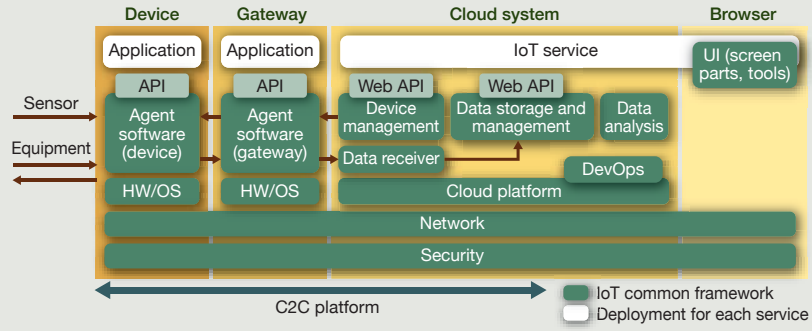
IoT Architecture for Smart Connectivity to Create New Values

The Internet of Things (IoT) will help service providers to create new values such as asset optimization, product operation optimization, lifecycle cost reduction, and product value enhancement. In order to assist such businesses in their operations, Toshiba is offering the Toshiba IoT Architecture consisting of an IoT common framework and a service business framework.



Functional framework of IoT common framework

The chip-to-cloud (C2C) platform incorporated into the IoT common framework is designed to assist in making things smart and connected via the network. This platform provides network connectivity by means of the SmartEDA open and smart middleware. SmartEDA, which runs on edge devices and gateways, provides automatic device registration, data collection, and device management functions.

Furthermore, our C2C platform provides an "edge-rich computing" environment in which users can run various algorithms on edge devices and gateways, including event detection algorithms based on threshold comparison, pattern recognition algorithms, and any other user-defined algorithm.

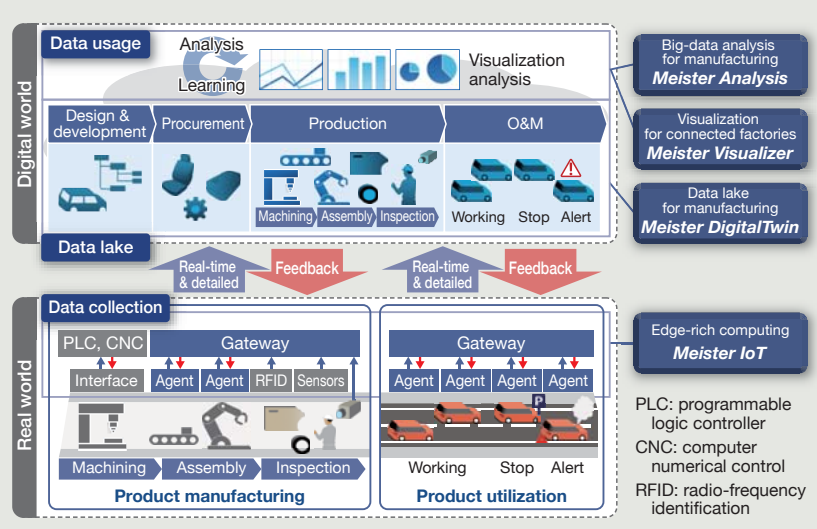
The service business framework is responsible for back-end tasks. It provides new payment schemes such as pay-per-use and pay-per-performance in the form of software as a service (SaaS) and reduces the initial investment and operating costs of users.

By leveraging our system-on-chip, embedded system, and other leading-edge technologies, we are focusing on the development of image recognition, speech recognition, data analysis, and other edge-rich computing solutions.

Next-Generation Solutions for Smart Manufacturing and Intelligent O&M

Approaches represented by Industry 4.0 and the Industrial Internet aimed at realizing smart manufacturing, intelligent operation and maintenance (O&M), and transformation of industrial structures through the use of information and communication technology (ICT) and IoT technology across the industrial value chain have been attracting much attention in recent years.

