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Smart Meter Radio Devices Heading towards Practical Use Phase

−International Standard Compliant Low-Power Radio Device Development−

Fumihide Kojima

Senior Researcher, Smart Wireless Laboratory, Wireless Network Research Institute

In 1999, Kojima completed a doctoral course. The same year, he joined Communications Research Laboratory, Ministry of Posts and Telecommunications (currently, NICT). Since then, he has engaged in research and development in 384kbps high-speed PHS, low-rate dynamic image real-time transmission, ROF multiservice road-vehicle-communications, and VHF customer-provided mobile communications. Currently, he is engaged in research and development related to PHY/MAC technology in smart utility networks and standardization promotion activities. Ph.D. (Engineering).

Usage image and prevalence trend for smart meter radio system

Recently, creation of both people and nature-friendly environments are progressing where energy wastage is minimized as long as possible by exploiting automatic meter reading on electricity, gas and water meters employed in homes and buildings. According to the increased interest in this energy conservation, urgent attention has been called to research and development of smart meters that utilize radio technology to efficiently realize operation control, status monitoring, and automated meter reading of various meters.

Figure 1 shows a usage image of a smart meter radio system. Smart meters equipping radio devices are applied as electricity, gas and water meters in each household, meter data is collected into collection stations in the service areas corresponding to residential area images of housing complexes and single-family homes, and on the other hand, an application example with control over each meter from collection stations is also shown. In this type of application image, multi-hop transmission function based on smart meter integrated multi-stage relays and low-power performance are thought of as chief technology components. Multi-hop transmission functions held by smart meters secure communication distance and are effective for resolving radio blind spots due to shielding, etc., and moreover, smart meter low-power performance realizes approximately 10 years of continued performance in battery drive, reducing battery replacement costs.

In Japan, “950 MHz band” allocation for RFID systems was originally considered to be suitable for the allocation of smart meter utilities. However, MIC (Ministry of Internal affairs and Communications, Japan) officially announced “920 MHz band” allocation for smart meter usage in Jan. 2012 for the benefit of the international cooperation and competitiveness. Accordingly, NICT, domestic users and manufacturer companies have submitted a unified proposal for clear and effective 920 MHz utilization to IEEE 802 committee. As a result, those task groups have finalized the drafts (to be finalized as standards in Mar. 2012) defining such “920 MHz band” allocation. Although significance of standardization and realization of the smart meter system is confirmed with the establishment of the world-first organization that supports certification and promotion in Jan. 2012, any radio device compliant to such finalized IEEE 802.15.4g/4e standards has not been developed yet.

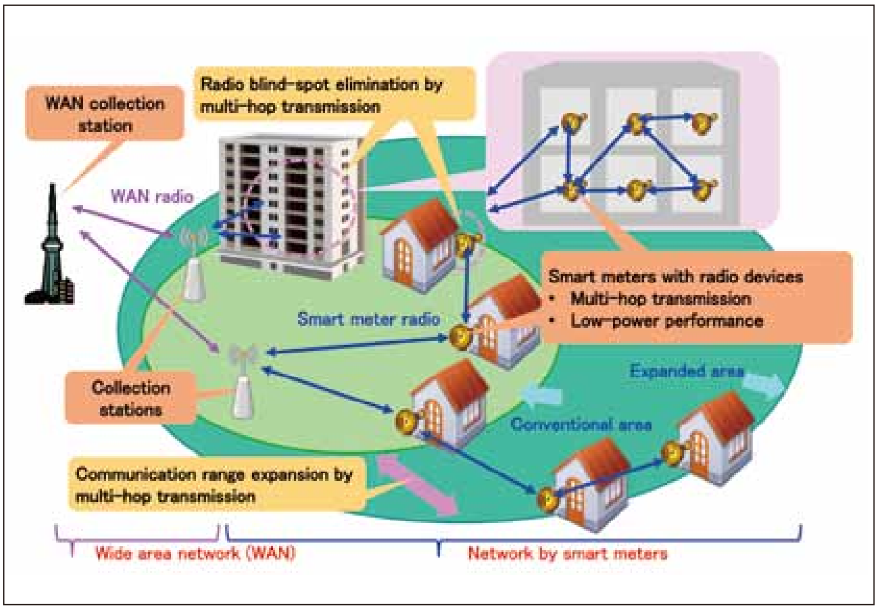


Figure 1●Usage image of radio by smart meters

Smart meter radio device research and development

With practical use being expedited under such circumstances, NICT developed a radio device compliant with the latest IEEE 802 international standard draft. The specifications for the developed device and a part of the inner module in Figure 2 are each shown in Table 1. This radio device qualifies for the radio transmission system that NICT proposed to IEEE 802 committee up to now and supported the new domestic smart meter radio frequency band 920MHz, so it succeeded in becoming a device that implements low-power and miniaturization. The radio device has technical standards conformity certification and has the potential to operate immediately in any domestic area.

