

# Research and Development

## Aiming to Contribute to Society through the Development of Advanced Technology

**Ubiquitous Services**—“to enable users to obtain information, products and services wherever, whenever and with whatever in their desired format at their fingertips”—continue to expand as the e-Society\*<sup>1</sup> evolves. OKI supports the development of this e-Society by pushing the boundaries of R&D in five specific areas to provide leading Ubiquitous Services.

### Five Areas of Technological Development in Provision of Ubiquitous Services

#### 1 Ubiquitous Networks

Technology that provides individuals with freedom of activity, anytime and anywhere. Centering on the development of technologies for next-generation networks (NGNs), OKI also engages in the development of wireless multihop communication technology using Near Field Communication (NFC) technology that can be applied to sensor networks, as well as inter-vehicle communications technologies that can be applied in the intelligent transport system (ITS).

#### 2 Service Platforms

OKI is developing technologies in such areas as context awareness\*<sup>2</sup> and mobile security in addition to technologies relating to SaaS\*<sup>3</sup> / cloud computing, based on servers and mobile terminals to contribute to the establishment of a service platform technology that facilitates the effective and efficient provision of Ubiquitous Services.

#### 3 Human Media

OKI engages in the development of technologies encompassing highly-realistic communications system that utilize data collected by sensors in addition to audio and visual data; sound source separation technology to pick up specific speakers' voices; and face detection technology to provide user-friendly interfaces.

\*1 e-Society: A wide range of information is being exchanged beyond time and space over global networks. This breaks down the boundaries among countries, regions and cultures, enabling individuals to engage in various social activities in an impartial, secure way.

\*2 Context awareness technology: Technology by which computers actively gather and process information relating to user situations and perform situation-specific operations.

\*3 SaaS: Software as a Service

\*4 Energy harvesting technology: A technology for driving electrical components without primary batteries or external power sources, instead converting energy, such as heat, light and vibration, found in surrounding environments into electricity.

#### 4 Ubiquitous Module

OKI is bolstering the development of e-Functional module technologies, which include component-embedded substrates and high-density mounting. At the same time, OKI is leveraging these technologies to develop energy harvesting technology\*<sup>4</sup> and low power consumption wireless communications technology.

#### 5 Mechatronics

OKI continues to upgrade its printing technology and ATM-related technologies for overseas markets, while enhancing technologies related to eco-friendly, energy-saving, security and universal design features / products that bring higher customer value. In addition, OKI is aiming to create new values applying robotic technologies.

OKI maximizes efficiency in its R&D efforts by delegating basic research functions to its Corporate Research and Development Center and entrusting product development to the development departments of each business division. Also, by promoting technological exchange between business divisions, OKI is accelerating the creation of new technologies and businesses. Research at the level of elemental technology development is promoted through business-academia collaborations.



Green IT Awards 2008  
Commendation Ceremony



#### OKI Receives the Jury's Special Award of the Green IT Awards 2008

OKI's energy-saving system for store outlets received the Jury's Special Award in the "IT-Based Energy Saving in Society category" of the Green IT Awards 2008 sponsored by the Green IT Promotion Council. This system consolidates data collected by wireless sensor networks both inside and outside of store outlets and integrates system control functions by means of context awareness technology to efficiently achieve energy savings. This award-winning technology has gained recognition owing to OKI's energy conservation measures at each store outlet in the actual store network as well as easier data collection and management at the store headquarters with regard to environment and energy usage at all store outlets. In addition, wider application of the system to facilities other than store outlets helped OKI earn high evaluations.



OLT (Optical Line Terminal), the main equipment of this system



### Development of the World's First 160Gbps Ultra High-Speed Optical Next Generation Access Asymmetric PON System

OKI succeeded in the development of the world's first 160Gbps ultra high-speed optical next generation access (NGA) asymmetric PON system using its unique hybrid Optical Time Division Multiplexing (OTDM) and Optical Code Division Multiplexing (OCDM). Transmitting signals downstream at a speed of 160Gbps on a single optical fiber enables high-quality video delivery service, such as movie distribution and telemedicine, and will vitalize local communication environment.

The mainstream optical access systems used by carriers today belong to the GE-PON system (1.25Gbps) in Japan and G-PON system in the United States and Europe (2.5Gbps) are used mainly to transmit data and video. With such optical access systems, the communication capacity per user when 16 users are connected, is limited to 78 to 156Mbps.

OKI's new system significantly increases the communication capacity compared with conventional optical access systems. The system achieves 128-times larger capacity than GE-PON systems and 64-times larger capacity than G-PON systems. This means that with 16 users, telecom carriers can offer a 10Gbps communication capacity for each user, enabling high-resolution, high-quality video delivery service. The research was conducted as part of the "Research and development for ultra high-speed optical NGA Asymmetric PON system," under the auspices of NICT's "Basic Technology Promotion System for Private Sectors Program."

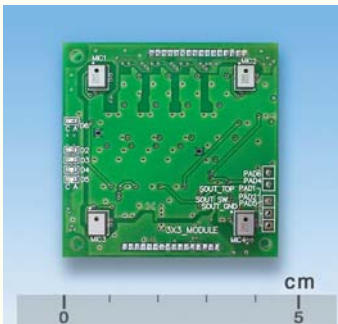


### Development of a Small Sound Source Separation Module to Extract Sounds from Specific Directions

OKI developed a small sound source separation module for embedded devices to separate and pick up sounds from specific directions. Packaging the "sound source separation technology" into a compact module of 4.5cm×4.5cm×1.0cm with the ability to process signals from multiple microphones, this product can be installed in small equipment.

Sound source separation technology is for isolating a target sound from multiple audio sources or a varied environment with mixed sounds. This technology has attracted attention for its ability to improve deteriorated sound quality and speech recognition performance when sound source other than the person speaking is mixed when telecommunicating remotely or performing speech recognition with devices such as mobile phone handsets, navigation systems and teleconference systems. Using the conventional sound source separation method, however, a number of microphones are required; therefore, it is difficult to achieve a smaller sized system. Given this situation, OKI, jointly with Waseda University, developed a sound source separation technology that separates and extracts sound from a specific direction\* with only a small number of microphones, and based on this technology, OKI realized a small sound source separation module that can be mounted on a mobile phone handset or other equipment. Adopting this module enables clearer communications by controlling noise even in loud situations when participating in a teleconference or speaking on a mobile phone. In addition to this feature, this module can prevent howling during communication. Furthermore, in combination with speech recognition technology, this product can be mounted in in-vehicle handsets or the remote controllers of home appliances to realize voice-activated operations.

\* Sound source separation technology that separates and extracts sound from a specific direction: This technology was jointly developed with Professor Tetsunori Kobayashi of Waseda University as a part of the "2007 Strategic Cultivation of Technologies" by the Ministry of Economy, Trade and Industry.



Small sound source separation module