There are three keys to the success of these efforts: (1) collection of more detailed data using IoT technology to understand how a product is manufactured and used; (2) synchronization of the collected IoT data with end-to-end business data to reproduce a product lifecycle in the digital world; and (3) visualization, analysis, and feedback and feedforward to the real world using these data.



Overview of Toshiba next-generation manufacturing solution

In order to support customers' efforts to process these innovation activities, Toshiba has released the Meister Series consisting of four solutions: Meister IoT, Meister DigitalTwin, Meister Visualizer, and Meister Analysis. The Meister Series provides edge-rich computing solutions using our unique algorithms that support data collection and real-time data processing, digital reproduction of product life cycles, and big-data analysis.

Drawing on our manufacturing expertise, advanced underlying technologies, ICT, IoT, and manufacturing technologies, as well as global open partnerships, we will continue to expand the lineup of our solutions to assist each manufacturing company in the realization of next-generation manufacturing.

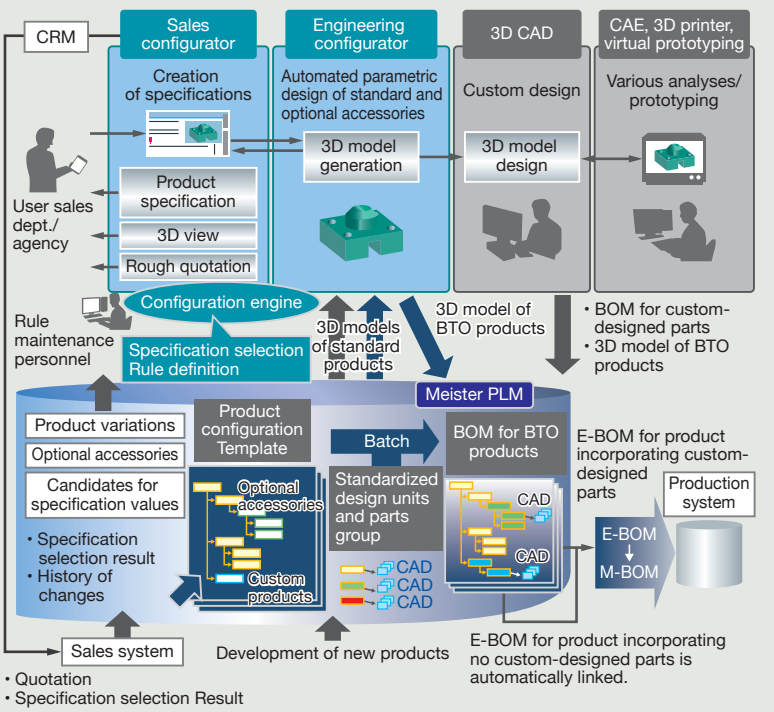
Meister PLM Providing PLM Solutions to Realize Industry 4.0

In Industry 4.0 scenarios, all processes of an industry are interlinked, integrated, and automated. Industry 4.0 is also characterized by high-mix, low-volume production tailored to meet the specific needs of individual customers.

To realize Industry 4.0, rapid adaptation to diversifying user and market needs is necessary. Under these circumstances, product lifecycle management (PLM) is expected to serve as a solution for the horizontal integration of the entire lifecycle of a product from specification development through quotation, design, and production planning and execution, to logistics and inventory management, sales, and customer service.

Conventionally, solutions for these processes have been provided in separate packages, and a comprehensive and seamless PLM has not been available.

In Toshiba's Meister PLM, the product data management (PDM) tool communicates and cooperates with an engineering configurator in order to integrate all processes from specification development to design. This makes it possible to achieve the required level of productivity to realize high-mix, low-volume production.



