



## 2 Information and Telecommunications

Information and communication technology sparks an enormous revolution in a wide range of socio-economical activities, including realization and diffusion of the use of e-commerce, e-government, telework, telemedicine, and distance learning, affecting both industry and lifestyles, and representing an increasingly important infrastructure for safety and security in people's lives. In addition, prioritizing investment in information technologies with international advantages from mid- to long-term perspectives will result in the enhancement of Japanese S&T and academic research efforts as well as the global industrial competitiveness of Japan.

As part of the government's efforts in relation to information and communication as a whole, the Strategic Headquarters for the Promotion of an Advanced Information and Communication Network Society (IT Strategic Headquarters) set forth the "New Strategy in Information and Communications Technology" (May 2010) and to "realize a e-Government (Electronic government) focused on the Japanese public, regeneration of bond between communities, and creation of new markets and international expansion." In addition, the National Information Security Policy Council established the "The Information Security Strategy for Protection of Nation" (May 2010) to "establish an environment with reliable information and communication technology for the Japanese public and realizing the world's most advanced nation in information security."

The Ministry of Internal Affairs and Communications (MIC), in increasing coordination with the government's S&T policy, is utilizing the information and communication technology (ICT) to promote R&D in particular for green innovation and life innovation, strengthening international competitiveness.

MEXT is promoting R&D utilizing seeds of technology in universities and similar institutions to address issues such as efficient use of computational resources and large-scale data, reduction of electricity consumption, and enhanced reliability of the information system, in order to realize a society in which cutting-edge information S&T will be fully exploited.

METI implements programs such as the "Green IT Project" to promote "green IT" as a means of realizing a society in which the environment and the economy can coexist. In addition, it is also promoting efforts such as software engineering to yield highly reliable information system software.

The following sections are the summary of seven areas of "important R&D issues" from the sectoral promotion strategy reflecting major projects implemented by the respective ministries.

### (1) Network

MIC is conducting R&D on basic technology required to build all-packet type high-spec networks for next-generation network technologies, which can instantly transfer vast amounts of information and can be easily and conveniently used by anyone. It is also engaged in R&D for technologies to strengthen the information communication infrastructure compatible with the dramatic increase of internet traffic, network technologies enabling anyone to use highly reliable cloud services, technologies facilitating common use all-optic networks, in which high speed and energy conservation are mutually compatible, technologies in which multiple wireless systems can be used at the same frequency, technologies enabling easy use of wireless systems at unused spectra, and other R&D related to new network architecture for next-generation networks.

METI is conducting R&D on technology to produce highly efficient network devices using electronic/



optical technology.

### (2) Ubiquitous network

In order to resolve technological issues to realize a “ubiquitous network society,” that allows information communication services best suited to the situation to be accessed anytime and anywhere easily and subconsciously from a convenient terminal by anyone, MIC has implemented R&D on “Ubiquitous Platform Technology,” which is the core of a common infrastructure (ubiquitous platform) for linking information systems which utilize electronic tags and sensors and exchanging highly sensitive information at a low cost. In FY 2010, the final year for R&D, MIC has implemented comprehensive demonstration experiments in actual commercial facilities and by evaluating the extent of the maturity of the developed technology and acceptance by the society, the results achieved are considered and developed for commercial use by private companies.

### (3) Device and Display

The National Institute of Information and Communications Technology (NICT) is conducting R&D for photonic devices, which are necessary for development of high speed/high spec telecommunications optical networks with low power consumption.

MEXT is developing technologies for high capacity and high speed storage infrastructure that uses innovative spintronics<sup>1</sup> to realize high-function and ultra low-power consumption computing.

With respect to semiconductor technologies, METI is conducting R&D in areas such as miniaturization technologies with technology nodes of 45 nm or less that realize next-generation high-function semiconductors with low power consumption (process/material, exposure system, design, masking and other technologies), next-generation non-volatile memory technology, and 3D integration technology for semiconductor devices. It also invites public participation from universities, joint venture organizations, and other companies in the private sector to conduct test manufacturing and evaluation of semiconductor chips with their excellent circuit designs. In addition, METI is pursuing green cloud computing technology and developing next-generation power devices as part of the “Green IT Project,” while conducting R&D for individual devices and equipment yielding energy-saving technologies for the data centers that serve as focal points in the cloud computing age.

