

OKI aims Smart Society

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The Great East Japan Earthquake that occurred on March 11, 2011 has left a big scar in Japan. We respectfully express our deepest sympathy to everyone who was affected and wish for a safe, speedy recovery of the devastated region. OKI group is committed to supporting the reconstruction efforts and has a vision toward building a smart society.

Introduction

In addition to the “energy crisis”, “global warming” and “population in excess of 70 million” problems facing the world today, Japan is dealing with “earthquake recovery” and “rapidly aging population/low birthrate”. On the other hand, spectacular advances in ICT technology promises advanced data processing and broadband communications that have hidden potential to solve many of the mentioned problems. For instance, it is now possible to gather vast amounts of information from various locations which are then analyzed, processed and used to predict events, thus enable the next course of action to be taken in real-time at a reasonable cost. Therefore, attempts are underway at various locations to achieve a “smart community” that solves problems through merging of energy and information.

Generally, smart community is defined as “a concept for the next generation energy and social system that compositely combines regional transportation system, changes in citizens’ life styles, and energy utilization including effective use of electricity as well as heat and untapped energy on a regional basis”). The important point is that although “smart community”, a smarter community (city), in a narrow sense refers to reduction of environmental impact such as from energy use, on a broader sense it is considered an aim toward changes in lifestyles and social system for people to live comfortably with the aid of the advanced ICT technologies. What will support all of these changes, are the real physical place (area) and the services available at the place.

OKI has been providing equipment (ATM (Automated Teller Machine), PBX (Private Branch Exchange),

printers) and services (maintenance, LCM (Life-Cycle Management)) to “real places” such as banks, corporations and government agencies. Even at these “real places”, the trend for smarter equipment and services is becoming essential.

Viewing the smart community from a broad perspective, this article describes how OKI will contribute to the “smart society” of various “places”.

OKI’s Idea of a Smart Society

OKI’s initiative policies for the smart society are given below.

(1) Energy Savings

As an ICT equipment manufacturer it is expected, but further promote “energy savings” in systems, equipment and during the production process.

(2) Pursuit Ease of Use

In the future, as more office equipment becomes interlinked, it is important for various settings to be easily performed while using less energy. Systems and equipment will likely become more and more sophisticated. However, with the aging population, chances the user will be elderly are greater, which makes ease of use increasingly important.

(3) Coexistence of Safety/Security with Comfort

OKI has long since been developing disaster management systems to provide “safety and security” in an event of a disaster or emergency. In order to spread the usage of such systems, it is necessary to add functionalities that can be used on a daily basis and provide more comfort to the users.

(4) Partner Cooperation

In order to achieve a smart community, it is necessary to answer various demands than ever before. Instead of pinpoint solutions, solutions that cover the entire plane must be proposed. Otherwise, what OKI considers to be a concrete solution cannot be delivered. However, OKI

cannot achieve the goal alone and will require even more cooperation with various partners. As part of this effort, OKI is promoting standardization activities and actively participating in demonstration experiments with various partners.

(5) Global Expansion

Smarter social system is a global trend. Instead of limiting OKI's efforts to Japan, our technologies, products and services will be polished to meet the challenges towards the global market.

Based on the above, we have set forth a goal to "achieve a smart society that is environmental friendly, human friendly, safe, secure and comfortable". "Environmental friendly" naturally refers to the provision of energy-saving products. We will aim for clean factories and develop products that will contribute to the energy-saving efforts of customers.

"Safety and security" have long been keywords in our offering of various social systems, but the concept will be further strengthened. With "comfort", the goal is to achieve unprecedented comfort and ease of use. This includes such concepts as convenient to use, use without awareness, and fun to use.

Furthermore, smart society is classified into five "places" where ICT technology can be used to contribute to society. The "places" are office, mall, public service, mobility and home as shown in **Figure 1**.

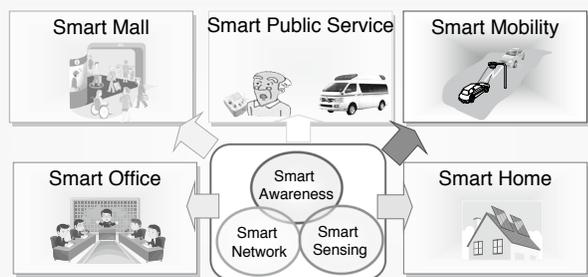


Figure 1. OKI's Aim for a Smart Society

Key Technologies behind the Smart Society

Key technologies that support the smart society are described below.

