

FUJITSU LABORATORIES LTD. Sustainability Report 2017

The Fujitsu Group is committed to "Creating Things in Harmony with Nature." As a member of this group, Fujitsu Laboratories undertakes research and development that places environmental contribution as a priority item based on the FUJITSU Way-the Fujitsu Group's corporate philosophy-in which "protecting the environment and contributing to society" is a key corporate value.



Kawasaki Laboratories (Head Office)



Atsugi Laboratories

1. Greetings from the CEO

We currently face many global environmental issues, such as global warming, depleted natural resources and loss of biodiversity. The international framework known as the Paris climate agreement came into effect in November 2016 as a worldwide attempt to resolve these issues by keeping the global temperature rise this century below 2 degrees Celsius above pre-industrial levels. In addition, various initiatives are being undertaken worldwide to realize the sustainable society of the Sustainable Development Goals (SDGs) adopted by the UN General Assembly in 2015.

Given this background, Fujitsu Laboratories considers environmental contribution to be one of our most important priorities. We conduct research and development in wide-ranging areas from advanced materials, next-generation elements, computers, networks, and ICT systems, to creating next-generation solutions, services and business models, by determining the roles we can perform to contribute to the realization of a sustainable society.

Based on these innovative technologies and our slogan of "Developing technology to contribute to the resolution of social and environmental issues," Fujitsu Laboratories promotes various environmental activities including CO2 emissions reductions through energy saving and work efficiency improvements, resource saving, natural disaster response, conservation of biodiversity, and countermeasures to global warming.



Shigeru Sasaki
CEO and Representative Director
FUJITSU LABORATORIES LTD.

2. Introduction to Fujitsu Laboratories Offices

- Kawasaki (Head Office)
 - Location: 4-1-1 Kamikodanaka, Nakahara-ku, Kawasaki, Kanagawa
 - Established: 1968
 - No. of employees: about 850
- Atsugi
 - Location: 10-1 Morinosato-Wakamiya, Atsugi, Kanagawa
 - Established: 1983
 - No. of employees: about 350

3. Green ICT Activities

■ Environmentally Conscious R&D (Promotion of Advanced Green R&D)

- The Fujitsu Group formulated the Fujitsu Group Environmental Action Plan (Stage VIII) for environmental targets for the FY 2016 - FY 2018 period. This plan consists of the two axes of "Our Society: Contributing to Society" and "Our Business: Fujitsu's own business activities."
- Within "Our Society," Fujitsu Laboratories is promoting "Advanced Green R&D" with the aim of developing innovative technologies in all its R&D projects toward resolving environmental issues.

■ FY 2016 Performance and Results

- Positioning and highlighting Our Key Green Technologies
 - To disseminate the Fujitsu Group's advanced green ICT throughout society, promote its early deployment in businesses, and raise the awareness of researchers, we are positioning our best-in-class and world-first technologies and technologies with remarkably high environmental contribution as Key Green Technologies. We are also intensifying dissemination of our technical capabilities and expertise through ongoing R&D efforts and press announcements.
 - In FY 2016, the Fujitsu Laboratories announced 25 research and development achievements, with 19 of these in the Green by ICT category (reducing environmental burden throughout society by use of ICT) and 6 of these in the Green of ICT category (reducing the environmental burden of ICT itself).
 - Development Achievements (25 items)
 - (1) April 27, 2016
Fujitsu Develops Technology that Quickly Tracks Changes Made to Large-Scale Open Source Software
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/0427-01.html>
 - (2) May 10, 2016
Fujitsu develops High-Accuracy Fuel Efficiency Estimates through a ship's operational data
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/0510-03.html>
 - (3) May 10, 2016
Fujitsu Develops AI Technology to Quickly Solve Urban Security Positioning Problems
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/0510-01.html>
 - (4) May 13, 2016
Fujitsu Develops High-Speed Forensic Technology to Grasp at a Glance the Entirety of a Cyber Attack
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/0513-02.html>
 - (5) May 17, 2016
Japan Gymnastics Association and Fujitsu Agree to Jointly Research Scoring Support Technology for Competitions
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/0517-02.html>