### (4) Security and software

In terms of security technologies, MIC is working on “R&D for information security prevention technologies for large-scale virtual server environment,” and “technologies to detect illegal or harmful information on the Internet.” In addition, MIC and METI are implementing development and test operation of the BOT collection and analysis system, along with infection control. METI is also developing technologies to prevent damage from new threats on information security and to control damage, and is conducting research on management methods in relation to information security, which is interrelated with lifestyles and socio-economic activities, and on creation of an environment in which people can access reliable IT.

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<sup>1</sup> A new electronics technology utilizes two properties of electric charge and spin (magnetism) that electrons possess.



Concerning software development, MEXT is implementing R&D for “technology development program for highly reliable software,” which aims to visualize large-scale and complex software constructions and improve the reliability of the system. To secure the reliability and safety of systems installed in the automobiles and robotics industries, among others, METI is implementing functional safety for on board basic software for vehicle control and deciding on the guidelines for the development of functional safety regulations whose standardization is being considered in Europe. In addition, in order to enhance international competitiveness through reforming the industrial structure and creating high level industries, METI is developing the basic technology for cloud computing such as technology to process and analyze mass data and anonymization technology, while at the same time using actual cloud computing in demonstrations of advancing the medical and content related industries.

#### (5) Human interface and content

MIC is developing the technology for coding systems necessary for the high-definition image broadcast system, which is anticipated to be the next-generation broadcasting system, and also the elemental technology for three-dimensional imaging technology, similarly anticipated to be the imaging technique of the future, based on high-definition image broadcast technology. In addition, for the “realization of voice communication technology that overcomes language barriers,” a project intended to accelerate the return of research achievements to society, MIC conducts R&D for technologies such as network speech translation. In FY 2010, to accelerate the commercialization of automatic speech translation technology, large-scale demonstration experiment was implemented with the help of public users within the country and overseas and a network type speech translation system using smart phones was constructed. In addition, MIC is verifying and investigating the application of automatic speech translation technology in real life environments such as airports, large-scale theme parks, tourist spots and hospitals. Furthermore, it is implementing R&D of information analysis technology to offer reliable and verifiably credible information on the network (“R&D of information believability validation technologies in telecommunications services”).

MEXT is developing a basic technology (R&D of Web social analytical basic software) enabling users to efficiently collect and analyze movie and image information on the Web and use it for research and other purposes. In addition, MEXT is implementing R&D to realize a digital museum where visitors can interactively enjoy the tangible and intangible cultural heritages through their five senses.

#### (6) Robot

MIC is promoting R&D for network robots enabling protective oversight, health care, and life assistance, especially for the elderly and those with special needs (the challenged), utilizing the networks and robots positioned in various places in teamwork situations.

In the fields of personal care and transport assistance, METI collects and analyzes data to determine the safety verification method required for development and international standardization of personal safety technology, which is essential to utilize robots that assist people in their daily living. It also developed mechanical element technologies for next-generation robots, indispensable in high-demand areas such as next-generation industrial robots, service robots, and robots for special environments. In addition, METI performed feasibility experiments of intelligent robots, which undertake a variety of jobs in myriad