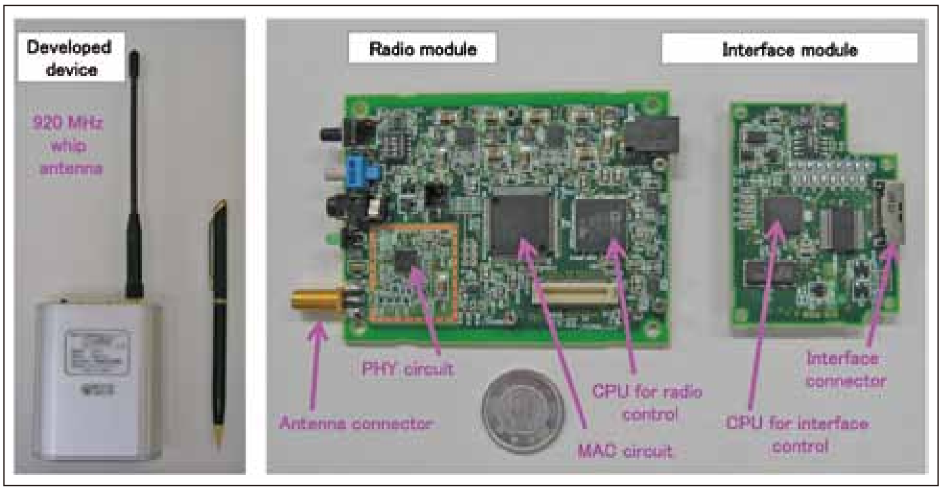


Figure 2●Developed radio device for smart meter

Table 1●Our radio device specifications

Size	82 mm×70 mm×35 mm (without antenna)
Frequency band	926.3～927.9MHz
Transmission power	20mW
Modulation scheme	2GFSK
Data rates	50k、100k、200kbps
Maximum PHY payload size	2047octets
Access control system	CSMA/CA in the active period
Routing system	Tree topology-based, unidirectional routing from each node to the root

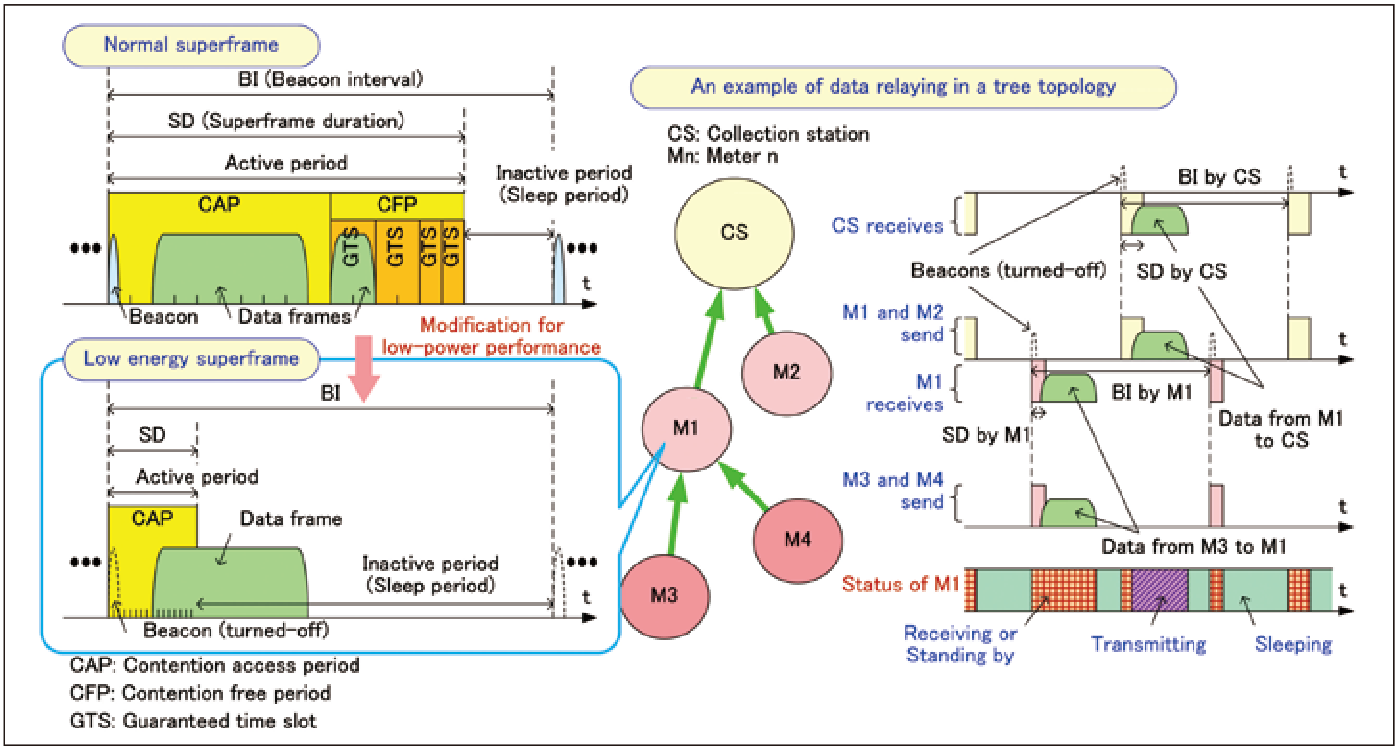


Figure 3●Access control scheme for smart meter radio

One of the remarkable points of the developed radio device is low-power multi-hop transmission management capability that automatically and autonomously constructs data collection/circulation topology among meters when they are turned on. Then, any pair of communicating devices synchronizes with each other by employing intermittent and short periods for data receiving/standing by and transmitting each of which is less than one-hundredth shorter than the remaining periods for sleeping. Therefore, these devices can achieve low-power performance implying possibility of long-lived battery-powered operations for several years without battery replacement. Moreover, these devices have flexible interface modules suitable for a variety of external meters and sensors.

Figure 3 shows access control of the radio device. The beacon signal is usually turned off in order to avoid excessive power consumption owing to periodical transmission and it is transmitted only when requested. There are two types of periods; the active period and the sleep period as in Figure 3. Only the active period includes receiving or standing by state of the device. In contrast, the sleep period indicates sleeping state of the device except for the case the device continuously receive a data frame from the last active period as in Figure 3, which can decrease the average power consumption by exploiting the existence of sleep period. The developed radio device automatically and autonomously constructs a tree topology as in Figure 3 after turned-on, then conducts an effective data relaying to the collection station as depicted in Figure 3.

Future prospects

For the future, I will continue to promote the spread of smart meter radio devices based on the IEEE 802 international standard with the support of organizations that support certification and promotion and strive for the realization of a safe and secure society that utilizes ICT.

