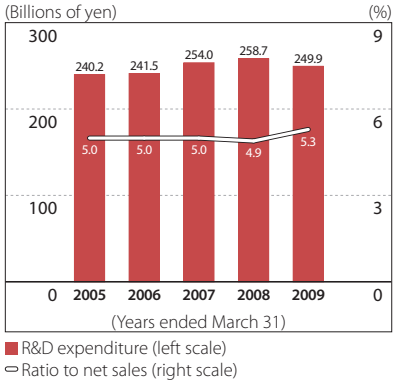
Research & Development

Our Mission in R&D

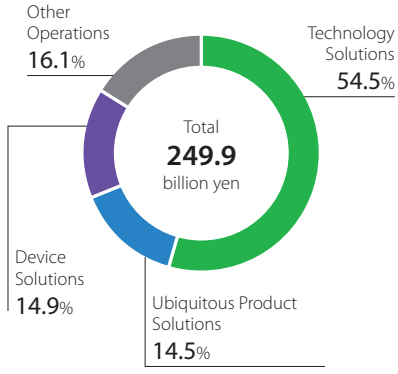
Our basic R&D policy is to pursue the latest in technology for next-generation services, computer servers and networks, as well as the various electronic devices and materials which serve as building blocks for our products. This policy supports the overarching goals of creating new value for customers and achieving our Corporate Vision of contributing to the creation of a networked society that is rewarding and secure, bringing about a prosperous future that fulfills the dreams of people throughout the world.

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

R&D Expenditure, and Ratio to Net Sales



Fiscal 2008 R&D Expenditure by Segment



Major Achievements for Fiscal 2008

(1) Development of secure USB memory with automatic data-erase function

Fujitsu has developed a new type of universal serial bus (USB) memory that after a fixed period of time automatically erases stored data, and a file redirect technology*1 which ensures that the data from the USB memory device can only be stored on a specified server. Both technologies are designed to prevent the unauthorized disclosure of data from lost USB memory devices or uploads to Winny and other file-sharing networks. This creates an environment that protects confidential information and allows USB memory devices to be used as a convenient way to safely carry customer data back to one's own company to manage and utilize the data.

Secure USB memory device

*1 File direct technology: This technology can prevent data from being copied from the self-erasing USB memory device to specific folders on a PC, or it can give the appearance of data being written to the PC's hard disk drive, when in fact it remains on the USB memory device.

(2) Full-scale operation of new JAXA supercomputer with world's highest computing efficiency

Fujitsu has constructed a new supercomputer system for the Japan Aerospace Exploration Agency (JAXA) using FX1 high-end technical computing server and Fujitsu's "Parallelnavi" middleware. The new system achieved performance of 110.6 teraflops*2 and computing efficiency*3 of 91.19% when running the LINPACK*4 benchmarking tool. These results placed the supercomputer first in the world for computing efficiency, and first in Japan and 17th in the world in terms of computing performance against a list of the world's TOP500*5 supercomputers published in November 2008. The new system began operations on April 1, 2009.


New supercomputer from Fujitsu (photo courtesy of JAXA)

*2 Teraflop: One trillion floating point operations per second.

*3 Computing efficiency: The ratio of actual execution performance against theoretical performance.

*4 LINPACK: A program for measuring computer performance.

*5 TOP500: A project dedicated to comparing the performance of supercomputers.

(3) Development of multi-channel high-speed transceiver circuit for high-speed blade server performance

In the IT systems sector, there is a growing demand for servers and other hardware that achieve greater energy efficiency and consume less space, while also realizing higher levels of performance. Fujitsu has developed a compact and power-efficient multiple-channel high-speed transceiver circuit that enables high-speed transmission at 10 Gbps in backplanes—special circuit boards that act as transmission conduits between the server blades*6 of blade servers. Fujitsu has adopted a new control method that enables the circuit to compensate for transmission losses while reducing noise. Compared to conventional technology, this groundbreaking circuit requires just half the area and only one-fourth the power consumption to realize a transmission conduit capable of 4-channel 10Gbps transmission in backplanes.

