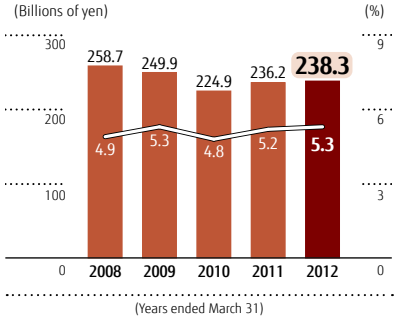
Research & Development

Our Mission in R&D

As our fundamental R&D policy, we pursue initiatives to create new value for our customers and to achieve our Corporate Vision of contributing to the creation of a networked society that is fulfilling and secure, bringing about a prosperous and dream-inspiring future. In order to achieve these initiatives, our R&D of advanced technologies includes technologies for next-generation services, computer servers and networks, as well as various electronic devices and advanced materials which serve as building blocks for our products.

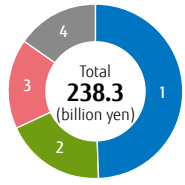
- **Create and accumulate advanced technologies**
- **Extend our value chain globally**
- **Foster the creation of new businesses**
- **Fulfill our social responsibilities**

R&D Expenditure, and Ratio to Net Sales



Fiscal 2011 R&D Expenditure by Segment

1	Technology Solutions	49.5%
2	Ubiquitous Solutions	18.7%
3	Device Solutions	16.5%
4	Other Operations/ Elimination and Corporate	15.2%



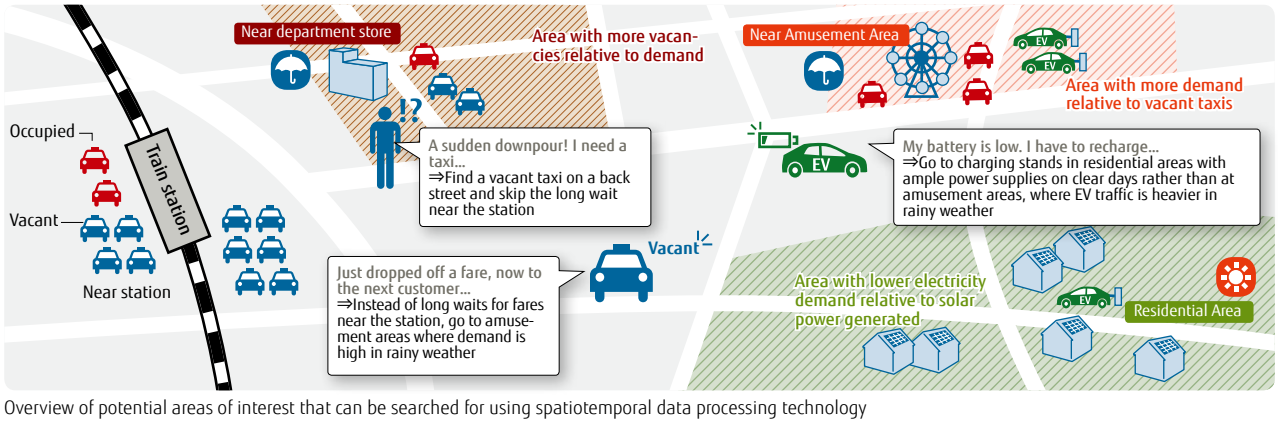
Major Advanced R&D Achievements for Fiscal 2011 (April 2011–March 2012)

(1) Technology for Spatiotemporal Data Processing to Quickly and Precisely Search Areas of Interest

By gathering various real-time data from social infrastructure and quickly and precisely searching areas of interest, it is possible to swiftly recognize positional patterns of people and society, and devise appropriate solutions.

GPS and other sensors generate a vast amount of positional data concerning people and their vehicles, and Fujitsu has developed a technology that identifies within this data those areas where the searched-for activity—for example, high demand for taxis or for electricity—is most likely to occur. This technology enables outstanding flexibility when searching for areas of complex shapes and different sizes, so that areas of interest can be searched with greater precision. Narrowing the search to areas where events of interest are most likely to occur produces a boost to speed of roughly 60 times compared to previous techniques.

Potential uses include the dispatch of taxis and delivery vehicles, or to efficiently control electricity distribution based on supply and demand differences between areas. Another potential use is to support marketing based on real-time and accurate commercial area analysis. The spatiotemporal data-processing technology will also be rolled into SPATIOWL, Fujitsu's cloud service for using and managing location data, launched in July 2011.



