Edge Computing Supporting Customer Values in the IoT Era

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Abstract

In the IoT era, large amounts of "things" and "people" are interconnected. The data of "event" generated in the real world (Physical world) are processed on ICT platforms (cyber space) such as in cloud systems and then the processed results are sent back to the real world. Such a cycle of processing is then repeated. When visualization of data or analysis using AI are executed in this cycle, new knowledge that has not hitherto been noticeable can then be acquired. This enables the creation of new values and opens the way to a data-driven world in which data increases more than ever in importance. Looking ahead to such a data-driven world, this paper introduces customer values that can be provided by edge computing that makes use of ICT technologies and assets that NEC has been cultivating thus far.

Keywords

IoT, edge computing, data-driven, autonomous distributed coordination technology, acceleration technology, IoT security technology, connectivity technology.

1. Introduction

In the IoT era, not only large amounts of "things" (sensors/devices) but also "people" (data corresponding to the five human senses and biological data) are also interconnected, and the connection between the ICT platforms (cyber spaces) and the real world (physical world) makes possible to process data generated from "events". The platforms history shown in **Fig. 1** indicates that several changes have ensued following the improved performances and the expansion of applications. The IoT era can be regarded as the fourth phase of this history, in which lies the cycle of processing the data generated in the real world by ICT platforms and the feeding back of the results to the real world. We believe that executing the visualization of data and analyses using AI in this cycle enables the processing of "events" via ICT. Acquisition of knowledge that has previously been unnoticeable will now enable creation of new values and opens the way to the data-driven* world in which data is increased in importance more than ever.

This paper introduces edge computing that supports the customer values of the IoT era by looking ahead to such a data-driven world.

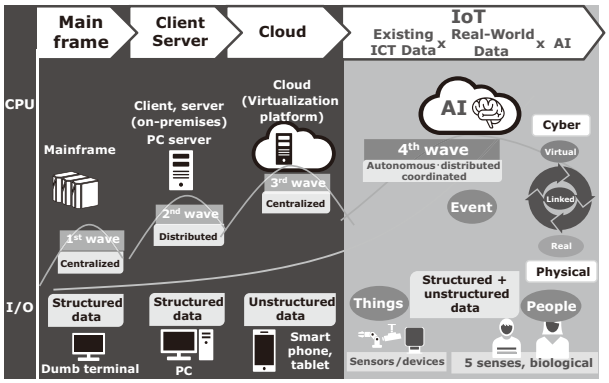

Fig. 1 History of ICT platforms.

2. Value of Providing Edge Computing in IoT

In the data-driven world of the IoT era, the expansion

* Refers to using data acquired by effect measurements etc., as the basis for taking the next action.

of applications to various business domains makes it necessary to handle larger quantities of data in order to obtain a wider variety of data than before. This includes images and highly confidential items as well as detailed information. However, this is hard to deal with for current cloud computing procedures because of the communications costs, the problem of transfer delays, as well as the need for more advanced security and for considerations of privacy.

NEC's edge computing comes between the cloud layer and sensors/devices layer and provides IoT solutions for mission-critical jobs such as efficient system resource utilization, communications cost reduction, real-time processing, advanced security, privacy protection and improved applications availability. It does this by utilizing NEC's original autonomous distributed processing technology, accelerator technology, IoT security technology and connectivity technology (abstraction, zero-touch config,) (**Fig. 2**),

Fig. 3 shows the operations and effects of edge computing. Direct transfer of data from a large quantity of sensors to cloud systems is difficult due to the physical limit of the bandwidth of the L4 layer communication line and the cost required for it. Consequently, it becomes important to transfer part of the processing from the L5 layer to the L3 layer as pre-knowledge processing and to abstract and to minimize the data. In addition, as it is difficult to secure the real-time response from a cloud system to real world phenomena, it becomes important to reflect the judgment model learned in the L5 layer to the L3 layer so that the data can be processed in a location closer to the position in which it is generated. The introduction of edge computing can optimize the system by distributing and coordinating processing and data in the L5 and L3 layers.