Evaluation of Infrared Nano-antennas Properties using FTIR System

—Development of International Standard Compliant Low-Power Radio Devices—

Akira Kawakami

Senior Researcher, Nano ICT Laboratory, Advanced ICT Research Institute

After completing a master's course, Kawakami joined Communications Research Laboratory, Ministry of Posts and Telecommunications (currently, NICT) in 1988. He is engaged in research on THz Josephson array oscillators, superconducting SIS receivers, and superconducting device fabrication techniques. Ph.D. (Engineering).

Introduction

Both Light and radio waves are electromagnetic waves, the difference in denomination being mainly in frequency. According to radio law, "an electromagnetic wave with a frequency under 3,000,000 megahertz (3 terahertz)" is called a radio wave, and any electromagnetic wave with a higher frequency is infrared, that is to say "light." Electromagnetic waves intrinsically have "particulate" and "fluctuation" properties, but until now, research has been done on devices from the frequency difference where mainly radio waves utilize "fluctuation" and light utilizes "fluctuation" with "particulate". In particular, most photodetectors have device structures / mechanisms based on light "particulate." The reason was because of the high energy of photons and short wavelengths of light. However, due to recent advancements in nano fine processing technology, new optical device applications that utilize light "fluctuation" are being proposed. One of those being what our research aims at, optical nano antenna technology, it is development towards optical frequency domains of radio technology where so-called fine processing technology lower than light wavelengths is actualized. Here at the Advanced ICT Research Institute, research on superconducting low noise terahertz receivers more than ever before. Electromagnetic receivers in this frequency band, as with television and radio receiver methods, are comprised of antennae for efficiently receiving electromagnetic waves from space and microdetectors such as superconductor tunnel junction and niobium nitride (NbN) ultrathin filmstrips that are placed on the antenna feeding point. Both the effective securement of the receiving area and high sensitivity/high speed via microdetectors are each independently achieved. From this background and advancements in nano fine processing technology, optical antennae that operate in optical frequency even with photodetectors being developed, many interrelated photodetectors like optical receiver mechanisms and detection mechanisms clearly separated into "light antenna" and "ultra-micro detector" that is placed on the antenna feeding point, and aiming for high-efficiency and high-speed in infrared photodetectors through optimization of each part is thought as a natural research development and direction. Figure 1 shows an example of the optical nano antenna-coupled infrared photodetector that our research is pursuing.

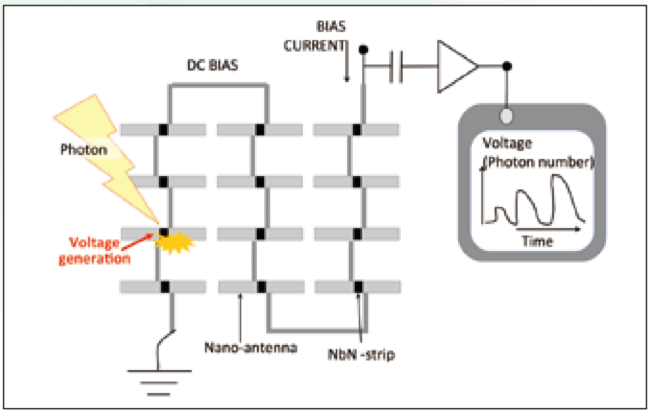


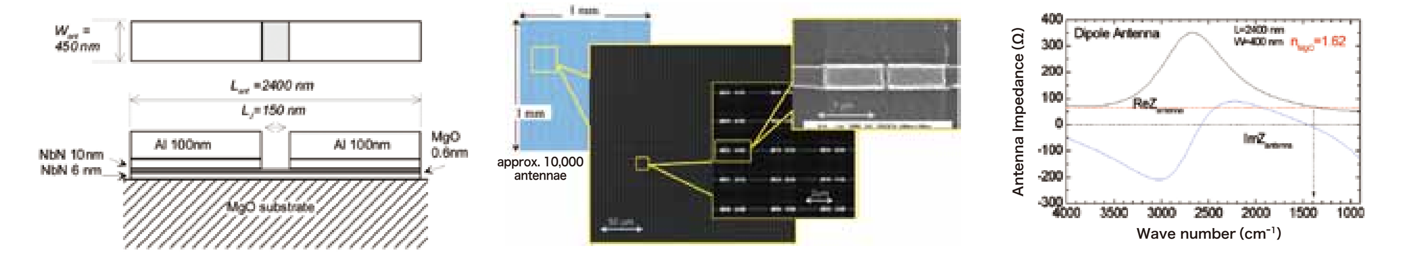
Figure 1●Optical nano antenna-coupled infrared photodetector by serially biased operation

Connects detector to multiple series and applies constant current bias. The superconducting state of the NbN ultrathin film strip on the feeding point is destroyed by photon incidence, generating output voltage.