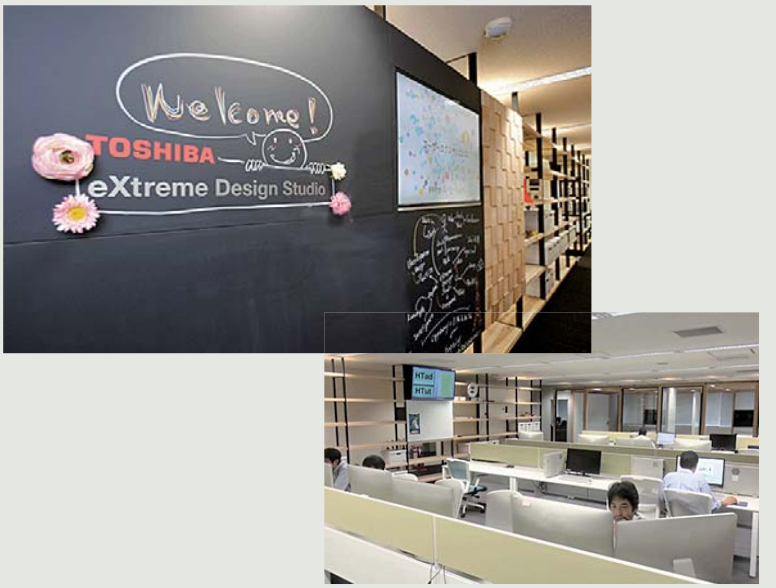
Overview of Meister PLM personalized order solution

"eXtreme Design Studio" MVP Development Studio for Business Innovation

In March 2015, Toshiba opened the "eXtreme Design Studio" (XDS) to aggregate resources and co-create new business value with its customers, particularly service owners.

At the XDS, we use an agile development approach cultivated through collaboration with Pivotal Software, Inc. in the United States. The purpose of this approach is to "visualize" the business ideas of service owners by applying a proof of concept (PoC) through consensus processes. The use of open-source tools to develop, test, and examine services helps to quickly create a minimum viable product (MVP) necessary to test a hypothesis about users' needs.

The XDS has been utilized in-house for new consensus-based PoC projects in order to better leverage data, provide trial courses on agile development, and engage in value co-creation with service owners. We will continue to create new user experiences and promote business innovation using the XDS.

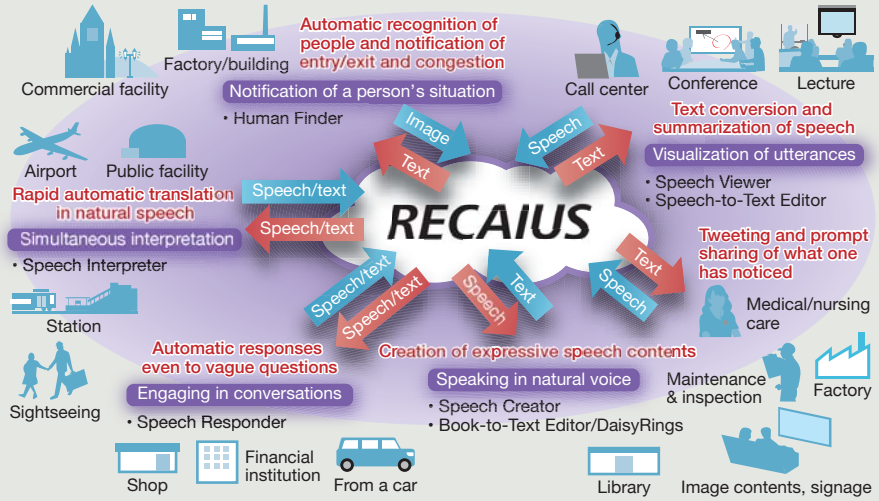


Facilities of XDS

RECAIUS Cloud Services Supporting Understanding of Intentions or Situations from Speech or Images to Enhance Human Activities

Toshiba launched its RECAIUS cloud services utilizing speech and images in July 2015, and has been incorporating various new services into the RECAIUS lineup since that time.

Speech Viewer, a smartphone app released in September 2015, converts speech to text using our speech recognition technology. It also provides a feature for automatically visualizing keywords extracted from the converted text. This helps users to share information and communicate in field work. RECAIUS also provides a speech recognition function in the form of a platform as a service (PaaS).