The introduction of edge computing enables the provision of performances and functions equivalent to or

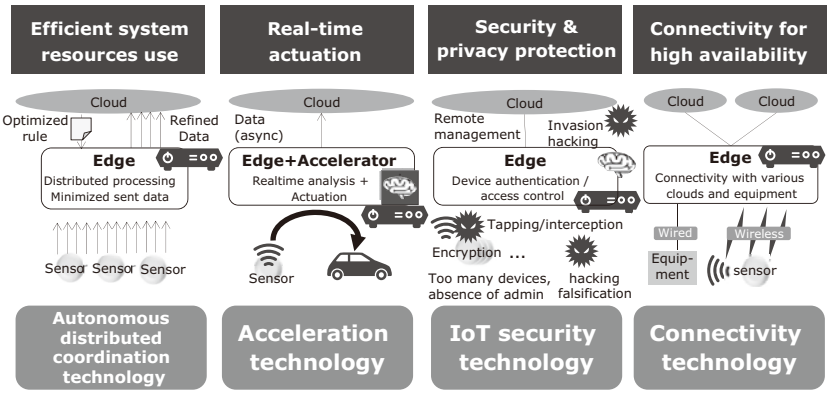

Fig. 2 Value provided by edge computing.

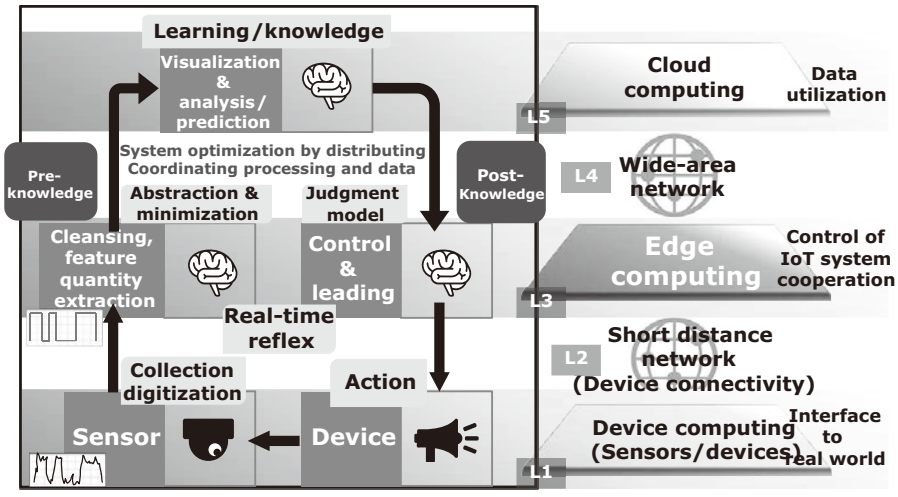

Fig. 3 Operations and effects of edge computing.

better than the previously used on-premises systems. It also provides other advantages such as the possibility of using AI-based big data analyses as services as well as the reduction of field maintenance costs and the facility of transferring jobs generating a large quantity of data to cloud systems.

3. Customer Value Provided by Edge Computing

In this section, we will specify the customer values provided by edge computing in the three business domains of public safety, retail and industry (**Fig. 4**).

(1) Public safety domain

In the public safety domain, the progress of urbanization has been accelerating urban problems such as security deterioration and traffic congestion. This is a trend that makes it necessary to create safe and secure infrastructures. At NEC, we are deploying solutions in this domain that include personal authentication and security camera solutions that make use of image/video processing technologies such as face recognition. One of the issues facing these solutions is more real-time phenomena identification over a wider area to deal with disasters or large-scale events. When edge computing is applied to this issue, the distributed processing with cloud systems, database linkage and processing in a location closer to the field enables massive high-accuracy authentications and early suspicious person detection. This capability leads to customer values such as stress-free personal authentication and early crime prevention measure taking.