Mid-infrared optical nano antenna production and evaluation

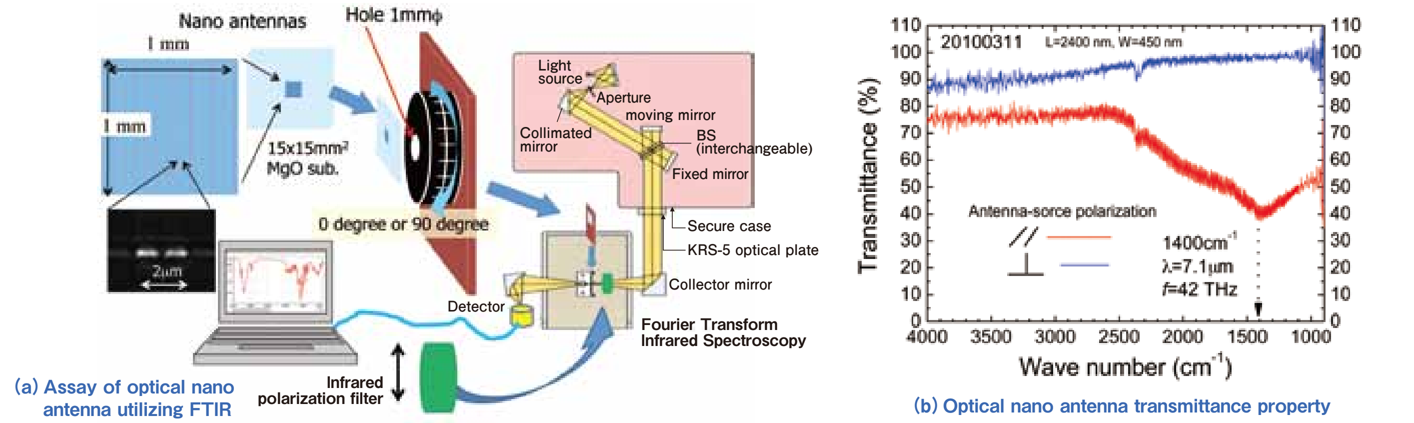
Here, I will describe the production of the first mid-infrared optical nano antenna we attempted, its property evaluation, and future research prospects.

In order to produce an infrared optical range antenna, nano-sized micro processing technology is essential. Therefore, to produce an infrared optical range antenna, we are introducing an electron beam writing technique*2 into every lithography process*1. A patterning technique to process metallic thin film based on electron beam patterns is also necessary. And so, recently we developed a new patterning technique that uses magnesium oxide (MgO) thin film that shows high fluorine resistant based on the low-damage ion-beam sputtering method*3 as an inorganic resist. Figure 2 shows (a) a schematic view of the nano antenna we developed, (b) a micrograph, and (c) antenna impedance calculated from n=1.62 refractive index of an MgO substrate in an antenna-size, mid-infrared region. The optical nano antenna is a dipole antenna with a length of 2,400 nm, width of 450 nm, and an NbN micro-strip placed at the center feeding point as load resistance. The load resistance placed at the antenna feeding point was set at an antenna impedance (approximately 60 Ω) in the vicinity of wave number 1,400 cm^{-1} (approximately 42THz).



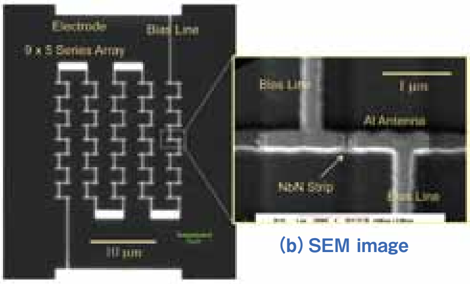
(a) Nano antenna schematic (b) Nano antenna micrograph (c) Simulated antenna impedance calculation result

Figure 2●Optical antenna (a) schematic, (b) micrograph, and (c) antennaimpedance



(a) Assay of optical nano antenna utilizing FTIR (b) Optical nano antenna transmittance property

Figure 3●(a) Assay of optical nano antenna utilizing FTIR, (b) transmittance property



(a) Microscope image (b) SEM image

Figure 4●Optical nano antenna-coupled infrared photodetector we produced

When the matched load is connected to the antenna and its transmission properties measured, the antenna response is believed to be observed as an “absorption property” in a consistent frequency. We thought that by evaluating the dipole antenna’s transmission properties using middle and near infrared ray Fourier Transform Infrared Spectroscopy (FTIR) from its precise polarization dependence, we could confirm its antenna operations in the optical frequency domain. The first issue was that one of the nano antenna’s effective area was extremely small at a square of a wavelength, so this time in order to obtain a clear absorption property, we evaluated it by arranging approximately 100,000 nano antennae in 1mm × 1mm areas that is same to FTIR luminous flux-size at intervals of several μm.

Figure 3 shows (a) a nano antenna assay using FTIR and (b) transmittance measurement result. When incident light’s polarization direction aligns with the antenna, a clear absorption property in the vicinity of wave number 1,400 cm^{-1} (42THz) was observed. However, the incident light and antenna’s polarization surface differed by 90 degrees, no marked absorption property could be seen. We think that by aligning the antenna impedance with the load resistance in this wave number vicinity, this confirms the antenna operations in the nano antenna’s mid-infrared region. The maximum rate of absorption (approximately 50%) also closely coincides with theoretical values, so in the future, by optimizing the alignment of the antenna, we think it will be able to ensure superior light receiving efficiency.

Examining an infrared photodetector with nano antennae

Currently, along with the establishment of nano antenna design guidelines, we are examining and producing a superconducting mid-infrared photodetector. Figure 4 shows a micrograph of a mid-infrared photodetector with nano antennae we produced. Superconductive transition temperature at 11.8K of 45 NbN superconducting strips (5.9 nm film thickness) placed on the nano antenna feeding point is shown as well as good superconductivity property with critical current uniformity. In the future, we plan to evaluate photoresponse spectrum in mid-infrared region.

Future Prospects

Hereafter, we will evaluate properties in mid-infrared region such as optical nano antenna directive property, load resistance dependence, and antenna length dependence, and establish an optical nano antenna design guideline. We will also examine micro strip optical transmission lines along with passive circuits like filters, and research and develop new optical device technology with nano fine processing technology. Our goal underneath the terahertz collaboration project is to develop new optical devices using radio technology that utilize fluctuation.

Glossary

＊1 Lithography process
Technique in which light and electron beams are used to transcribe fine element patterns onto a substrate via LSI fabrication and nano device production processes.

＊2 Electron beam writing technique
A technique in which by utilizing deflection circuits that deflect in prescribed locations, blanking circuits that switch ON/OFF, and high-precision stages to control electron beams focused up to several nm in diameter, an intended pattern is formed and exposed.