- (6) May 19, 2016
Fujitsu Boosts Efficiency of Manufacturing Processes at Shimane Fujitsu through IoT Collaboration with Intel
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/0519-01.html>
- (7) May 23, 2016
New Packaging Substrate Developed for Best Suitable Thin Film Capacitor(TFC) Embedding
<http://www.fujitsu.com/jp/group/fict/en/resources/news/press-releases/2016/0523/r20160523.html>
- (8) May 25, 2016
Fujitsu Develops Field Engineering Technology to Rapidly Provide IoT Services
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/0525-01.html>
- (9) June 9, 2016
Fujitsu Develops AI-Utilization Platform for Design and Manufacturing, Launches Consulting Service
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/0609-01.html>
- (10) June 29, 2016
Fujitsu Develops Energy-Saving Technology to Cool Data Centers
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/0629-02.html>
- (11) July 19, 2016
Fujitsu Develops Novel Technology to Automatically Assess Personal Data Privacy Risks
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/0719-01.html>
- (12) August 15, 2016
Fujitsu Develops Solution to Detect Sewer-System Flooding due to Torrential Rain
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/0815-01.html>
- (13) September 6, 2016
Fujitsu Develops Low Power Consumption Technology for 5G
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/0906-01.html>
- (14) September 27, 2016
Fujitsu Develops LED-watermarking technology for Automating and Optimizing Manual-Labor Tasks
<http://pr.fujitsu.com/jp/news/2016/09/27.html> (Japanese edition)
- (15) October 11, 2016
Fujitsu Develops Technology to Automatically Extract Business Specifications in Programs
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/1011-01.html>
- (16) October 13, 2016
Fujitsu Develops Millimeter-Wave CMOS Circuitry for Automotive Radar
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/1013-01.html>
- (17) October 17, 2016
Fujitsu Technology Uses Conversational Speech to Identify Customer Satisfaction
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/1017-01.html>
- (18) November 16, 2016
Fujitsu Develops Analysis Technology to Improve Communication Performance of Virtual Networks
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/1116-02.html>
- (19) December 5, 2016
Fujitsu Develops In-Memory Deduplication Technology to Accelerate Response for Large-Scale Storage
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/1205-02.html>
- (20) December 8, 2016
Flexible, Battery-Less Beacon that Uses Analog Power Circuit Control to Create a Compact, Slim configuration
<http://pr.fujitsu.com/jp/news/2016/12/8.html> (Japanese edition)
- (21) December 8, 2016
Fujitsu Develops Technology for Measuring Magnetic Properties under Stress Using Piezoelectric Device
<http://www.fujitsu.com/global/about/resources/news/press-releases/2016/1208-03.html>
- (22) January 30, 2017
Fujitsu Develops and Partners to Trial Mobile-App Control Technology to Revolutionize Home Healthcare
<http://www.fujitsu.com/global/about/resources/news/press-releases/2017/0130-01.html>
- (23) February 6, 2017
Fujitsu Develops Technology for the Centralized Management of Data Distributed in the Cloud and on Edge Servers
<http://pr.fujitsu.com/jp/news/2017/02/6-1.html> (Japanese edition)

(24) February 16, 2017

Fujitsu Enables Secure Use of Cloud Services via IoT Devices Using a Smartphone's Biometric Authentication
<http://www.fujitsu.com/global/about/resources/news/press-releases/2017/0216-01.html>

(25) March 13, 2017

FDK Introduces 1/8th Brick 450W Isolated Power Module
<http://www.fdk.com/whatsnew-e/release20170313-e.html>

■ Contributing to the UN General Assembly's Sustainable Development Goals (SDGs)

- In FY 2016, Fujitsu Laboratories positioned and highlighted our environmental contribution from the perspective of "Goal 11: Make cities and settlements inclusive, safe, resilient and sustainable" and "Goal 13: Take urgent action to combat climate change and its impacts" of the SDGs.

- The Case of Goal 11: Make cities and settlements inclusive, safe, resilient and sustainable
Fujitsu Develops High-Speed Forensic Technology to Grasp at a Glance the Entirety of a Cyber Attack
 (Announced May 13, 2016)

In the event of malware attacks, which infect organizations to cause a great deal of damage, including information leaks, it was previously necessary for an expert to spend large amounts of time conducting analysis of the various types of logs in networks and terminals.