(2) Retail domain

Because of diversifying consumer needs and increasing safety requirements, the retail domain has come to need customer values that can expand sales via safe, secure, efficient store management and service improvements. The important factors for providing such customer values include real-time identifications of consumer trends and merchandise conditions and connectivity to various devices in the field. The use of edge computing can provide customer values that include sales expansion as well as energy saving and preventive maintenance. This is enabled by executing real-time sales promotion that identifies the at-shelf behavior of consumers in real time and displays optimum promotion messages and via equipment control by accommodating the operational information regarding various equipment and facilities. These include legacy equipment without networking capabilities, transferring it to the cloud systems and controlling the equipment according to the transferred data.

(3) Industry domain

In the industrial domain, the trend of challenging the innovations of corporate products, business models and processes by using the IoT is becoming active in Germany and the US as well as in Japan. In the fields of fabrication in Japan where the activities for kaizen (improvement) of production processes have been enforced, there are still issues such as the possibility of applying countermeasures only after a problem has occurred. This is because of a huge amount of work being necessary for data collection and analysis and of the impossibility of identifying the real situation because data can only be partially analyzed. Furthermore, we expect that the data collected from diverse facilities and IoT

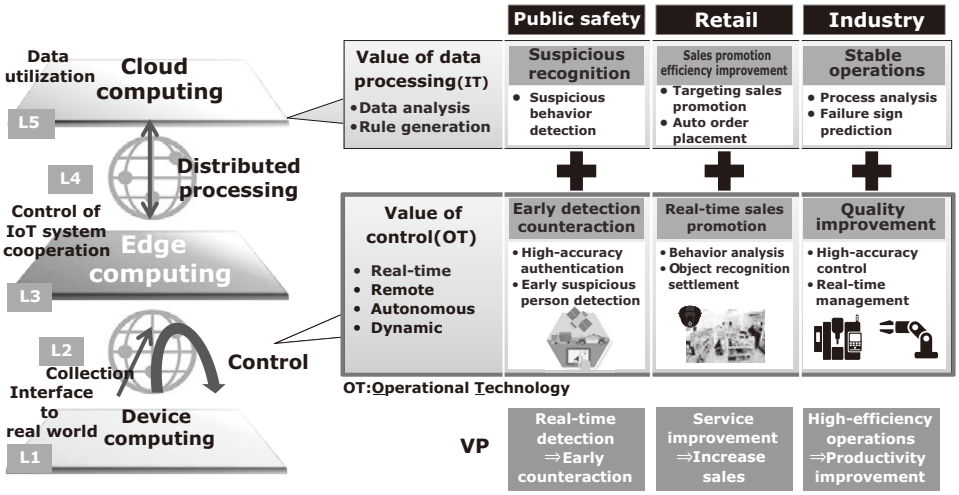

Fig. 4. The advantages of edge computing introduced to various fields.

devices in the field will increase more and more, which makes it difficult to operate management and administration in the actual field. Applying edge computing procedures to these issues can achieve quality improvement and cost reduction by providing connectivity with various facilities and devices and by achieving pre-knowledge processing of massive data as well as real-time management/control. Such advances make it possible to provide even higher values than the simple productivity improvements for customers obtained in the manufacturing industry.

4. Conclusion

In order to deal with the data-driven world of the future, in which people and things are connected and their conversion into data and digitization are advanced, NEC has developed distributed coordination, acceleration, IoT security and connectivity technologies as the feature technologies to support edge computing. The details of these technologies are described in "Edge Computing Technologies to Connect the Missing Link to IoT" (pp. 24-28) in this issue. We intend to make full use of these technologies to provide the customer values that are available via edge computing. These will include higher security and safety in the public safety domain, further sales expansion in the retail domain, and further productivity improvements in the industrial domain.

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