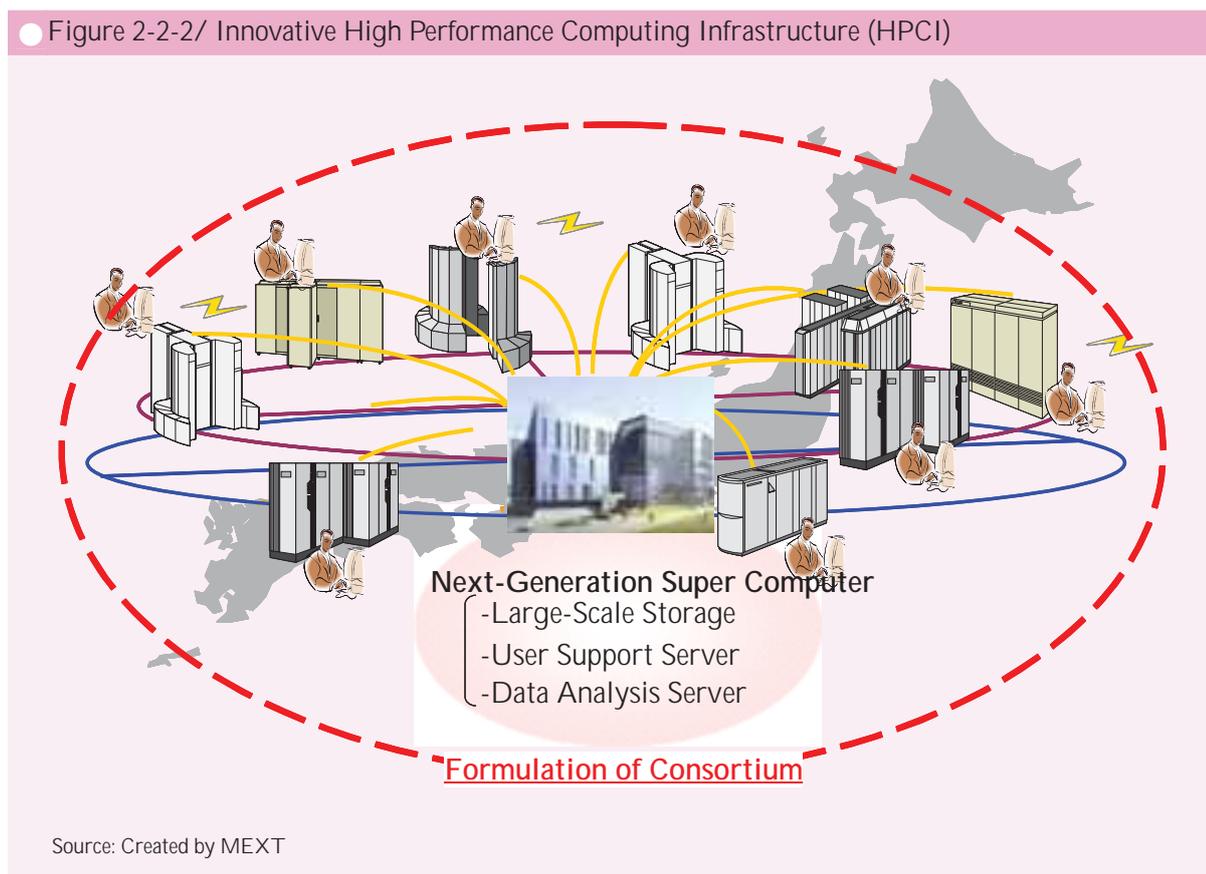
situations subject to frequent change, such as production, daily living, etc., conducted R&D of reusable “componentization (modularization)” through standardization of connection and control systems of robot components such as sensors, motors, etc.

RIKEN has established RIKEN-TRI Collaboration Center for Human-Interactive Robot Research in conjunction with Tokai Rubber Industries, Ltd, conducting R&D on life assistance robots (RIBA) that play important roles in the hospitals and care homes and developing a new robot with improved practicality.

### (7) R&D platform

MEXT is committed to promote the construction of the “Innovative High-performance Computing Infrastructure (HPCI)” (Figure 2-2-2) that realizes the computing environment that responds to the various user needs by considering the next generation supercomputer, “K,” as the core system and connecting main supercomputers located in universities and research institutions throughout Japan via network. In addition, MEXT conducted the preliminary study of the “HPCI Strategic Program” which intends to organize R&D in strategic fields<sup>1</sup> and the computational S&T system in Japan and is going to be fully implemented in FY 2011. [Refer to Part 2, Chapter 2 “Transdisciplinary areas” 1 (4).]

● Figure 2-2-2/ Innovative High Performance Computing Infrastructure (HPCI)



<sup>1</sup> Strategic fields: the following five fields in which the social and academic breakthrough are expected through the utmost use of HPCI.

Field 1: Computational Life science and Application in Drug Discovery and Medical Development.

Field 2: New materials and Energy creation

Field 3: Protection of global change toward the mitigation of natural disaster.

Field 4: Next generation manufacturing.

Field 5: The origin of matter and the universe.



Furthermore, MEXT is implementing R&D on basic technology that supports the e-science, a new scientific methodology to discover scientific knowledge by connecting the computational resources and enormous amount of data collected in computing, experiments, and observations through the network (system integration and R&D of related software to realize e-science).

#### (8) Others

Targeting graduate schools, MEXT is promoting the “Leading IT Specialist Training Promotion Program” and similar projects aimed at establishing a base for training future leaders of corporations and other organizations that can deal flexibly with social changes as insightful, world-class IT human resources.

Main research topics in the field of information and communications in FY 2010 are shown in [Table 2-2-3](#).