Of the core technologies supporting smart society, these three technologies are OKI's core competence.

(1) Smart Sensing

Aside from the basic energy, temperature and humidity information, "smart sensing" is an advanced sensing

technology that enables real-time recognition of people and objects from various kinds of sensor signals such as image and radio sensors.

(2) Smart Network

"Smart network" is an energy-saving, highly reliable network that can easily connect together a variety of systems and equipment and even tiny sensors.

(3) Smart Awareness

From the large volume of collected information, "smart awareness" performs real-time analysis of meaningful information, discovers new awareness and utilizes the new discovery.

OKI's Architecture for a Smart Society

Relationship between the three smart technologies previously mentioned is shown in **Figure 2**.

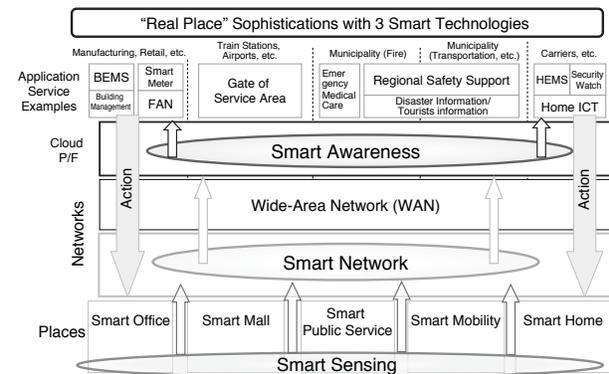


Figure 2. Smart Society Architecture

People and object information collected from offices, malls and other places with smart sensing are sent to a data center via smart networks. Smart awareness technology is then used to predict potential danger or purchasing behavior, and specific service actions can be performed through a variety of applications.

The features and benefits of each technology are explained below.

(1) Smart Sensing Features and Application Example

"Facialrecognition" is a typical example of smart sensing. OKI has been working on the technical development of an automatic facial recognition system since early 2000's and started delivering the facial recognition engine FSE (Face Sensing Engine) in 2006. FSE is already used in over 100 million devices. The feature of OKI's face recognition engine is the high recognition accuracy. Regardless of

changes in hairstyle or whether the subject is wearing a hat, glasses, or other accessories, FSE is capable of recognizing age, gender, and individuals with high degree of accuracy. Utilizing this technology as a sensor, smart (high accuracy, high reliability, low cost) sensing will be possible at many places.

(2) Smart Network Features and Application Example

OKI is developing a wireless multi-hop technology to easily and efficiently transmit sensing information. Wireless multi-hop is a technology that uses radio waves to relay transmissions between equipment. Small-scale or large, the technology can be used to build a highly reliable network that is energy efficient and robust against disasters with high cost performance. **(Figure 3).**²⁾³⁾

More specifically, OKI's expertise is being applied to the development of a large-scale network connecting home solar energy equipment of an entire town, and smaller networks to easily connect together appliances in homes.

In terms of "energy efficient and high reliability", these technologies will enable battery-powered sensor devices to operate several years without battery replacements, and devices may be placed near refrigerators and microwave ovens, which are traditionally difficult locations for signals to reach. Smart network technology is not limited to sensor networks. It is a key technology for object to object communication (M2M: Machine to Machine Communication) as well.

To confirm the efficacy of the smart network, OKI is participating in a demonstration experiment led by Japan's Ministry of Economy, Trade and Industry in Aomori Prefecture. In the experiment, home solar energy equipment in densely residential urban or suburban areas will be connected together using wireless multi-hop communication to perform effective power control. The experiment is scheduled for implementation in several dozen homes using the 920MHz band that will become available in 2012.