By compressing and accumulating large amounts of network communications data necessary for attack status analysis, Fujitsu Laboratories has developed technology to automatically analyze the status of a targeted cyber-attack in a short period of time and show the whole picture at a glance. This technology infers the commands carried out on the PC from communications data flowing through the network, and by connecting command operations with specified user information, it can identify who executed what type of remote control and collect trace information about command operations.

Further, this technology can extract the state of progress of an attack in a short period of time, by analyzing the trace information collected. It distinguishes between communications generated by ordinary tasks and communications with a high probability of being attacks on the basis of defined actions characteristic of targeted cyber-attacks. By installing an analysis system incorporating these technologies, when a targeted cyber-attack is detected, PCs related to the attack can be extracted one after another, and because the attack status is automatically drawn in a bird's-eye view, it is possible to grasp the whole picture of the attack at a glance.

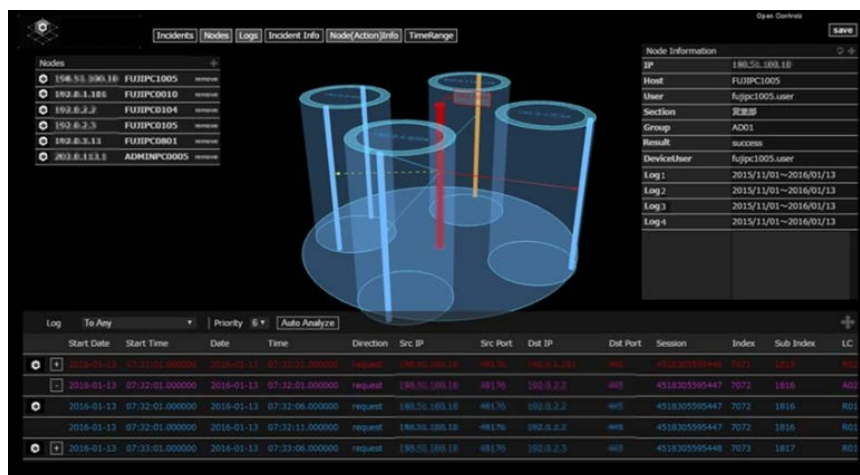


Figure: Screenshot of the analysis system for the status of targeted attacks

- The Case of Goal 13: Take urgent action to combat climate change and its impacts
Fujitsu Develops Energy-Saving Technology to Cool Data Centers (Announced June 29, 2016)

Currently, data center energy consumption is increasing along with growth in the data center market, and reports state that data center energy consumption accounts for 1-2% of all electricity use. With the aim of preventing global warming, there is demand for energy-saving in data centers, particularly with air-conditioning equipment, which accounts for 30% to 50% of total electricity use.

To flexibly respond to the dynamic status changes that are issues unique to data centers, such as moving information equipment in and out and changing rack arrangements, Fujitsu Laboratories has developed technology that sequentially builds a model that predicts air-conditioning effects from collected data, enabling reductions in air conditioner energy use.

This new technology creates a database that incorporates the status of air-conditioning equipment, including the utilization rate of machines and fan speed, and has a requirement to not only select useful information concerning prediction targets, but also to automatically select at least one variable from the air-conditioning equipment status database. By creating a highly accurate predictive model using the selected variables, this technology succeeds in improving predictive accuracy. With this technology, Fujitsu Laboratories is contributing to improving energy saving at data centers, contributing to preventing the warming of the planet's environment.