Overview of potential areas of interest that can be searched for using spatiotemporal data processing technology

(2) Development of Distributed Parallel Complex Event Processing Technology that Rapidly Adjusts Big Data Load Fluctuations

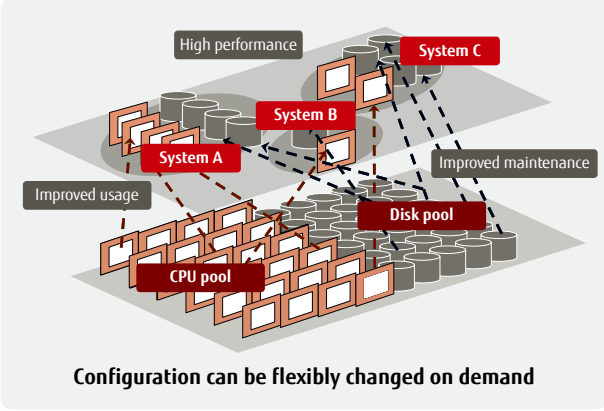
Effective use of big data demands an ever-increasing amount of time-series data be analyzed continuously in real time. Fujitsu developed the world's first distributed parallel complex event processing technology designed for use with cloud technology that rapidly adjusts big data load fluctuations. This research was supported in part by Japan's Ministry of Economy, Trade and Industry's Project for the Program to Develop and Demonstrate Basic Technology for Next-Generation High-Reliability, Energy-Saving IT Equipment for Fiscal 2010 and Fiscal 2011.

The newly developed technology enables greater segmentation during processing; when the volume of data increases, the load can be spread across more servers, while a decrease in data volume conversely sees processing concentrated among fewer servers. The ability to scale event processing across servers has resulted in a throughput function of 5 million events per second, enabling real-time analysis of big data.

(3) Prototype of World's First Next-Generation Server Simultaneously Delivering High Performance and Flexibility

The increasing diversity of cloud services–including those involving big data–has created a need for flexible systems better tailored for each service, compared to datacenters for traditional Web services.

To answer this need, Fujitsu has developed a resource pool architecture in which the hardware components, such as CPUs and HDDs, are linked together with high-speed interconnects. This has enabled development of a next-generation server prototype that simultaneously delivers high performance and flexibility. The new architecture makes it possible at all times to flexibly configure systems to suit not just Web services and big-data processing, but also newly emerging cloud services. Furthermore, more efficient use of hardware components minimizes system costs and contributes to power conservation.



Resource pool architecture

(4) Development of Anti-Distortion Technology to Cut Power Used by Compensation Circuits in Ultrafast Optical Fiber Transmission Systems

As the amount of data transmitted over the Internet swells–due in part to growth in big data–harnessing optical fiber technology to build ultrafast networks at low cost and with low energy consumption will become increasingly important.

In response, Fujitsu has developed a digital signal processing algorithm to compensate for waveform distortion in long-haul transmission systems over several hundreds of kilometers. This has enabled a roughly 20-fold improvement in compensation ability per circuit size compared to conventional technology, thereby extending the long-haul operating range of optical signals. The technology eliminates the need for signal regenerators in telecom carriers' trunk-line networks and in networks linking datacenters that provide cloud services and other services, paving the way for ultrafast, long-haul transmission systems that are low-cost and energy-efficient.

(5) Supercomputer "K computer" Takes Consecutive No. 1 in World Ranking; Launch of PRIMEHPC FX10 Supercomputer

The next-generation supercomputer, the "K computer," jointly developed by RIKEN (Japan's flagship research institute devoted to basic and applied research) and Fujitsu, took the No. 1 position on the TOP500 List*1 announced in November 2011 for the second consecutive time, having previously been identified as the world's highest performing supercomputer in June 2011. The K computer system is equipped with 88,128 SPARC64 VIIIfx CPUs developed by Fujitsu to deliver high performance, exceptional reliability, and low power consumption. The system achieved the world's best LINPACK*2 benchmark performance of 10.51 petaflops*3, signifying a speed of ten quadrillion (one "kei" in Japanese; equals ten thousand times one trillion) floating-point operations per second. It achieved this performance with a computing efficiency ratio*4 of 93.2%, surpassing the previous figure. In November 2011 Fujitsu commenced global sales of the PRIMEHPC FX10 supercomputer, which further improves on the supercomputer technology employed in the K computer in being capable of scaling to a top theoretical processing performance of 23.2 petaflops.

*1 TOP500 List: A project ranking the world's supercomputers based on comparative performance, with rankings announced twice yearly.

*2 LINPACK: A program for measuring computer performance.