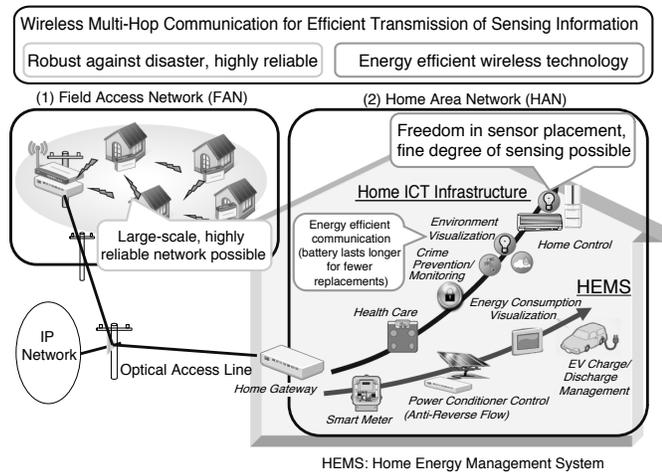


Figure 3. Features of a Smart Network

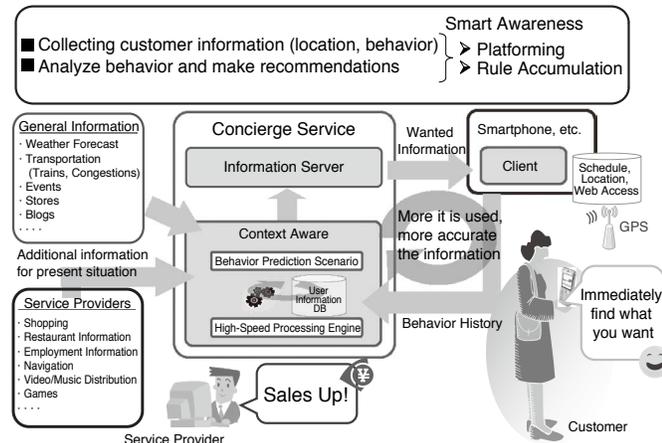


Figure 4. Features of Smart Awareness

(3) Smart Awareness Features and Application Example

“Smart awareness” involves predicting customer preferences or foreseeing dangers based on behavior and environment information collected from smart sensing and smart network. OKI’s aim is the efficient development of applications through rules accumulated from various demonstration experiments and system platforming.

An example application of “smart awareness” is the “concierge service” that predicts customer preferences and recommends appropriate services. For instance, the customer’s location information, event information of surrounding area, and past shopping history can be analyzed to make real-time suggestions of products or services that meet the customer’s interests (Figure 4).

OKI’s Initiatives toward a Smart Society

OKI plans to expand business by using current business areas, which includes social infrastructures and business solutions/services, as a base, and making each real place smarter. Office, mall, public service, mobility and home areas presented in Figure 1 that make up OKI’s smart society will each be discussed with a specific system or solution/service example.

(1) Smart Office

What is currently required in business activities is preparedness for a variety of environmental changes. First is business continuity in case of a disaster. Second is the seamless connection between an office and remote location as was seen in the form of telecommuting after the 2011 earthquake disaster and subsequent energy-saving measure. Third is how to efficiently operate an office’s

physical space such as facility/floor, or building energy are important. Smart office is exactly the concept needed to solve these requirements. We would like to respond to the smart office expectations with EXaaS™*1).

EXaaS provides cloud and BPO (Business Process Outsourcing) services along with terminal LCM for various industries so that customers utilizing IT can optimize total business cost. For terminals, service staffs of 2,500 are spread out at 250 locations across Japan to provide maintenance services and perform terminal LCM service in conjunction with procurement and kitting (Figure 5).

Recently, outsourcing utilizing cloud computing services for business continuity plan (BCP) in the event of a disaster has been attracting attention. When considering business continuity, in addition to “people, goods, money”, it is necessary to take into account continuity of assets such as “places” (offices, factories) and “information” (documents, data). “Outsourcing” that uses “cloud computing” is an effective way to ensure business continuity of “places and information”. Our goal is to contribute to the continuity of customer’s business by focusing on BPO service as a BCP measure in addition to OKI’s expertise in shared application service and total LCM service including terminal maintenance. That is, provide business-critical applications for each industry, so that customers can “prepare for the worst”.