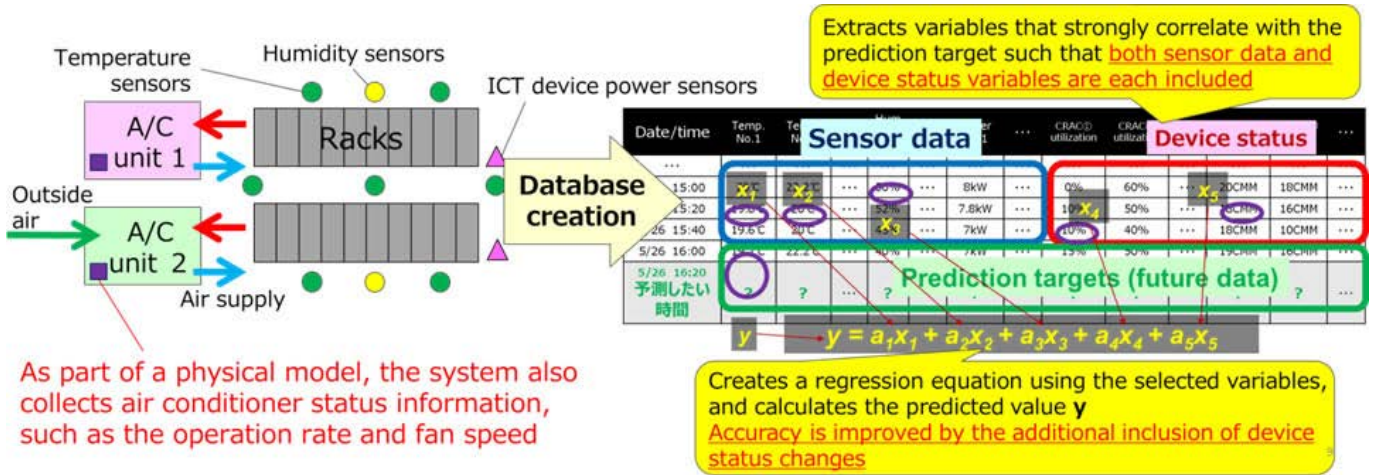
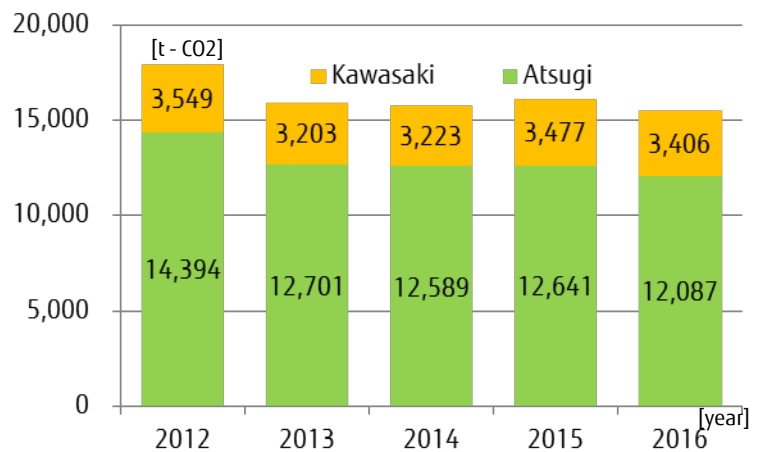


Figure: Highly-accurate predictive technology of air-conditioning effects

4. Environmental Activities

Countermeasures to Global Warming

- Reduction of energy use and CO2 emissions
 Fujitsu Laboratories promotes energy-saving activities at each location to reduce of energy use and CO2 emissions.
 - Strategic facility investment
 - Introduction of energy-saving pumps
 - Thorough elimination of wasteful electricity consumption
 - All lights turned off during lunchtime and enabled the turning off of lights on an individual basis
 - Reduction of impact of outside air on indoor environment
 - Updating to multi-layer energy-saving windows
 - Cool Biz/Warm Biz campaigns



* CO2 emissions factor by energy use amount: Ton -CO2/MWh
 FY 2012 - FY 2015: 0.570 → FY 2016: 0.534

5. Social Contribution Activities

■ Environmental Social Contributions

■ Volunteer Clean-up (Atsugi Location)

Fujitsu Laboratories teams up with three neighboring firms twice a year in the spring and fall to clean up the area surrounding its offices. November 2016 marked the 40th time these clean-up activities were held and Fujitsu Laboratories is making a continuous contribution to cleaning and beautifying the local social environment.



39th Volunteer Clean-up (June 2016)



40th Volunteer Clean-up (November 2016)

6. Biodiversity

■ Conservation of Biodiversity

■ Preservation of endangered plants (Atsugi Location)

Threatened and near-threatened plants specified by Ministry of the Environment and Japan's prefectural governments, such as Golden Orchids, *Cephalanthera erecta* and *Calanthe Discolor*, etc., grow wild in the green belt. Fujitsu Laboratories preserves biodiversity by conserving the locations where these plants grow wild to ensure they are not trampled on.



