GREENING ICT PLATFORMS TO SUPPORT THE ERA OF 5G × IOT

The next generation standard for mobile communications is 5G, and its practical application will become a driving force to further utilize IoT and thereby contribute to the creation of new value. To meet the needs of an era in which enormous amounts of data are transmitted at unprecedented levels, Fujitsu is pursuing drastic reductions in energy usage within network infrastructure platforms. It is working to accomplish this through collaboration among industry, government, and academic institutions, and in so doing, to realize its goal of a sustainable society.

Fujitsu's Mission to Address Climate Change

As concerns grow over the deepening impact of climate change, realizing a paradigm shift to a decarbonized society has become an urgent matter. For the Fujitsu Group, which is active on a global scale, addressing the issue of climate change is both a social obligation and an important element of the Group's management strategy.

In 2017, the Group announced its medium- to long-term environmental vision, the FUJITSU Climate and Energy Vision. The key goals of this vision are to work toward the realization of a decarbonized society and to contribute to adaptation measures to counter climate change. By utilizing digital technologies, such as AI, IoT, and big data, we aim to bring about a new future through co-creation with customers and business partners.

When 5G makes possible high-density (multiple connections across multiple areas), high-capacity, high-speed communications with ultra-low latency, there will be a further progression in the utilization of IoT, and this will drive greater efforts to address climate change in a variety of fields, including disaster prevention, transportation, manufacturing, and energy. To accelerate digital transformation through 5G and IoT, we believe that initiatives to reduce energy consumption within network infrastructure platforms, which process enormous amounts of data, will become even more important going forward.

Edge Computing in the Era of 5G × IoT

Edge computing is a kind of technology that can promptly process a massive amount of data and maintain response speed. The technology allocates a partial amount or entire amounts of data that require a real-time response to an edge computer, which is placed between an IoT device and a cloud environment, referred to as the "edge," where the data is processed. Through 5G, there is a potential to expand the usage of this technology. For example, edge computing can help assign tasks as necessary within such processes as the transmission of high-definition video to mobile devices or the provision of real-time information to connected cars.

Task Allocation between Cloud and Edge Computing in a Connected Car
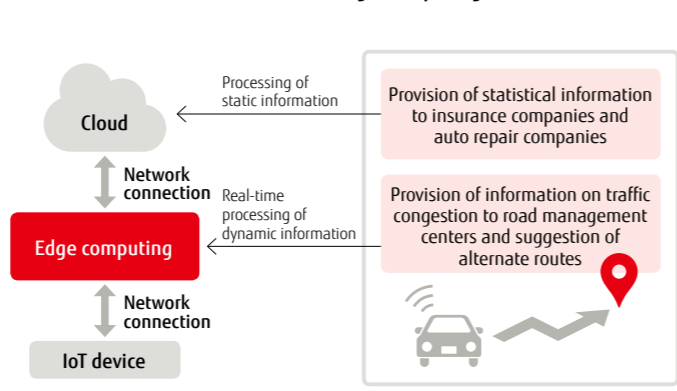
Edge computing systems are expected to be installed at not only mobile network base stations but also in buildings, in stores, and at other facilities. To curtail the heightened energy consumption that will likely follow the increased installation of these systems, one solution is to realize two-way load balancing among edge computers (horizontal distribution), which are distributed across a wide area, and between the cloud computing and the edge computing (vertical distribution).

### Optimizing Load Distribution Using AI

From fiscal 2018, Fujitsu is working on a project commissioned by the Ministry of the Environment, "technological development for drastic energy savings achieved by regionally dispersed edge computing systems," with NIPPON TELEGRAPH AND TELEPHONE WEST CORPORATION and Osaka University (EEC Research Institute).

Specifically, in order to realize horizontal and vertical load balancing, we are leveraging the Group's specialized deep learning AI processor, Deep Learning Unit, to develop technologies that forecast energy consumption and assign tasks. The first step in this process is developing an optimal energy model by using AI machine learning technology to forecast patterns that lower the overall energy consumption of air conditioning to the greatest extent possible.

These forecasts are based on such conditions as the fluctuating energy consumption volumes of each edge computing system, the operating conditions of internal system devices, and outside temperatures. Furthermore, to ensure that tasks are assigned based on this energy model, Fujitsu Next Generation Cloud Research Alliance Laboratories (FCRAL)[1] are developing and verifying algorithms that realize the optimal dynamic control of regionally dispersed edge computing systems, both horizontally and vertically, with the aim of reducing energy consumption across entire regions.

In addition, Fujitsu makes efforts to save the overall energy consumption of the network systems by such developments as the water cooling technologies for base stations' network equipment. With Fujitsu's technologies, we aspire to achieve 5G network base stations that maintain the optimal level of power usage effectiveness (PUE),[2] an index for measuring the power efficiency of ICT-related equipment, of 1.1 or less.

Optimal Control through Regionally Dispersed Edge Computing Systems
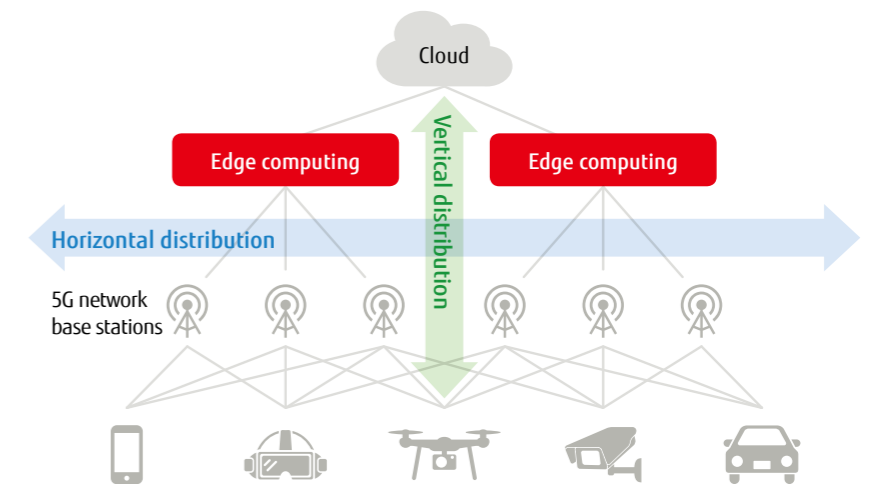
Through the full realization of these technologies, we anticipate to support the overall performance of the 5G network available for regional use. By balancing the burden of processing data both horizontally and vertically, the performance of 5G networks can be maintained, even during sudden events such as the suspension of operations of base stations due to natural disasters or the rapid increase of transmitted data volumes from connected cars at times of traffic congestion.

*1 Fujitsu Next Generation Cloud Research Alliance Laboratories (FCRAL) were established by Osaka University, Fujitsu Limited, and Fujitsu Laboratories Ltd. in April 2017.
*2 Power usage effectiveness (PUE) is a ratio that illustrates how efficiently a facility uses energy. The ratio is calculated by dividing total facility energy consumption by IT equipment energy consumption. The closer a facility's PUE is to 1, the more efficient.

Realizing a Decarbonized Society

By making the ICT infrastructure supporting the era of 5G × IoT more environment-friendly, we can promote the utilization of a greater amount of data and accelerate resolutions to complex and difficult social issues, such as climate change. As a digital co-creation partner, the Fujitsu Group will undertake concerted efforts to realize a decarbonized society going forward.

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LETTERS FROM THE MANAGEMENT

SPECIAL FEATURE

CORPORATE GOVERNANCE

SUSTAINABILITY MANAGEMENT

REVIEW OF OPERATIONS