networks that have traditionally developed independently and to achieve the next-generation network including IOWN.

(3) Devices act as contact points with customers in the real world, and at NTT DOCOMO, we have been focusing our efforts on glasses-type devices using eXtended Reality (XR) technology. We have undertaken the research and development of various elemental technologies and have been proactively involved in the creation of heretofore nonexistent technologies such as 8K Virtual Reality (VR) (omnidirectional 8K video) and volumetric video*2 using Head-Mounted Displays (HMDs). Going forward, we plan to implement these novel technologies in devices that can provide customers with new experiences at events and elsewhere.

If we were to classify these technologies according to approach, we would divide them into network technology as a fundamental platform and service technology above that platform to provide customers with services. It is important, however, that these technologies

be closely linked. Furthermore, in addition to technology development, our future efforts will include the strengthening of our service creation and development abilities that will become increasingly important in responding flexibly to severe competition from other companies and to a society with a high degree of uncertainty. We will also promote the evolution of the DOCOMO Open Innovation Cloud as a distributed and consolidated computer infrastructure for connecting the 5G network and service platform and its implementation in real-world fields.

To promote and merge core technologies (1) – (3) and to keep the cyber-physical fusion loop moving, it will be important to interface with other departments in NTT DOCOMO and with the NTT Group while also enhancing our tie-ups with partner companies. Our R&D departments will collaborate with the Corporate Sales and Marketing and Smart-life Business departments to enhance our service creation and development abilities. We will also promote the embodiment of the future mobile-fixed integrated network, further 5G enhancements, and R&D toward 6G in collaboration with the NTT Group. Finally, we will continue to promote research and development on a global scale by expanding tie-ups with domestic and international vendors and ramping up our international standardization activities as reflected by our support for a "5G Open RAN Ecosystem [3]," which was launched with the aim of globally expanding open radio access networks (Open Radio Access Network (O-RAN)*3, virtualized Radio Access Network (vRAN)*4).

REFERENCES

[1] J. Sawada, M. Ii and K. Kawazoe: "(IOWN) Innovative Optical and Wireless Network—Beyond the Internet," NTT Publishing Co., Ltd., 2019.

[2] N. Tani: "R&D for Continuous Creation of New Business Value," NTT DOCOMO Technical Journal, Vol.22, No.4, p.1, Apr. 2021.

[3] NTT DOCOMO Press Release: "Creation of '5G Open RAN Ecosystem' to Accelerate Open RAN to Operators Globally," Feb. 2021.

*1 DX: The use of IT technology to revolutionize services and business models, promote business, and change the lives of people for the better in diverse ways.

*2 Volumetric video: 3D video captured with specialized equipment enabling free viewpoint viewing and interactive video expression.

*3 O-RAN: A radio access system configured with an open interface for improving function extendibility as defined by the O-RAN Alliance.

*4 vRAN: A radio access system for implementing a radio access network in a more open and highly flexible form by applying virtualization technology using general-purpose processors, accelerator, etc.