＊3 Ion beam sputtering method
A film deposition method in which a target is exposed to ion beams such as argon, and the sputtered target’s materials accumulate onto a substrate. By electrically neutralizing on the target, damage by charged particles to the substrate is reduced, and ultrathin film several nm in thickness can be fabricated with high reproducibility.

Secure Network Switch with Quantum Key Distribution System

—Aiming towards contributing to network security—

Mikio Fujiwara

Quantum ICT Laboratory, Advanced ICT Research Institute

After completing a doctoral course, Fujiwara joined Communications Research Laboratory, Ministry of Posts and Telecommunications (currently, NICT) in 1992. He is engaged in research on satellite-mounted far-infrared detectors, photon-number discriminators, and cryoelectronics. Ph.D. (Science).

Introduction

Current cryptographic technology is used not only in text concealment but also authentication and signatures, making it indispensible for Internet services. Quantum key distribution that NICT has been developing is being further improved everyday as a means to a cryptic function where text concealment remains permanently unbreakable.

In quantum key distribution, the sender modulates (affixes information) and transmits photons. When measuring operations are performed on photon level signals with modulation applied, its traces invariably remain and copying without altering a single photon state is impossible. This principle is used to eavesdrop and makes secure random digit sharing between a sender and receiver information-theoretically possible. By using the exclusive OR operation with a symmetric key (0 and 1 random bit sequence) the same length as the transmitted information's digital data, the key and digital data is encrypted, and complete secret communication is realized by an encryption method called Vernam's one time pad which decodes using the reverse process of encryption. Because the information carrier in a quantum key distribution system is a single photon, transmission rates were limited by fiber photon attenuation and single photon detection performance, and only NICT's world's top-level quantum key distribution device had transmission distance and speed at hundreds of kbps and 50km, that when compared to modern optical communication speeds was very slow.

This random digit sharing rate is the same as communication speed, so it is clear how difficult complete secret communication is. Questions such as, "Aren't there functions in this slow device besides complete confidentiality of text?" and, "Can't you apply advanced hardware in quantum key distribution devices to other security technologies?" motivated the Quantum ICT Laboratory, Security Fundamentals Laboratory, and Information Systems Office to work together on a study up to now. The next thing we will introduce is a device that supplies a network switch with quality random digits generated by a quantum key distribution device, can use these random digits as keys of symmetric key code like AES (Advanced Encryption Standard) and in authentication.

Network switch that uses keys generated by quantum key distribution system

According to the standard communication protocol TCP/IP OSI reference model used in the current Internet, quantum key distribution is simply a communication device classified into Layer 1's physical layer. In this study, we introduce an example that supplies keys to switches in Layer 2's data link layer and Layer 3, the network layer. Repeaters in Layers 2 and 3's data link layer and network layer are called Layer 2 switch and Layer 3 switch, respectively. In a Layer 2 switch, the MAC (Media Access Control) address of a communication device connected to the switch is relayed as address information. In a Layer 3 switch, an IP address is used and pathway control/routing performed.

In newly developed Layer 2 switches, random digits are supplied by the quantum key distribution system, and after authentication, that random digit is shared between the Layer 2 switch and each terminal. The shared random digit is used and the Media Access Control address encrypted by each terminal with every packet. In Layer 2 switching, a deciphered Media Access Control address and IP address configured in advance are run against one another, the terminal checked to see if it is falsified, or in other words, whether there is any spoofing activity, and after authentication the requested packet is connected. The random digit used in encrypting the Media Access Control address is information only known by the switch and the terminal, so spoofing is impossible. Improper acquisition of data by spoofing in Layer 2 was reported in the news in March of this year, but with the switch we developed, we believe that kind of improper access could have been prevented (Figure 1).

In the Layer 3 switch, a key shared by quantum key distribution is used in encryption methods in protocol IPsec that provides concealment function and tamper-proofing of data in IP packet units. The key, one generated with quantum key distribution for symmetric keys used in cryptographic protocols, is used, and in a short time or per each packet, by changing the key (a key is never used more than once), security can be substantially enhanced, and large amounts of data can be transmitted for key consumption. Because it has much higher speeds than generating symmetric keys in public key cryptography used within normal IPsec, it is expected to become systems faster and securer than ever before, but future theoretical studies on quantitative evaluation of security enhancements must be pursued (Figures 2, 3).

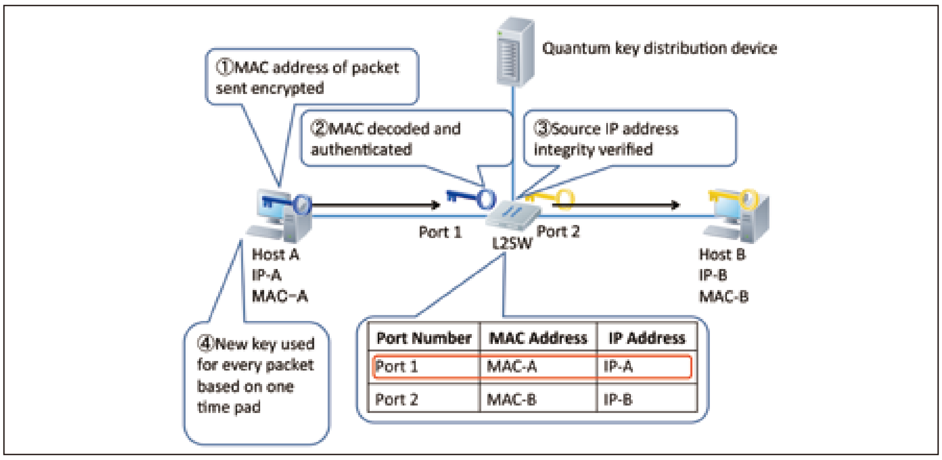


Figure 1●Schema of authentication function based on supplying key to Layer 2 switch