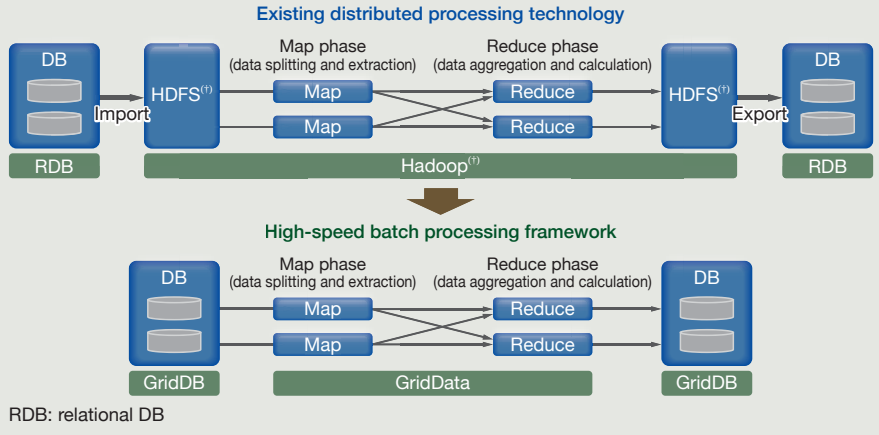
Overview of RECAIUS cloud services and potential applications

In November 2015, we released Speech Creator, a speech synthesis service that can vocalize any text naturally and expressively in 11 languages and provides up to five emotional expressions such as joy and anger. In addition, we launched Speech Interpreter, which recognizes and translates natural human speech; Speech Responder, which understands a speaker's intentions and responds appropriately; Book-to-Text Editor, which reads out books using speech synthesis mainly for the visually impaired; and Speech-to-Text Editor, which assists in the transcription of meetings and lectures.

We will continue to expand the application of RECAIUS to various services including field work support, book reading, and intelligent speech response for financial operations.

High-Speed Distributed Processing Platform Tightly Coupled with Big-Data Technology

Apache(†) Hadoop(†), a distributed processing framework, is widely used for the rapid processing of large amounts of data. However, it is necessary to transfer data back and forth between a database (DB) and the Hadoop(†) Distributed File System (HDFS(†)) during data analysis because Apache(†) Hadoop(†) can obtain data only from the HDFS(†). If the volume of data to be transferred over the network is large, the performance advantage of distributed parallel processing is offset by the long data transfer times involved.



RDB: relational DB

Configuration of high-speed distributed processing platform

To solve this problem, Toshiba has developed a high-speed distributed processing platform consisting of GridDB and GridData. This platform makes it possible to process data by directly accessing a DB without involving the HDFS(†). As a result, the processing time is reduced compared with that required for the conventional Hadoop(†) system.

Apache Hadoop, Hadoop, Apache, and HDFS are either registered trademarks or trademarks of the Apache Software Foundation in the United States and other countries.

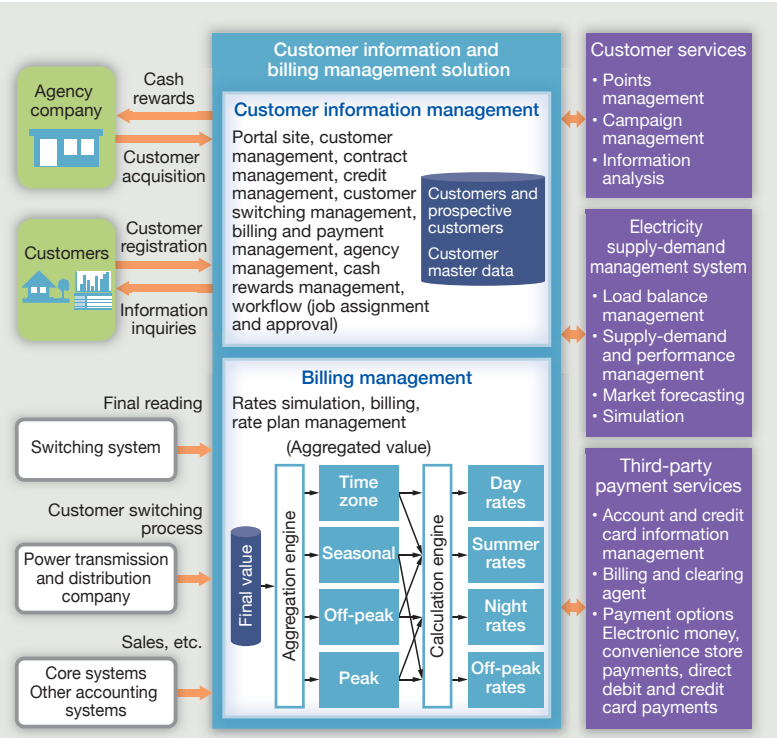
Customer Information and Billing Management Solution for Deregulated Electricity Retailing Market