Following the commitment to support BCP, the next initiative is to address the growing locations where business activities take place. Popularity of mobile terminals and services, represented by smartphones and tablets, is rapidly expanding the usage of these terminals as a business tool. However, mobile terminals introduce new issues such as coordination with existing

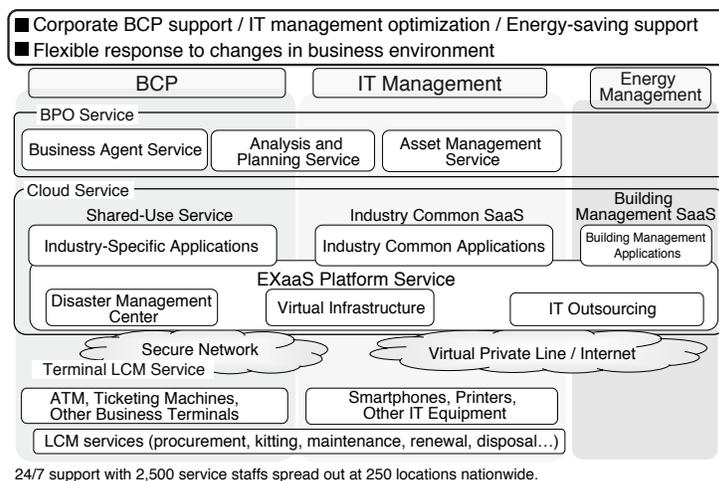


Figure 5. Smart Office Achieved with EXaaS

*1) EXaaS is a trademark of Oki Electric Industry Co., Ltd. Other company names and product names mentioned in this document are trademarks or registered trademarks of their respective owners.

applications, ensuring new securities, communication cost, and supporting new models that appear frequently. In terms of business use, the mobile terminals are a heavy burden on IT management cost and resources.

To solve these issues from an IT standpoint, OKI has developed “SmartWorkspace”, a one-stop service for managing ICT equipment used both in and out of the office. Utilizing this service, business users are able to manage the life cycle of ICT equipment, and from outside workspace participate in conference calls, use extension numbers, securely access intra-network information and link with business systems.

It is no exaggeration to say that after the Great East Japan Earthquake, many of us experienced first-hand what it is like to run low on energy. Until the 3/11 event, energy saving efforts were carried out as measures against global warming, but we have come to realize that energy supply itself is also limited.

To counter this newly realized energy issue, overall management of building energy, which includes real-time visualization of various energy usages, usage control through information analysis, use of solar and other natural energy sources, and linkage with energy storage systems, will become important.

OKI already offers “Web Sensing⁴⁾” service that measures, collects and visualizes office energy usage. Additionally, OKI provides a building energy management system that employs a sensor network to transmit information to BEMS (Building and Energy Management System) or building automation system for a more refined “visualization”, and database for storing various measurements collected in real-time. In the future, these services and systems will be offered to customers as a comprehensive business solution (Figure 6).

(2) Smart Mall

A mall is generally defined as a promenade-like, often enclosed complex containing various retail stores (shopping mall) or a sheltered walkway. For the purpose of our discussion, the meaning will be expanded as “places of public gathering” to include, besides shopping malls, other commercial facilities where people gather for communications and activities such as train stations, airports and hotels.

People found at the mall can be largely classified as those who gather to use the mall (mall users) and those who conduct business at the mall (business operators).

What mall users expect from a mall is something that arouses their curiosity, be able to readily obtain goods and information, or look to spend a good time. On the other hand, business operators want to run their businesses efficiently and have many mall users gather with willingness to purchase, thus increase their sales and profit.

A mall that will solve these expectations is the smart mall. To achieve this smart mall, the mall needs “intelligence” and “ability to mutually communicate with people”, thereby enabling the awareness of an individual’s entrance and provide “information and services wanted now” that will satisfy the individual’s need for activity.

It is OKI’s plan to take information such as customer data from ATMs/ticketing machines and maintenance service records obtained from past business activities to structure a knowledge base. Then, this knowledge will be utilized to predict activities of mall users for delivery of “information and services wanted now” (Figure 7).

For example, consumer goods manufacturers and distribution companies make variety of sales promotions toward mall retail stores to increase sales. As part of their marketing activities, many conduct hands-on surveys that