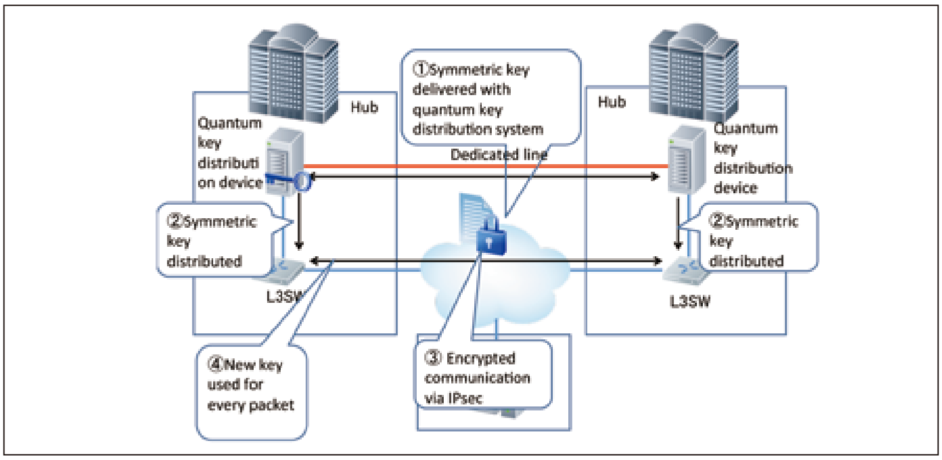


Figure 2●IPsec security enhancement based on supplying key to Layer 3 switch via quantum key distribution device

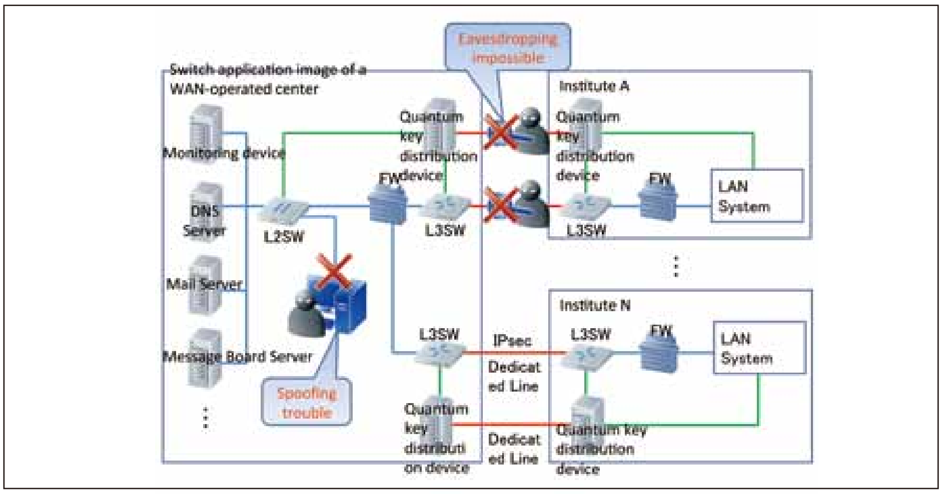


Figure 3●Operation image of network switch with enhanced security

Conclusion

The physics that make quantum key distribution a reality is based on axioms that are foundations of physics and communications, a subject of great appeal to many researchers. However, as of now, the only item that can be provided generally as a communication function is the sharing of random digits covertly between two parties. As we continue fundamental research on random digit sharing technology non-existent up to now, we also focus on how this sharing of random digits can contribute to our daily lives. Information leaks through networks are threats to governments and citizens, and the maximum protective barriers with counter-measures that prevent unauthorized access, even now with impending dangers, are careful checks by system engineers. Although security will naturally not be completely ensured by the switch we developed, we very much hope that it is applied to future network switches and that it can ease even slightly the time and effort of human checks.

Opening International Programme Office of ICSU-World Data System

—Toward advanced use of world-wide scientific data—

Integrated Science Data System Research Laboratory

On Wed. May 9, 2012, an opening ceremony for the World Data System International Programme Office (WDS-IPO) was performed at the Tokyo International Forum. The office was established within NICT under a collaboration between the International Council for Science and NICT in order to implement a program aimed at improving the handling of scientific data. The unveiling of its "nameplate (plaque)" design was performed together by guests including Tatsuo Kawabata, Minister for Internal Affairs and Communications and Mieko Kamimoto, Vice Minister of Education, Culture, Sports, Science and Technology in front of approximately 200 visitors.

●**Participants in the unveiling ceremony**

From left: Prof. Yuan Tseh Lee, President of the International Council for Science (1986 Nobel laureate in chemistry), Dr. Norihisa Doi, Chair, WDS National Promotion Council, Tatsuo Kawabata, Minister for Internal Affairs and Communications, Mieko Kamimoto, Vice Minister of Education, Culture, Sports, Science and Technology, Dr. Takashi Ohnishi, President of Science Council of Japan, Dr. Hideo Miyahara, President of NICT

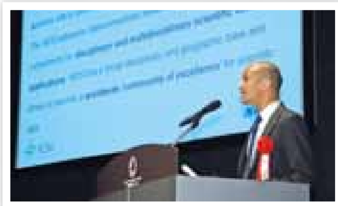
A signing ceremony for a cooperation document in relation to the International Programme Office's establishment was also held.

Furthermore, greetings and a presentation on an outline of ICSU and WDS-IPO were held by Prof. Lee, President of ICSU, Dr. Steven Wilson, Executive Director of ICSU, and the newly appointed WDS-IPO Executive Director, Dr. Mustapha Mokrane. Dr. Yasuhiro Murayama, Director of Integrated Science Data System Research Laboratory gave a presentation on the relationship between NICT and the office.