*6 Server blade: A single board that contains all of the elements required to function as a server, including memory, hard disk, and microprocessor. Servers that combine multiple server blades that function together as a single server are called blade servers.

(4) Field testing of LTE*7 and confirmation of high-speed transmission in Sapporo's Special Ubiquitous Zone

LTE mobile phone base station developed by Fujitsu

Fujitsu is responding to recent calls for a mobile communications system that will enable mobile phones to utilize broadband. Fujitsu collaborated with NTT DOCOMO, INC. to field test Long-Term Evolution (LTE), a next-generation mobile communications standard. Tests took place in the Special Ubiquitous Zone, a wireless communications testing area in the Japanese city of Sapporo in Hokkaido, designated by the Ministry of Internal Affairs and Communications in 2008. For the tests, Fujitsu used prototype wireless LTE base stations developed jointly with NTT DOCOMO, INC. which, with the utilization of spatial multiplexing (4x4 MIMO)*8 technology, resulted in high-speed wireless transmission with peak speeds of 120 Mbps (using 10 MHz bandwidth). Recalculated using the maximum LTE bandwidth, these transmission speeds are equivalent to 35 times those of services currently available for 3.5G mobile phones. Once available, high-speed wireless communications services of this kind will allow users in various environments to send and receive large data volumes, enabling high-definition video and other applications.

*7 LTE: The name for the wireless communications standard devised by members of 3GPP (the project that produced the detailed specification for IMT-2000 W-CDMA).

*8 Spatial multiplexing technology (4x4 MIMO): A transmission technology that uses multiple antennae transmitting/receiving different signals on the same frequency at the same time. The 4x4 MIMO employed in field testing used four such antennae.

(5) Consumer sales of FLEPia, world's first color e-paper mobile terminal

A special feature of e-paper is that it consumes power only when refreshing screens, and no power is consumed to hold an image displayed. Fujitsu developed FLEPia as the world's first mobile terminal using color e-paper, and launched consumer sales of the unit in March 2009. Compared to earlier commercial samples used in field marketing, the latest FLEPia offers 1.5 times higher brightness and greater contrast, enabled through optimization of the product's optical properties. By realizing a faster driver circuit, the screen refresh speed is also now 1.7 times faster than before. Users can purchase e-books online using the device itself, and FLEPia's wide, 8-inch screen makes reading away from home or the office easy. In addition to a digital photo frame function, FLEPia can be used with a variety of other software for viewing spreadsheets, reading e-mail, and other applications.

FLEPia mobile information terminal

(6) Development and commercialization of ultra-low power full HD H.264 CODEC LSIs

Fujitsu has developed H.264 CODEC LSI devices capable of encoding and decoding Full HD (1,920 dots x 1,080 lines) video in the H.264 format*9. Shipments of two H.264 CODEC LSI products commenced from April 2009. The first, the MB86H55, features industry-leading low power consumption of only 500mW during encoding (including the in-package memory). The second, the MB86H56, offers processing of Full HD video at 60 frames per second, thereby delivering high picture quality. Both products enable greater miniaturization and lower power consumption in portable devices such as digital video cameras, AV equipment, and commercial broadcast equipment, while also enabling high-quality recording, playback and transmission of HD video.

*9 H.264: A video compression standard noted for offering higher compression than MPEG-2 and earlier formats.

Prizes and Awards

Two Commendations for Science and Technology (Development Category) and the Young Scientists' Prize From the Minister of Education, Culture, Sports, Science and Technology in Fiscal 2009

The Fujitsu Group was honored with two Commendations for Science and Technology (Development Category), and a Young Scientists' Prize by the Minister of Education, Culture, Sports, Science and Technology in fiscal 2009. These awards are in recognition of the outstanding success that the Group has enjoyed in R&D and in advancing our understanding of science and technology.