In Japan, electricity retailing and market deregulation have recently been a focus of attention as the low-voltage market (100 to 200 V) became deregulated in April 2016 in addition to the high-voltage market (nominal voltage: 6 kV).

In response, Toshiba has developed a customer information and billing management system using a core system from Hansen Technologies Inc., a company that has experience, know-how, and a proven track record in overseas market deregulation. However, since Japan has numerous unique requirements and market-specific features, we have carefully considered all of the requirements and tailored our system optimally for the domestic market.

We have a strong background in the domestic high-voltage sector that was already deregulated prior to the low-voltage sector. High-voltage clients also do business in the low-voltage sector. Thus, we are working with these users and strategic partners to create a new business model as well as a system that supports it.

In addition to the electricity market, the gas market will soon be deregulated in Japan. In response, we are planning to expand our system according to the changes that take place in the energy market.



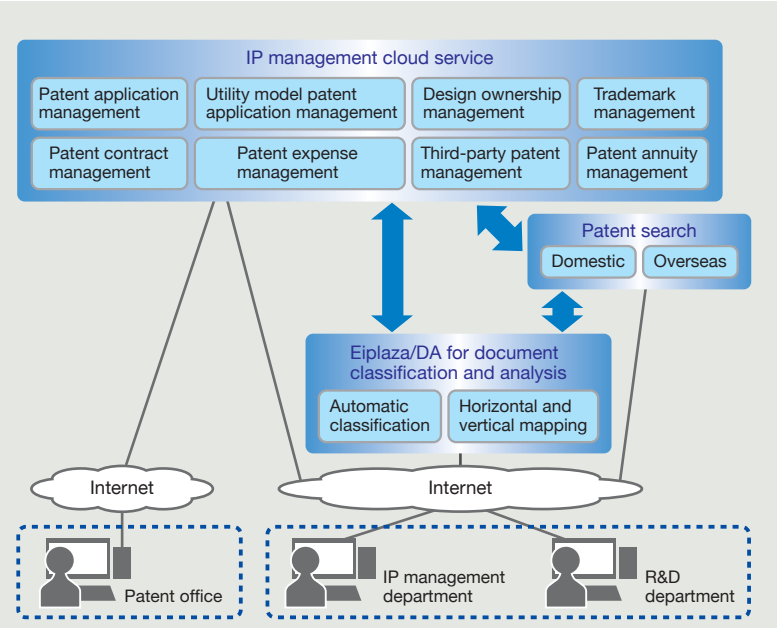
Overview of customer information and billing management solution

Cloud Service for Reducing Workload of Complex Intellectual Property Management

Toshiba has launched a cloud service for intellectual property (IP) management that assists corporate IP management and R&D departments as well as patent offices in the management of invention proposals, application processes, and patent evaluations.

Since the service is provided in the cloud, users can outsource the management of complex IP management systems to reduce their workload. Users can start using the service quickly regardless of the system size. All information on patent and utility model patent applications is managed in the cloud, allowing users and patent offices to easily share such information.

Furthermore, the newly developed cloud service can work in tandem with Eiplaza/DA, our cloud service for automatic classification and analysis based on a Japanese language analysis technology. This combination allows users to search for and analyze publicly known inventions and prior art and to evaluate application procedures and patent maintenance.



Overview of IP management cloud service