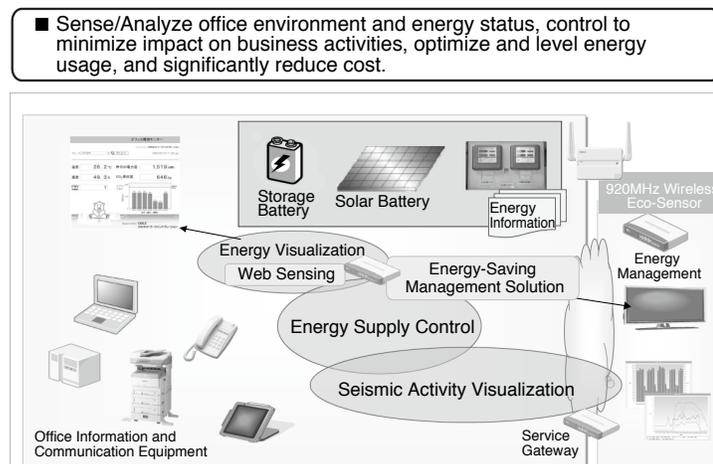


Figure 6. Office and Facility Energy Management

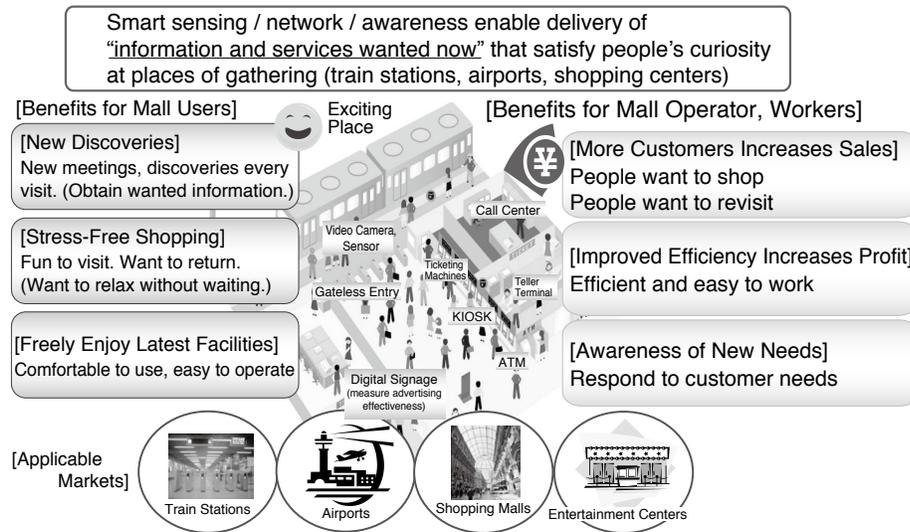


Figure 7. Smart Mall Overview

are short-term, costly and plagued with fluctuating data.

In contrast, purchase behavior measurement/analysis system (RESCATSM) takes customer behavior detected from video sensors in stores and combines it with POS sales history, date/time, weather, past data, and other available information to perform a multifaceted analysis. It then produces such reports as people count both in-store and out, and product/content visibility.

The use of this system will help support merchants and consumer goods manufacturers with effective marketing. Furthermore, research and development is being conducted to link this system with the context awareness engine to provide digital signage service that will display ads according to customer interest.

(3) Smart Public Services

Smarter public services are considered core services of a smart society. Public services refer to various services including supply of energy offered widely to residents by a municipality, nation or corporation. Companies committed to the building of a smart society often work on regional energy management systems, electric automobiles or renewable energy controls. However, OKI's plan is to contribute to the advancement of information systems. OKI is already working on municipal announcement broadcasting systems, disaster response systems and fire systems, but for achievement of a smarter society, intends to incorporate the following two policies.

The first is to create new services utilizing ICT. Second is to interconnect information and terminals that are currently separated due to independence of the system. We believe these policies will enable richer services to be provided to more people (Figure 8).

(a) Emergency Medical Transport System

One example of a new service is the emergency medical transport system.

Currently, there are situations when a hospital that meets a patient's particular emergency needs cannot be found. The purpose of the new system is to "swiftly and efficiently transport a patient to a medical facility with a specialist capable of treating the emergency" therefore, the patient can quickly receive appropriate treatment and thus improve his/her survival rate.

The issue with emergency transport so far has been the lack of a system that shares patient information which would support selection of an appropriate medical facility.

Emergency medical transport system utilizes the previously described smart awareness technology and is under development as part of OKI's participation in the implementation of an emergency medical support information system promoted by Professor Ogura at Gifu University.

This system shares information of a region's medical facilities in real-time and provides emergency responders information that will allow quick, efficient transport of the patient to a medical facility which can offer appropriate care for the patient's condition. The results will later be fed back to the system as knowledge for better decision making.