- "Development of Content Protection Technology for Digital TV receivers on PCs" (Science and Technology Commendation, Development Category)
- "Development of heat-stable electromagnetic recording media through magnetic exchange coupling" (Science and Technology Commendation, Development Category)
- "Research on telecom-band single photon sources for quantum key distribution" (Young Scientists' Prize)

Topics

"10-Year Vision" Topics for Realizing a Prosperous Future That Fulfills People's Dreams

Fujitsu has formulated a "10-Year Vision" as a guide for providing people across the globe with the prosperous and rewarding future we envisage. Fujitsu is systematically promoting the research and development of advanced technology in its determination to make this vision a reality.

Enabling a Human-Centric Networked Society

By linking everything together, we generate value, realizing a human-centric networked society that delivers inspiration, discovery, reliability and growth.

Inspiration

Fujitsu seeks to bring about a society that delivers unprecedented levels of happiness and inspiration, by mobilizing information and communication technologies to assist people, such as when the elderly or children need help, or when advice or guidance is sought in a work environment.

Discovery

By drawing together large volumes of real-world data to analyze and visualize complex situations, Fujitsu seeks to provide people with the data that will enable the realization of an environmentally sustainable society that is comfortable to live in.

Reliability and Growth

Through eco-friendly and secure information and communications technologies that are all-encompassing and ubiquitously deployed ("available like air"), Fujitsu supports a human-centric networked society that is reliable and has superior growth prospects.

Strategic Direction in Fiscal 2009

With sights on future development, the company intends to focus its cutting-edge research efforts on the targets outlined below in order to create a stronger, more strategic business base for the Fujitsu Group.

1. Enhancing the contributions of research to core businesses

The company will focus on the following research domains to enhance the Fujitsu Group's global core businesses.

(1) x86 servers

The goal here is a top-down approach that goes beyond simply boosting the performance of individual platforms by developing elemental technologies that will enhance performance for the entire IT system. Specifically, this will entail a focus on the development of elemental technologies for achieving virtualization and energy efficiency, simplifying management and operation, and realizing high-speed interconnection. Such achievements will set Fujitsu's high-performance blade servers and large-scale datacenters apart from competitors.

(2) Cloud computing

Fujitsu will develop distinctive technologies for cloud computing such as technology to create the virtual platforms required for cloud computing, as well as an intuitive development and operation environment that is open and highly expandable.

(3) LTE

Fujitsu is an industry leader in LTE field testing. We are leveraging this experience to develop differentiated technologies that will support our LTE business. At the same time, we are pursuing the technical standardization and intellectual property that will be necessary for the LTE-advanced communications standard of the future.

(4) Platform technologies

Fujitsu will focus on the development and enhance the competitiveness of distinctive device technologies for the hardware used in IT systems.

2. Pioneering R&D and new businesses creation

Determined to create the new businesses of tomorrow, Fujitsu is advancing research in the following areas.

(1) Human-centric computing

Fujitsu will develop innovative technologies that merge sensors, terminals, and services in ways that enable us to use sensors to transform real-world information into intelligence, and offer new services tailored to peoples' actual situations.

(2) Green technologies

Fujitsu will take steps to create innovative, cutting-edge technologies that focus both on enhancing the energy efficiency of IT systems themselves, and achieving greater energy efficiency through IT utilization. In this way, the company will build an ecological value chain that contributes to society and generates new businesses.

Raku-Raku Phone Basic II

The Raku-Raku Phone Development Challenge

—Uncompromising Cutting-Edge Voice Technology

The Raku-Raku Phone that Fujitsu started supplying to NTT DOCOMO, Inc. in 2001 has become one of Fujitsu's most successful products. Over the years, this phone lineup has expanded to include 13 different models, with cumulative sales volume topping 15 million units. The Raku-Raku Phone was developed with a commitment to universal design to make it easy for anyone to use. In fact, the phone embodies the determination of its developers to provide customers with an exceptionally easy-to-use phone by combining cutting-edge Fujitsu technologies based on ergonomics, with a careful survey of customer needs, and a functional design that optimizes ease of use. The following is an introduction to Fujitsu's proprietary voice technologies that figure prominently in the success of the Raku-Raku Phone.

