RESEARCH & DEVELOPMENT AND INTELLECTUAL PROPERTY

IT has become an essential part of society, and it will continue to transform the way we live and do business. Through groundbreaking technology development embodying innovative concepts over the years, the Fujitsu Group has contributed to the emergence of a rewarding and secure networked society by consistently generating new value through innovation. The Group recognizes that intellectual property—as the end-result of our innovation—is a key corporate asset supporting our business activities. Accordingly, patents, copyrights, trademarks and other relevant intellectual rights are proactively acquired and secured for business use with the goal of enhancing corporate earnings.



Underpinned by a comprehensive management strategy, the Fujitsu Group has integrated its business, R&D, and intellectual property (including standards) strategies to promote its business activities.

049

Our Mission in R&D

Our basic R&D policy is to pursue the latest in technology for nextgeneration 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





Major Achievements in Fiscal 2007

(1) The world's first technology for automatic verification of Java-based, practical-use web applications

Fujitsu pioneered core technology for automatic verification of Java-based practical-use web applications. This technology eliminates the need to manually prepare detailed test procedures and data by automatically extracting and coding the verification procedures and test data, and then performing exhaustive and automatic testing to verify that a web application can operate according to specification. This technology helps programmers develop high-quality software more quickly by making it possible to perform comprehensive tests encompassing a range of use scenarios.

(2) FCMDB supports international standards to enhance IT systems management

We developed a Federated Configuration Management Database (FCMDB) to automatically correlate and integrate the various forms of IT system operation management information that exist for various objectives, including server management and network management. FCMDB will make it possible to observe and manage a wide array of configuration information on a single screen, from multiple types of information on hardware to details of service to clients. This will help reduce operational management costs and provide a stable platform for the management of IT systems. In addition, together with five major vendors and, we are currently working towards international standardization of the basic specifications of the FCMDB.

(3) Technology for ultra-small optical link module used in next-generation supercomputers

Fujitsu is at the forefront of the development of an ultra-small optical link module to provide the high-speed calculation node interconnectivity required in petaflop-class^{*1} supercomputers.

Our technology allows these link modules to be reduced to less than one-tenth the conventional size, contributing significantly to reductions in the size of new supercomputers.



Ultra-small optical link module with a transfer speed of 40Gbps

(4) Developing and implementing the world's smallest mobile WiMAX[™] base station and RF module for handsets

We have developed the world's smallest outdoor base station using mobile WiMAX^{*2} technology, a wireless communication format used to provide broadband speeds in mobile environments. By combining a high-output transmission amp using gallium nitride HEMT with Fujitsu's proprietary digital predistortion (DPD) technology^{*3}, we were able to achieve unparalleled efficiency at the world's smallest size. This device will help dramatically reduce base station construction costs and operating expenses. The BroadOne WX300 outdoor macrocell base station garnered the prestigious System Design Award at the WiMAX World EMEA 2008 conference. We have also devel-

oped a radio frequency module as technology for mobile WiMAX terminals. This module integrates all of the radio frequency circuits, such as filters, needed by a mobile terminal, and comes in the world's smallest size (15 mm²). This module makes it possible to reduce the size of a mobile terminal in addition to providing high-speed transmission and stable connection.



RF chip for mobile WiMAX[™] terminal (MB86K71)



Integrated mobile WiMAX[™] base station BroadOne WX300

(5) Successful creation of a nanocarbon structure by connecting carbon nanotubes and graphene

Fujitsu successfully created the world's first self-organizing carbon composite structure by combining carbon nanotubes and graphene—two nano-scale structures which differ in form but are both made from carbon materials. Since the combined structure exhibits the characteristics of both components, it is believed to have high electrical and thermal conductivity in all directions. Fujitsu expects these discoveries to lead to new avenues of materials research and a wide range of potential applications in electronic devices and heat dispersion devices.



Electron microscope images of the new nanocarbon composite structure (a) and graphene component (b).



- *1 Petaflop: Refers to the maximum calculation speed of the computer. 1 petaflop = 1 quadrillion floating-point operations per second.
- *2 WiMAX: Worldwide Interoperability for Microwave Access. IEEE802.16- and IEEE802.16e-compliant mobile wireless standard. WiMAX technology enables data transmission speeds of up to 75 Mb/sec even when traveling at speeds of 120 km/hour.
- *3 Digital pre-distortion (DPD) technology: Technology that adds an input signal with the opposite characteristics to the distortion generated in an amplifier, thereby correcting the distortion in advance.