Afterwards at the ceremony, talks were delivered by Fumihiko Imamura, Vice Director, International Research Institute of Disaster Science (IRIDeS), Tohoku University, on the analyzing technology for tsunami and archive of integrated disaster information, and by Prof. Masaru Kitsuregawa, Institute of Industrial Science, the University of Tokyo, introducing leading-edge information technology. The ceremony ended on a high note with a talk from Takeshi Murata, Director, Space Weather and Environment Informatics Laboratory, NICT, on big data science.

●**Prof. Lee (left) and Dr. Miyahara (right) shaking hands after signing**

●**Dr. Steven Wilson, Executive Director of ICSU**



●**Dr. Mustapha Mokrane, WDS-IPO Executive Director**

●**Dr. Yasuhiro Murayama, Director of Integrated Science Data System Research Laboratory, NICT**

Resilient ICT Research Symposium 2012 Report

Resilient ICT Research Center

On Wed, May 30, 2012, Resilient ICT Research Symposium 2012 (sponsor: NICT, co-sponsor: Resilient ICT Research Association, supporter: The Institute of Electronics, Information, and Communication Engineers (IEICE)) was held titled, “Toward the Realization of Resilient Information Communications Networks,” in Tokyo (BELLSALLE Yaesu). Pursuing the realization of networks that “connect” and “do not break” even during disasters like the Great East Japan Earthquake in 2011, on April 1, 2012, NICT established the Resilient ICT Research Center within Tohoku University, which is now promoting industry-academic-government collaborations while pursuing resilient ICT research. At the symposium, persons involved with resilient ICT research gathered from all over Japan to confirm the direction of future research/development and ties and cooperation between one another’s research.

The symposium opened with a greeting from host, Dr. Hideo Miyahara, President of NICT, followed by greetings from guests Shigeyuki Kubota, Director-General for Policy Coordination, Minister's Secretariat, Prof. Susumu Yoshida, President of IEICE (Department of Communications and Computer Engineering, Graduate School of Informatics, Kyoto University), and Prof. Nobuyoshi Hara, Executive Vice President, Tohoku University (head of earthquake disaster reconstruction implementation). In the keynote lectures that followed, Dr. Yoshiaki Nemoto, Director General of Resilient ICT Research Center(NICT), discussed NICT’s efforts and Dr. Atsushi Murase, Managing Director of Research Laboratories, NTT docomo, Dr. Fumio Watanabe, Executive Director of KDDI, Director of R&D Strategy Division, and Shuichi Fujisawa, Head of NHK Science & Technology Research Laboratories, each discussed their future research and development efforts in light of their earthquake disaster experiences.

In the last half of the program, with Dr. Yoshiaki Nemoto, Director General of Resilient ICT Research Center(NICT) as the moderator, a panel discussion was held with Prof. Masataka Nakazawa, Director, Research Institute of Electrical Communication, Tohoku University, Dr. Naoto Kadowaki, Director General, Wireless Network Research Institute(NICT), and Prof. Susumu Yoshida, President of IEICE (Department of Communications and Computer Engineering, Graduate School of Informatics, Kyoto University). In this panel discussion, along with lectures from Prof. Nakazawa on the goal of Tohoku University’s telecommunications research institute and the role of its resilience research and also from Dr. Kadowaki on promoting industry-academic-government collaborations through test beds, lively discussions developed on the future interconnection and research/development collaboration between telecommunications carriers, communications and broadcasting collaboration, as well as international contributions to resilient ICT technology. The panel discussions came to a close after confirming that the next symposium would have more concrete and deeper discussions. The number of participants was well over 270 and included persons involved in industry-academic-government research projects, as well as individuals from corporations, universities, and research facilities. The program ended on a high note with a panel exhibition on development efforts from NICT and the ten resilient ICT research projects.

Lastly, we would like to sincerely thank all those who were involved in the convening of this symposium for their cooperation.

●Keynote lecture

●Panel exhibition

●Panel discussion (from left: panelists Dr. Nemoto (moderator), Prof. Yoshida, Prof. Nakazawa, Dr. Kadowaki, Dr. Murase, Dr. Watanabe, and Mr. Fujisawa)

Interop Tokyo 2012 Exhibition Report

NICT ran a booth at Interop Tokyo 2012 (June 13(Wed)–15(Fri) Makuhari Messe) again this year.

This year, the contents of exhibition that had been released to the press one week before the event became a big topic of conversation via social media such as Twitter, as many visitors came with its exhibit in mind.

This year, the OpenFlow Controller “RISE Controller”, developed by Network Testbed Research and Development Promotion Center and performed a demonstration in ShowNet (the network base of Interop Tokyo), won the grand prize of ShowNet product category in Best of ShowAward 2012.

NICT also was selected for the runner-up grand prize of the Best of Interop for being the most talked about booth over social media during the event. It appears that its Twitter posts were effective.

Figure 1●Low-power consumption energy-oriented delivery system technology

We demonstrated a video delivery system that aims for high quality and low-power consumption energy when delivering video content expected to account for much traffic in new generation networks.

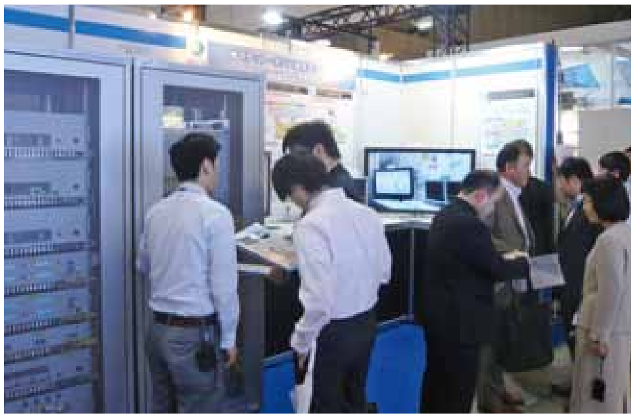


Figure 2●Optical packet and circuit integrated network

An exhibition demonstration was held that showed the superiority of incorporating “optical packet and circuit integrated node equipment” and introducing Ultrafast, High-Capacity Networks to multi-home network configurations that establish multiple routes between server-client devices.