● Table 2-2-3/ Major Research Projects in Information and Communications (FY 2010)

Ministry	Research organization	Subject
Ministry of Internal Affairs and Communications		<ul style="list-style-type: none"> <li>- Research and development on highly reliable and energy-conserving network control technology to support cloud service</li> <li>-Research and development on elemental technology toward high-level uses of frequencies in mobile communication systems</li> <li>-Research and development on basic technologies toward promoting a transition of wireless systems to unused frequency bands</li> <li>- Research and development on the integrated satellite-terrestrial mobile communication systems [literal translation]</li> <li>- Research and development on the ubiquitous platform technologies [literal translation]</li> <li>-A trial to stop cyber attacks, such as spam, phishing</li> <li>-Research and development on information security prevention technologies for large-scale virtual server environment</li> <li>- Research and development on ubiquitous network robot technology for elderly and challenged people [literal translation]</li> </ul>
	National Institute of Information and Communications Technology	<ul style="list-style-type: none"> <li>- Research and development on basic technologies for next-generation networks</li> <li>- Research and development on photonic network technologies</li> <li>- Research and development on the infrastructure technologies for next-generation networks [literal translation]</li> <li>- Research and development concerning information reliability validation technology in telecommunication services</li> <li>- Research and development on technology to detect illegal/harmful information on the Internet</li> <li>-Promotion of infrastructure technologies for network security</li> <li>- Research and development on super-high realistic communication technology using the innovative 3D imaging technology</li> <li>- Research and development on universal audio/linguistic communication [literal translation]</li> </ul>
Ministry of Education, Culture, Sports, Science and Technology		<ul style="list-style-type: none"> <li>-Development and use of next-generation Supercomputer</li> <li>-HPCI Strategic Program</li> <li>-Research and development on the system-integrated and collaborative software for realizing e-science</li> <li>-Research and development on Web social analysis core software</li> <li>-Research and development of device/system core technology for high-function and ultra low-power consumption computing</li> <li>- Research and development on technologies for highly reliable software</li> <li>-Promotion of research and development on realizing a digital museum</li> <li>-Leading IT Specialist Training Promotion Program</li> </ul>
Ministry of Agriculture, Forestry and Fisheries	National Agriculture and Food Research Organization	<ul style="list-style-type: none"> <li>-Development of technologies for robot-harvesting fruits and vegetables</li> </ul>



Ministry of Economy, Trade and Industry		<ul style="list-style-type: none"> <li>- Ultra low voltage device project for low carbon society</li> <li>-Silicon implementation support program for next generation semiconductor circuit architectures</li> <li>-Project to develop a platform for embedded systems</li> <li>-Program to develop and demonstrate key next-generation information technologies that incorporate high reliability and energy efficiency (Program of research and development and demonstration utilizing cloud computing) [literal translation]</li> <li>-Infrastructure project for a computer security early-warning system [literal translation]</li> <li>-Project for corporate and personal information security measures [literal translation]</li> </ul>
	New Energy and Industrial Technology Development Organization (NEDO)	<ul style="list-style-type: none"> <li>-GREEN-IT Project</li> <li>-Development of Functionality Innovative Three-dimensional Integrated Circuit (Dream Chip) Technology</li> <li>-MIRAI project</li> <li>-Developing technologies for next-generation process-friendly designing -</li> <li>-Spintronics nonvolatile function technology project</li> <li>-Development of high speed nonvolatile memory function technology</li> <li>-Development of core technology for the next-generation, large-size, low-power consumption display</li> <li>-Development of the next-generation high-efficiency network device technology</li> <li>-Project for development of the next-generation robot intelligence technology</li> <li>-Project for Open Innovation Promotion by Utilizing Basic Robotic Technology</li> <li>-Project for Strategic Development of Advanced Robotics Elemental Technologies</li> <li>-Project for industrialization of life assistance robots [literal translation]</li> </ul>
	Information Technology Promotion Agency	<ul style="list-style-type: none"> <li>-Task of creating an early warning system for computer security</li> <li>-Taking security measures for corporate and private information</li> <li>-Utilization promotion project for open software [literal translation]</li> </ul>
Ministry of Land, Infrastructure, Transport and Tourism		<ul style="list-style-type: none"> <li>-Study on unmanned work, inspection, and diagnosis by using subsea robots</li> </ul>

### 3 Environmental Sciences

The environment sciences, considered a prioritized area by the 3rd Basic Plan, is an essential area of science for preserving the natural environment, including ecological systems with diverse forms of life, for maintaining human health and preserving individuals' living environment, and for maintaining the platforms for the survival of human beings in the future. In particular, addressing climate change, one of the most important issues facing the international community, the 4th Assessment Report prepared by the Intergovernmental Panel on Climate Change (IPCC) in 2007 pointed out that there was a high possibility that climate change had already influenced the global environment. In addition, the "New Growth Strategy," decided by the Cabinet in June 2010, has set forth the goal to spread and promote Japan's top level environmental technology to make it the world number one "Environment and Energy Country," by promoting the package of green innovation and comprehensive measures. Japan divides the environmental