Outcome of the project will be utilized in our effort to deploy the system nationwide.

(b) Community Announcement and Welfare System

Another example is the "community announcement and welfare system" for residents of a region. OKI currently provides a wireless system and announcement

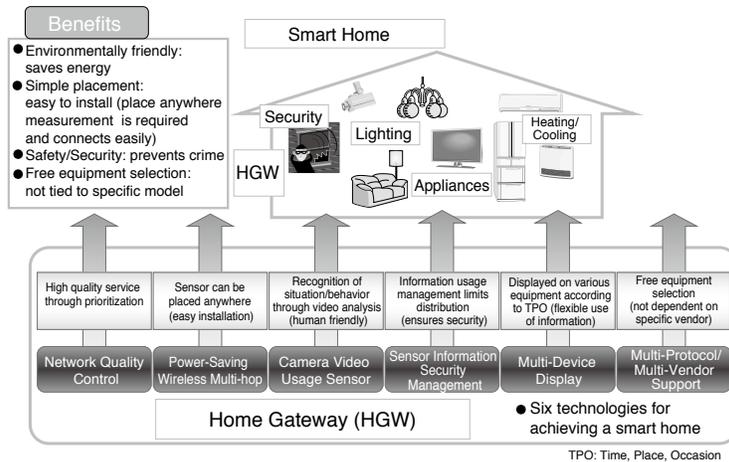


Figure 9. Smart Home Overview

home through comprehensive control of heating/cooling, appliances, lighting and security systems.

OKI does not manufacture home appliances, but plans to contribute to the energy-savings, safety and security of a home via the home gateway provided to telecommunications carrier. Additionally, the ability of the previously mentioned wireless technology to reach places not covered by Wi-Fi enables more freedom in the placement of equipment.

Figure 9 shows six technologies including sensor, security and communications that can be utilized over the home gateway. OKI considers cooperation with the appliance industry a key point and is currently participating in several trials. Furthermore, standardization is vital and necessary in achieving a smart home. Therefore, standardization activities of IEEE, ZigBee^{*3)} and OSGi^{*4)} will be closely followed.

“Monitoring service” is a specific example of a smart home. The service remotely monitors health of the elderly living alone, and when necessary contacts family members and/or care centers. The service can also be easily used for day-to-day communication. This service is considered essential for the Japanese society whose elderly population continues to grow.

Outlook

Efforts to build a smart society are still in the planning stages or are in trials therefore, it is extremely important to produce concrete verification and visible result. Key to the development of the smart society will likely be ICT platforms such as M2M. OKI will further seek to brush up advanced sensing technology, wireless technology and data processing technology for the M2M platform.

*3) ZigBee is a registered trademark of Koninklijke Philips Electronics N.V.

*4) OSGi is a registered trademark of OSGi Alliance in the United States.

Through cooperation with customers and various partners, we hope to expand pinpoint solutions into solutions that cover an entire plane, thereby making a wide range of contributions from assisting the reconstruction of regions affected by the Great East Japan Earthquake to helping developing nations. ◆◆

References

- 1) Ministry of Economy, Trade and Industry, “Basic Energy Plan”, June 18, 2010
- 2) Nozaki, et al, “Wireless multi-hop routing method for smart networks”, OKI Technical Review, October 2011/Issue 218, Vol.78 No.1, pp.78-81
- 3) Kubo, et al, “Interference avoidance based on channel switching for large scale wireless sensor networks”, IEICE Technical Report, 2011
- 4) Saito, “The Approach of Next Generation Environmental Information Gathering Service ‘Web Sensing’”, OKI Technical Review, October 2011/Issue 218, Vol.78 No.1, pp.46-49
- 5) Tsukamoto, et al, “‘RESCAT’, The Ad-Watcher’s Response Categorizing System Using Human Image Analysis”, OKI Technical Review, October 2011/Issue 218, Vol.78 No.1, pp.32-35
- 6) Shichijo, et al, “GEMITS (Global Emergency Medical supporting Intelligent Transport System)”, OKI Technical Review, October 2011/Issue 218, Vol.78 No.1, pp.28-31
- 7) Kaneko, et al, “Development of Pedestrian-to-Vehicle Communication System”, OKI Technical Review, October 2011/Issue 218, Vol.78 No.1, pp.72-77

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Note: Titles and organizations are current as of March 2012

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