



Preface Special Issue on Cutting-Edge R&D

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Fujitsu Laboratories' mission is to drive the growth of the Fujitsu Group by continuously developing emerging technologies with global application aimed at addressing current and future social issues. With this aim in mind, Fujitsu Laboratories is researching and developing technologies ranging from advanced materials, next-generation devices, computers, networks, and information and communications technology (ICT) systems to the creation of next-generation solutions, new services, and novel business models.

We are now entering an era where everything will be virtually connected and people, things, information, and services will be digitized for the creation and utilization of new values. The number of terminals connectable to the Internet will reach approximately 45 octillion ($= 45 \times 10^{27}$) per person for the current world population of 7.5 billion. We can say this number is almost infinite in real terms. Moreover, in this connected world, the values generated by ICT also have infinite possibilities.

This explosive increase in the number of connections will raise a number of issues. Further advances in ICT are required. For example, we are facing the limits of complementary metal oxide semiconductor (CMOS) device miniaturization and network transmission capacity, which is currently 100 Tbps ($= 100 \times 10^{12}$ bps). Data volume will increase exponentially to 1 yottabyte ($= 1 \times 10^{24}$ bytes) by 2030, a level difficult to handle simply by improving existing technologies. Borderless security problems in cyber space will arise one after another along with the spread of the Internet of Things (IoT).

To break through these difficult challenges, we have to develop new computing architectures, networks, cloud systems, data management systems, and artificial intelligence (AI) and security technologies and integrate all of them as a comprehensive ICT platform.

Fujitsu is providing "Connected Services" for customers to expand their business and services through cross-industry collaboration, which can create new value cycles, and promoting "Digital Co-creation."

Therefore, Fujitsu Laboratories is also pushing the research and development of "technologies to connect wisely, simply, and securely" to achieve the "Hyperconnected Cloud," which is the future "Digital Co-creation Platform" and our medium- to long-term vision. Fujitsu Laboratories

has now reached the phase to materialize this vision and put it into practice. Moreover, we are promoting applied innovation research to create business models and services for rapidly implementing cutting-edge technologies in various fields that will contribute to the public happiness and help create a prosperous society.

Fujitsu Laboratories is also conducting leading-edge basic research to solve the problems that require technologies that go beyond today's ICT and computing technologies. The important mission of Fujitsu Laboratories is to continue to explore research themes that produce impressive and amazing advancements.

This special issue introduces the future perspective of AI technologies covering all layers from hardware and middleware to applications as well as the latest achievements in leading-edge basic research and application examples of ICT such as blockchain technology.

In the fall of 2018, Fujitsu Laboratories will celebrate its 50th anniversary. As a world leader in research and development, we have been generating numerous innovative technologies and contributing to individuals, societies, and businesses, and institutions. We have inherited this researcher DNA and will use it to keep growing. Along with the other 160,000 employees in the Fujitsu Group, we will drive forward "Human Centric Innovation Digital Co-creation" for the happiness of people all over the world.