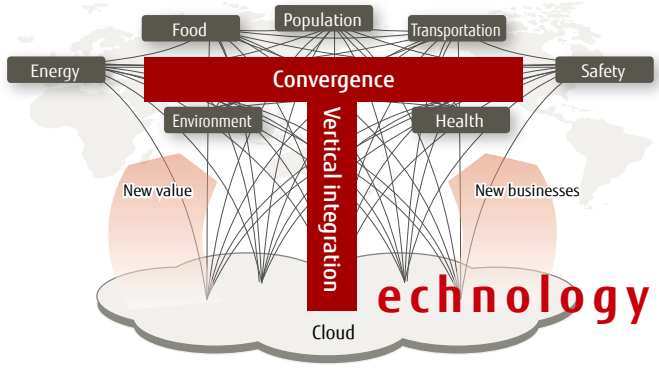
*3 Petaflops: Peta stands for one thousand trillion, or one quadrillion. FLOPS stands for floating point operations per second, or the number of calculations the machine is capable of in one second.

*4 Computing efficiency ratio: The ratio of actual performance reached versus theoretically possible peak performance.

Topics

Realizing a Human Centric Intelligent Society

To make the Human Centric Intelligent Society–creating new value in the real world through Human Centric IT–a reality, Fujitsu is researching and developing advanced technologies along two axes–"convergence," linking customers from different sectors together through big data spanning myriad industries, and "vertical integration" for overall optimization.



Awards and Prizes

2 Commendations for Science and Technology (Development Category) from the Minister of Education, Culture, Sports, Science and Technology of Japan

5 members of the Fujitsu Group were honored by Japan's Minister of Education, Culture, Sports, Science and Technology in fiscal 2011 with Commendations for Science and Technology: Development Category for the "development of speech quality improvement technology for mobile phones," with 1 other member honored for "development of supercomputer core technologies and relevant human resources."

Awarded the Keidanren (Japan Business Federation) Chairman Award at the Fiscal 2011 Persons of Merit Awards in Business–Academia–Government Collaboration

At the 10th Conference for the Promotion of Collaboration among Business–Academia–Government (hosted annually by the Cabinet Office and other government ministries of Japan), Professor Emeritus Hiroshi Ishiwara of the Tokyo Institute of Technology and 2 individuals from the Fujitsu Group received the Keidanren (Japan Business Federation) Chairman Award in the Fiscal 2011 Persons of Merit Awards in Business–Academia–Government Collaboration for the research and development of nonvolatile memory FRAM and its commercialization.

"K computer" Awarded the ACM Gordon Bell Prize, Ranked No. 1 in Four Benchmarks at the HPC Challenge Awards

A research group comprised of RIKEN, the University of Tsukuba, the University of Tokyo, and Fujitsu announced research results obtained using the K computer–jointly developed by RIKEN and Fujitsu–at SC11 (the International Conference for High Performance Computing, Networking, Storage and Analysis), receiving the ACM Gordon Bell Prize, Peak-Performance. In addition, the research group received top-ranking in all 4(*)HPC Challenge benchmarks used for evaluating the overall performance of supercomputers.

(*) HPC Challenge benchmarks:
1) Global HPL (operating speed in solving large-scale simultaneous linear equations);
2) Global Random Access (random memory access performance in parallel processing);
3) EP STREAM (Triad) per system (memory access speed under multiple loads);
4) Global FFT (total performance of Fast Fourier Transform)

Advanced R&D Strategic Direction in Fiscal 2012 (April 2012 – March 2013)

Fujitsu has classified its framework for advanced research into the three categories below, with a view to achieving group-wide optimization from a global standpoint. Through this framework Fujitsu will carry out strategic R&D for the future of the Fujitsu Group, align business segment strategies with research strategies, and enhance resource shifts in response to changes in Fujitsu's business portfolio. Fujitsu will employ a top-down approach to setting research themes, and will conduct strategic research investment.

1. **Core Strategic Themes: Technologies essential to the medium- to long-term future of the Fujitsu Group**
2. **Business Strategic Themes: Short- to medium-term technologies that business segments have committed to commercializing**
3. **Seeds-oriented Themes: Budding technologies not specific to current businesses, and medium- to long-term technologies targeting unknown domains**

In particular, Fujitsu is promoting the following five Core Strategic Themes.

(1) Human Centric Computing
Fujitsu will correlate, combine and analyze data from real-world applications with data from specific industry applications, to realize convergence services that generate value.

(2) Intelligent Society
Fujitsu will help create social infrastructure that solves increasingly complex social problems and transcends individual corporate and industry barriers, to contribute new value and knowledge to societies and corporations.

(3) Cloud Fusion
Through effortless connections between clouds, and with existing systems, Fujitsu will link and share information to expand the fields for applying ICT, thereby creating new markets.

(4) Green Datacenters
By optimizing power supply and cooling technologies, and employing optical networks, Fujitsu will build power-saving datacenters that realize high cost-performance as well.

(5) Manufacturing Innovation
Fujitsu will provide advanced technologies that can contribute toward innovative manufacturing, to support Fujitsu's business and to function as a core for aligning the Fujitsu Group's product manufacturing.