"Clear Voice"

—Easy Listening by Amplifying Only the Speaker's Voice

"Clear Voice" is a voice processing technology that exploits the difference in frequency between voices and background noise to make the speaker's voice easier to hear even in noisy places. When ambient noise is detected, the voice of the opposite party is automatically amplified. When the opposite party's voice is low, the volume of the voice is raised automatically. "Clear Voice" technology is used not only in the Raku-Raku Phone, but also by NTT DOCOMO's Formula Nippon car racing team DOCOMO TEAM DANDELION RACING for voice communications between the driver and the pit crew, an application that testifies to the power of the technology.

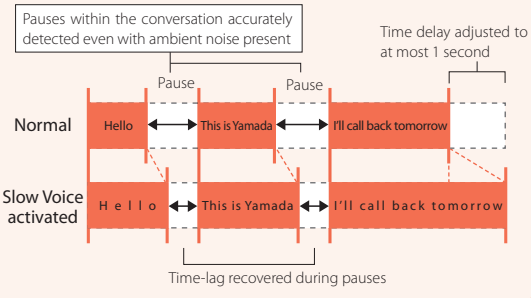
DOCOMO TEAM DANDELION RACING during a race

"Slow Voice"

—Changing Conversation Speed Without Changing Voice Pitch

Based on proprietary Fujitsu technologies, the "Slow Voice" feature enhances listener comprehension by adjusting the output of the opposite party's voice so that it can be heard more slowly. Of course, simply slowing the speed of the voice would lower the pitch similar to the slow playback of a recording, making it sound completely different. Meanwhile, slowing the voice speed only on the listener's side would simply prolong the comprehension time, resulting in unnatural pauses in the conversation. Fujitsu brought three technologies to bear in overcoming these problems and improving phone conversation quality. The first, voice expansion technology, preserves voice pitch even when slowing voice output speed; the second, pause detection technology, detects pauses between words; and the third, delay control technology, uses the detected pauses to compensate for time-lag resulting from the slower voice output to give a more natural conversation flow. The combination of these three technologies produces a natural, easy-to-hear conversation.

How Pause Detection and Delay Control Work



"Double Microphone"

—Conveying the Speaker's Voice More Clearly

"Double Microphone" is a noise cancellation technology that distinguishes between the speaker's voice and ambient noise and cancels the noise, leaving only the speaker's voice to be clearly conveyed to the opposite party. Enabling this are two microphones, one on each side of the handset. This configuration utilizes the time difference in the arrival of sound waves to each microphone to identify any sound from a direction other than that of the speaker's voice as noise, and lower the volume of the detected noise.

These Fujitsu-developed voice technologies have won wide industry acclaim. In particular, "Clear Voice" and "Slow Voice" were awarded the 55th OHM Technology Award in November 2007 by The Promotion Foundation for Electrical Science and Engineering, an organization whose members have contributed over the years to the development of electrical science and engineering in Japan.

The technologies found in the Raku-Raku Phone go beyond voice communications. With a commitment to making the phone easy to use from all aspects, Fujitsu has also included an easy-view display and with easy-to-read text, a more intuitive key layout, and voice input email functions. Fujitsu's customer surveys indicate a high degree of satisfaction with the Raku-Raku Phone among customers. Fujitsu, in cooperation with NTT DOCOMO, will continue to maximize ease of use and provide products that satisfy an ever-wider range of customers.

Product managers exchange opinions in their efforts to make the Raku-Raku Phone even easier to use

