

Cyber Physical System and Beyond 5G / 6G



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Mobile communications systems are rapidly increasing in sophistication. Cyberspace—composed of core networks that support mobile communications systems and servers on the internet—enables interactions between different people, between people and devices and between different devices. These interactions are becoming increasingly important in many aspects of our social activities. As commercial deployment of 5G networks is already underway, current R&D focuses are shifting to beyond-5G or 6G networks. In this article, I will describe our beyond-5G / 6G R&D in relation to various interactions mentioned above, which continue to grow in demand and which can be achieved through the integration of physical and cyber spaces.

■ Background

In response to the COVID-19 outbreak, the Japanese government issued a state of emergency declaration on April 7, 2020, to some severely affected prefectures, which was subsequently expanded to the entire nation on April 16 and was finally lifted for most prefectures on May 14. Even after the declaration was terminated, many people continue to refrain from making unnecessary outings to avoid the 3Cs (i.e., closed space, crowds, and close contact with others), work from home and use online schooling. This experience raised our awareness about the important role information and communications technologies (ICT) play in coping with infectious diseases and remote working. On the other hand, some experts view that the current technological levels and penetration rates of ICT in Japan are inadequate for people to maintain a “new normal” lifestyle. This view led to the July 17, 2020, cabinet approval of “Declaration to make Japan the most advanced digital technology nation in the world,” a guideline promoting the implementation of adequate digital technologies

to strengthen anti-COVID-19 measures and support a new normal lifestyle.

Integration of cyber and physical spaces: cyber-physical systems

The following insight came to me while working from home and experiencing increased online activities in response to the declaration of a state of emergency. People dispersed in space as they began working from home, using online schooling, and exercising other measures to avoid the 3Cs. Under the current circumstances, it is desirable to create a system in which spatially dispersed people can continue to be productive and engage in activities valuable to them by allowing them to remotely work together with other people, robots and avatars using ICT. Urgent efforts should be made to develop this system as soon as possible. The specific types of ICT I am referring to here are the internet and cyberspace composed of groups of interconnected servers (cloud). It is also important to develop a cyber-physical system in which various real-world events (e.g., COVID-19 outbreaks) are measured to collect data, which is then organized into big data and processed in cyberspace as the way of finding optimum solutions to social issues.

■ Greater role of beyond-5G networks

Mobile communications systems evolved from mere communications infrastructure (1G to 3G) to infrastructure vital to everyday life (4G). The role of the 5G network as social infrastructure is more diverse: it connects not only different people but also people and devices. Its use is expected to accelerate widespread adoption of the DX (digital transformation) initiative. Through beyond-5G/6G R&D, we plan to develop the artificial neural networks needed to bring Japan's Society 5.0 vision into reality by integrating physical space (real-world) and cyberspace.