Prizes and Awards

Fifth Annual Prime Minister's Award for Contribution to Industry-Academia-Government Collaboration

Dr. Mitsuru Sugawara, president and CEO of QD Laser, Inc. and serving concurrently as an executive of Fujitsu Laboratories, Ltd. and Fujitsu Limited, was recognized for his tremendous achievements in cooperative ventures between government, industry and academia with the Prime Minister's Award—the highest award that any individual or organization can receive in this field. The award was shared with Professor Yasuhiko Arakawa and Professor Yoshiaki Nakano of the University of Tokyo. The three scientists took part in a photonic network technology research and development project commissioned by New Energy and Industrial Technology Development Organization (NEDO) and conducted by the Optoelectronic Industry and Technology Development Association (OITDA). The award recognizes Dr. Sugawara's contributions to developing a practical application of quantum dot laser technology, and the establishment of a start-up company to commercialize this technology. QD Laser was established as a joint venture between the corporate venture funds of Fujitsu and Mitsui Ventures.

Topics Environment-related R&D efforts

Our Green Policy Innovation initiative aims to help Fujitsu customers reduce their environmental footprint. This project, which began in fiscal 2007 and runs through fiscal 2010, aims to cut CO₂ emissions over the four-year period by a cumulative total of over 7 million tons*. The company is researching and developing technology to support a wide range of solutions aimed at reducing the environmental burden of IT infrastructure as well as using IT to reduce customers' environmental footprint. Several examples of Fujitsu's progress in this area are described below. In the future, as new products and services incorporate these technical advances, Fujitsu hopes that it can make a contribution to combating global warming, and otherwise helping customers reduce their burden on the environment.

* See page 54 for more on the Fujitsu Group's environmental activities.

Real-time multi-point temperature measuring technology for data centers

One method of reducing energy consumption is to make more efficient use of energy. Fujitsu developed a monitoring system for data centers which have multiple heat-generating units, based on the use of a number of thermostats connected by optical fiber and accurate measurement of the temperature on a real-time basis. A single optical fiber can monitor the temperature in over 10,000 separate locations simultaneously, making it possible to "see" the distribution of heat in the room. Combining this basic technology with air conditioning control systems, it is possible to make fine adjustments to the settings of each air conditioning unit to ensure that there is a uniform temperature distribution throughout the room. This helps to reduce the total energy consumption of the data center.



Strategic Direction in Fiscal 2008

The Fujitsu Group is continually pursuing new innovations while working to solidify its business foundation, under a policy of reinforcing strengths while envisioning the future. The company intends to focus its cutting-edge research efforts on the targets outlined below, while pursuing globalization and cost reductions, and accelerating business speed and the incubation of new businesses.

1. Developing new business models in new business sectors

Fujitsu has identified three new areas of research where it will concentrate its efforts, pursuing research activities that can foster tomorrow's profitable businesses.

(1) Green technology

The problem of global warming requires an urgent response. Fujitsu will pursue the latest in technological innovation in this area, in order to contribute to society as well as to develop new businesses.

(2) Sensor technology and system solutions

Sensor technologies can help foster a synthesis between the virtual world of computers and the real world of human society. Innovations in sensor technology will help to expand the scope of IT applications and lead to new business opportunities.

(3) Next-generation terminals and services

Cross-pollination between computers and mobile phones is bearing fruit in a new generation of mobile terminals and services that will generate new business opportunities.

2. Enhancing the contributions of research to core businesses

Fujitsu is encouraging the development of next-generation services and solutions, next-generation server systems and next-generation network technology, taking steps to enhance the contributions that R&D make to the Fujitsu Group's core business operations.

3. Improving technological synergy in the Fujitsu Group

The company is developing synergies in its R&D operations, to support the development of next-generation technologies which can be used in a number of separate core business segments.

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 currently developing a framework to strengthen Group-wide intellectual property activities to enable the entire Group to leverage our intellectual property assets. One example is the need for international standards, an issue that requires action by every global base in the Group. Here, we use regular meetings among Group companies to share information as well as promote specific measures. In this way, we encourage greater coherence in our intellectual property activities.