Intellectual Property

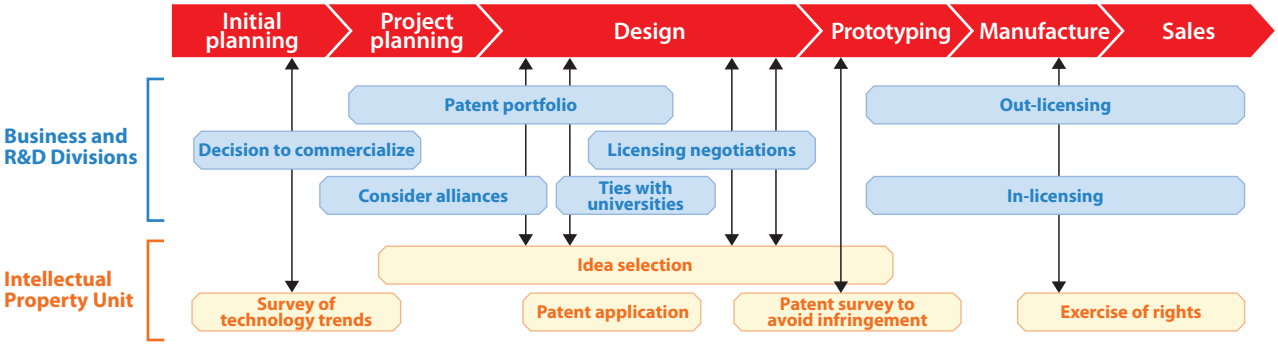
The Importance of Intellectual Property

Protecting and respecting intellectual property is part of the Code of Conduct in the Fujitsu Way, which articulates the philosophy of the Fujitsu Group and the core values and principles guiding the actions of each of its employees. Accordingly, every employee recognizes intellectual property as a key corporate asset supporting business activities. Moreover, Fujitsu employees are acutely aware of the role that technologies backed by intellectual property play in enabling customers to rely with confidence on the products and services we deliver.

Intellectual Property Strategy

We are promoting an intellectual property strategy closely integrated with our business and R&D strategies. Each business unit and R&D division is individually responsible for analyzing the intellectual property assets owned by Fujitsu and other companies in their respective fields. Based on this analysis, they formulate and implement intellectual property strategies.

Linking Business and R&D Divisions



Group-wide Initiatives

We are developing a framework to strengthen Group-wide intellectual property activities to enable the entire Group to leverage our intellectual property assets. Some issues, such as the need for international standards, require coordinated action among the global bases in the Group. Here, we use regular meetings among Group companies to share information as well as promote specific measures. In this way, we foster a unified approach to intellectual property activities.

1. Patent Rights

Patent rights support technological innovation. Recognizing these rights as an important corporate asset, we are assembling a global patent portfolio centered on patents in Japan.

We ensure that the acquisition, maintenance and utilization of patents are carried out in keeping with the Fujitsu Group's global business development strategy. We therefore acquire, maintain, and utilize the patents we need in the locations (countries) where they are needed, covering development and production bases as well as our sales bases. Representative offices have been established in the US and China so that local research or inventions at development bases can be securely protected.

For obtaining patents in the US, Fujitsu has a framework not only for yielding inventions but for handling the entire adjudication process to promote efficient acquisition of high-quality patents.

FMV Raku-Raku PC (announced November 6, 2008)

1. Cross-functional approach to identifying customer needs and commercializing products

   Marketing and intellectual property divisions teamed up with the development division to extensively explore ways to develop a user-friendly, simple, and dependable PC. The involvement of the intellectual property division from the development stages ensured that no patents or other intellectual properties were inadvertently compromised.

2. Sample of intellectual properties

   Patent rights: Approximately 20 patent applications have been filed in and outside Japan, centered on technologies that simplify user input and search functions.

   Trademark rights: "Raku-Raku PC"

2. Exercising Patent Rights

We conclude cross-licensing agreements with prominent firms worldwide aimed at preserving a high degree of business latitude. This policy of opening our wide range of basic technology research for potential use in the business activities and technologies of other firms applies even in fields in which Fujitsu does not directly conduct operations. On a for-fee basis, we make available basic technologies when we believe this will foster broader use of our technology compared with commercializing it on our own. We refer to this as "technology marketing." An example of products commercialized by a licensee are an antibacterial mask and antibacterial stationery created through application of titanium apatite technology developed jointly by Fujitsu Laboratories Ltd. and the University of Tokyo. This demonstrates how the use of Fujitsu technology in fields outside our main business areas can stimulate the creation of new value. Information on a number of other appealing technologies, including an atmospheric sensor and environmental evaluation system, can be found on Fujitsu's website. (http://jp.fujitsu.com/about/ip/)