Golden Orchid



Cephalanthera erecta



Calanthe Discolor
(Photographed in May 2017)

■ Tree-planting Activities (Atsugi Location)

53% of the Atsugi Location site consists of green land. Fujitsu Laboratories has been involved in ongoing tree-planting activities within the site since 2010 based on the slogan of "Project to Create a Living Forest" to conserve the tree varieties of the Tanzawa foothills.



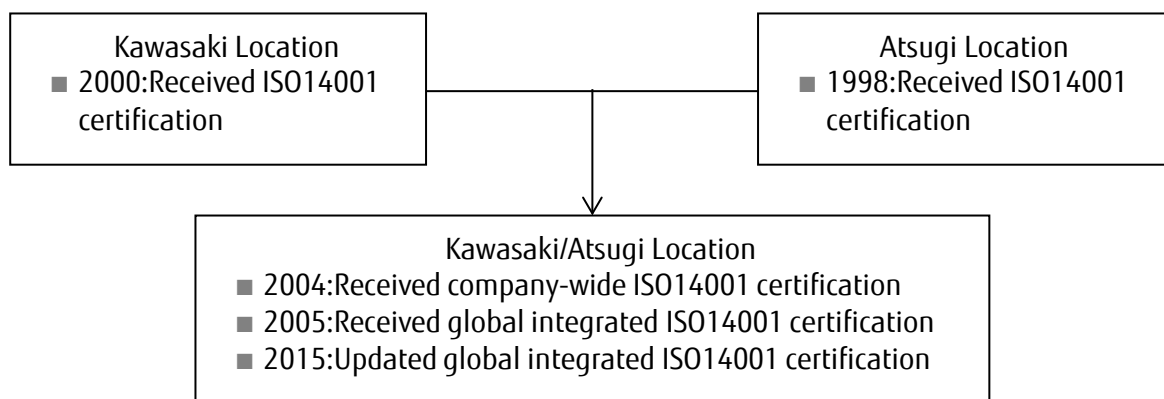
(Photographed in June 2016)

7. Environmental Management System

■ Environmental Management System

The Fujitsu Group engages in environmental activities based on an environmental management system (EMS) conforming to the ISO4001 international standard.

As a member of the Fujitsu Group, Fujitsu Laboratories operates an EMS at each of its Kawasaki and Atsugi locations and promotes activities toward the reduction of environmental burden.



8. Environmental Policy

■ Environmental Policy (Kawasaki)

At its Kawasaki location, Fujitsu Laboratories promotes environmental activities on the basis of the Kawasaki Plant Environmental Policy*.

* Please refer to the "Kawasaki Research and Manufacturing Facilities Sustainability Report" for details on the Environmental Policy.
<http://www.fujitsu.com/jp/about/resources/reports/sustainabilityreport/group/> (Japanese edition)

■ Environmental Policy (Atsugi)

As an independent site, Fujitsu Laboratories at Atsugi embodies the basic philosophy of "preserving the global environment and contributing to the sustainable development of society" as set forth in the Fujitsu Group Environmental Policy* and has established the following principles as a basis for conducting its activities as an R&D hub centered on ICT-related equipment, devices and materials.

- (1) Observe laws, regulations and agreements related to the environment and the Fujitsu Group Environmental Policy.
- (2) Operate an environmental management system that conforms to ISO14001 and make ongoing improvements in conjunction with changes in business activities to reduce environmental load and prevent pollution.
- (3) Develop innovative technology for the resolution of environmental issues.
- (4) Promote reductions in environmental load directly related to Fujitsu's own business activities.
 - Energy : Promote reduced use of energy through energy rationalization
 - Waste : Maintain zero waste emission and keep down the total volume of generated waste
 - Chemical materials : Intensify management of chemical materials and preventive measures against pollution
- (5) Promote environmental social contributions and the conservation of biodiversity using regional characteristics.
- (6) Specify clear environmental objectives, environmental targets, and action items to put these principles into practice and periodically review them to promote good environmental management activities.
- (7) Ensure that this environmental policy is well known to all employees of Fujitsu Laboratories at Atsugi and is released to the general public as well.

* Fujitsu Group Environmental Policy :
<http://www.fujitsu.com/global/about/environment/approach/policy/>

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