Promoting Shared Standards in the WiMAX Business

1. WiMAX Forum

The WiMAX Forum is an international, not-for-profit group dedicated to promoting compatibility and interoperability among IEEE802.16-compliant products. Fujitsu has served as a board member of the forum since its founding.

2. Efforts to Promote Standardization

- Relevant divisions at Fujitsu's head office have worked closely with overseas operations (US and European research centers, Fujitsu Microelectronics Canada) in a Group-wide effort to identify patentable inventions pertaining to standardization.
- In filing patent applications, Fujitsu drafts patent specifications with standardized technologies in mind.
- Globally, we have filed more than 100 related patent applications.



1. Patent Rights

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

We strategically channel our R&D investment into priority technology fields and work to acquire patents for not only basic technologies in these fields but also technologies in peripheral areas. For example, in the server field, home to our mainstay products, every year we file for around 500 patents in and outside Japan based on a wide variety of developed technologies. A similar pattern can be seen in software, where we annually submit roughly 500 patent applications worldwide through regular efforts to identify patentable inventions.

PATENT APPLICATIONS IN JAPAN IN 2007	
1 Matsushita Electric Industrial Co., Ltd.	4,765
2 Toshiba Corporation	3,423
3 Ricoh Company, Ltd.	2,813
4 Hitachi, Ltd.	2,726
5 Canon Inc.	2,655
6 Sony Corporation	2,641
7 Seiko Epson Corporation	2,628
8 DENSO Corporation	2,611
9 Fujitsu Limited	2,511
10 Honda Motor Co., Ltd.	2,466
11 Mitsubishi Electric Corporation	2,381
12 Sharp Corporation	2,005
13 Toyota Motor Corporation	1,849
14 Nissan Motor Co., Ltd.	1,720
15 FUJI FILM Corporation	1,680
16 Matsushita Electric Works, Ltd.	1,387
17 SANYO Electric Co., Ltd.	1,369
18 NTT Corporation	1,201
19 Fuji Xerox Co., Ltd.	1,071
20 Samsung Electronics Co., Ltd.	976

PATENT APPLICATIONS IN THE US IN	2007
1 IBM Corporation	3,148
2 Samsung Electronics Co., Ltd.	2,725
3 Canon Inc.	1,987
4 Matsushita Electric Industrial Co., Ltd.	1,941
5 Intel Corporation	1,865
6 Microsoft Corporation	1,637
7 Toshiba Corporation	1,549
8 Sony Corporation	1,481
9 Micron Technology, Inc.	1,476
10 Hewlett-Packard Development Company, L.P.	1,470
11 Hitachi, Ltd.	1,397
11 Hitachi, Ltd. 12 Fujitsu Limited	1,397 1,315
11 Hitachi, Ltd.12 Fujitsu Limited13 Seiko Epson Corporation	1,397 1,315 1,208
 11 Hitachi, Ltd. 12 Fujitsu Limited 13 Seiko Epson Corporation 14 General Electric Company 	1,397 1,315 1,208 914
 11 Hitachi, Ltd. 12 Fujitsu Limited 13 Seiko Epson Corporation 14 General Electric Company 15 Infineon Technologies AG 	1,397 1,315 1,208 914 856
 11 Hitachi, Ltd. 12 Fujitsu Limited 13 Seiko Epson Corporation 14 General Electric Company 15 Infineon Technologies AG 16 DENSO Corporation 	1,397 1,315 1,208 914 856 803
 11 Hitachi, Ltd. 12 Fujitsu Limited 13 Seiko Epson Corporation 14 General Electric Company 15 Infineon Technologies AG 16 DENSO Corporation 17 Texas Instruments Incorporated 	1,397 1,315 1,208 914 856 803 752
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OUR GLOBAL PATENT PORTFOLIO





Source: Fujitsu survey based on Japan Patent Office data

(Number of issued patents)

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

2. Exercising Patent Rights

We conclude cross-licensing agreements with prominent firms worldwide aimed at preserving a high degree of business latitude. On a for-fee basis, we also make available basic technologies when we believe this will foster broader use of our technology compared with commercializing it on our own. 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. We refer to this as "technology marketing," and based on these marketing efforts, Fujitsu has concluded more than 500 licensing agreements.

3. Respecting Third Parties' Rights

The impact of infringing upon the rights of third parties goes beyond having to pay significant fees. In the worst case, it could have a major economic impact on our company due to the loss of business opportunities and other issues. 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 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.