[Acquisition of an Influential Patent]

Example of US Patent Relating to a Card Type Wireless Device (Wireless LAN)

1. Reissued US patent number: Re. 36,769 (July 11, 2000)
2. Title of the invention: "CARD TYPE INPUT/OUTPUT INTERFACE DEVICE AND ELECTRONIC DEVICE USING THE SAME"
3. Summary: Card-type wireless device for sending and receiving data that can be easily inserted into a slot on a PC or other electronic device, thus encouraging widespread use.
4. Since the filing of this US patent application in 1992, Fujitsu has persisted through the US patent process to refine the claims of this patent application. This work helped fix the scope of the patent rights, which led to patent issuance on July 11, 2000.

3. Respecting Third Parties' Rights

The impact of infringing upon the rights of third parties goes beyond having to pay significant compensation. In the worst case, it could have a major economic impact on our company due to the loss of business opportunities. In addition, it could prevent us from providing products and services, thereby severely inconveniencing our customers. We are fostering a culture at Fujitsu that respects the patent rights of other companies, as well as creating an environment that allows all our engineers to utilize the ATMS/IR.net system* to efficiently and effectively research patents held by other companies.

* An ASP-based service which searches laid-open patent applications and prosecution history data provided by the Japan Patent Office.

Patents Issued in Japan in 2008

1	Panasonic Corporation	4,786
2	TOSHIBA Corporation	3,256
3	Ricoh Company, Ltd.	3,168
4	Sony Corporation	3,126
5	Toyota Motor Corporation	3,047
6	DENSO CORPORATION	2,701
7	Seiko Epson Corporation	2,628
8	Sharp Corporation	2,577
9	Canon Inc.	2,550
10	Mitsubishi Electric Corporation	2,548
11	Honda Motor Co., Ltd.	2,498
12	**Fujitsu Limited**	**2,439**
13	Hitachi, Ltd.	2,282
14	FUJI FILM Corporation	2,166
15	Nissan Motor Co., Ltd.	1,601
16	SANYO Electric Co., Ltd.	1,517
17	Panasonic Electric Works Co., Ltd.	1,325
18	Dai Nippon Printing Co., Ltd.	1,063
19	NIPPON TELEGRAPH AND TELEPHONE CORPORATION	985
20	Samsung Electronics Co., Ltd.	975

Source: Fujitsu survey based on Japan Patent Office data (Number of issued patents)

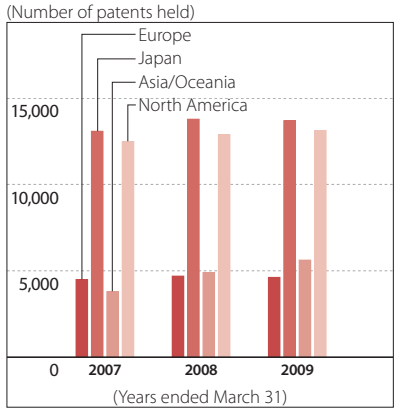
Patents Issued in US in 2008

1	International Business Machines Corporation	4,186
2	Samsung Electronics Co., Ltd.	3,515
3	Canon Inc.	2,114
4	Microsoft Corporation	2,030
5	Intel Corporation	1,776
6	Panasonic Corporation	1,745
7	TOSHIBA Corporation	1,609
8	**Fujitsu Limited**	**1,494**
9	Sony Corporation	1,485
10	Hewlett-Packard Development Company, L.P.	1,424
11	Hitachi, Ltd.	1,313
12	Micron Technology, Inc.	1,250
13	Seiko Epson Corporation	1,229
14	General Electric Company	912
15	FUJI FILM Corporation	869
16	Ricoh Company, Ltd.	857
17	Infineon Technologies AG	814
18	LG Electronics Inc.	805
19	Texas Instruments Incorporated	757
20	Honda Motor Co., Ltd.	747

Source: IFI CLAIMS Patent Services (Number of issued patents)

Our Global Patent Portfolio

(Number of patents held)



Fujitsu Patents by Business Segment

(Year ended March 31, 2009)