Figure 3●Highly available network construction technology

We demonstrated such as the ID/locator split-based technology which can automatically continue transmissions, even during system failure via other NW (networks), in multi-home NW built on JGN-X by using a technology that auto-configures multiple location identifiers (locators) in NW devices according to layered structures.

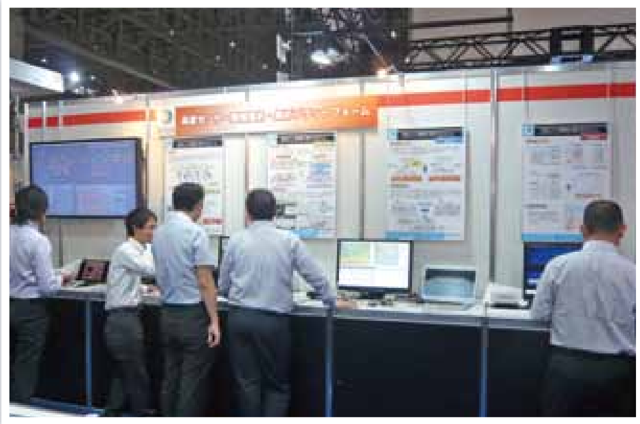


Figure 4●Advanced sensor information aggregation/analysis platform technology

A demonstration on platform technology was held that aims to collect and analyze information on the Internet and sensor data from a vast number of sensors configured in a broad area, and also grasp, in real-time, events occurring in the real-world.

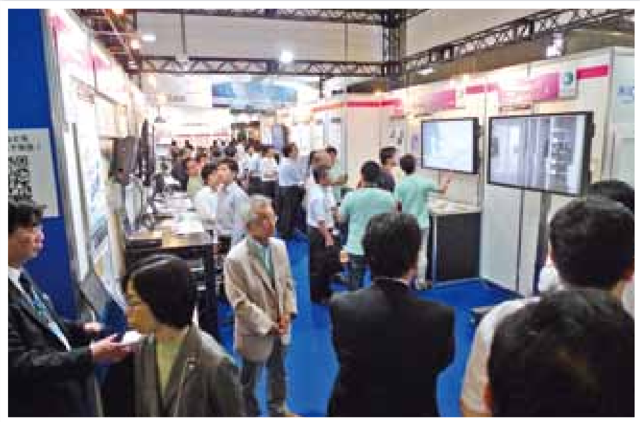


Figure 5●Networks headed from JGN-X/StarBED^3 to a new generation

We performed the field demonstration of multilayered virtualization technology using JGN-X and introduced the OpenFlow testbeds RISE as well as a restoration emulation of a communications infrastructure in time of a disaster based on StarBED^3.

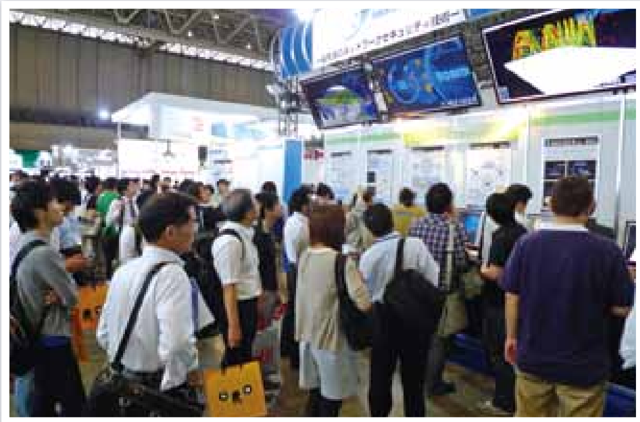


Figure 6●Incident analysis center nicter

An exhibition demonstration was held on nicter that analyzes cyber attacks occurring on a network in real-time with high-precision and also new features of its spinout technologies: NIRVANA and DAEDALUS. Many visitors came early to see DAEDALUS, which has been a big conversation topic before the exhibit opened.

Figure 7●Risk Visualizer system

We hold an exhibition to demonstrate a technology that enables internet users to understand risks and confirm safety by visualizing security technology used in network routes from a terminal at hand through servers such as cloud as well as potential vulnerabilities.

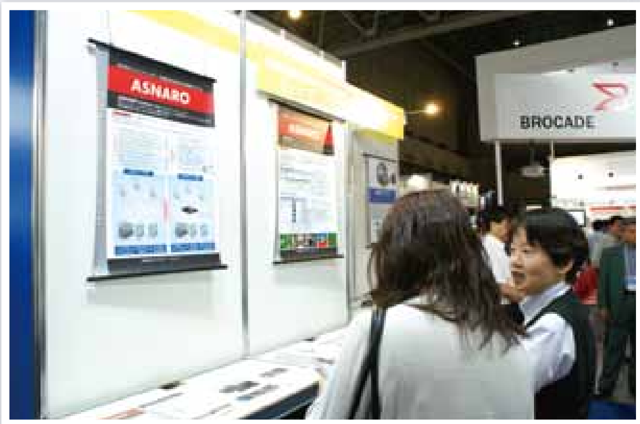


Figure 8●CAE simulation cloud platform

We carried out the demonstration for the platform technology enable to swiftly and easily launch a cloud system that tremendously improves R & D operations such as simulations / CAE (Computer Aided Engineering) dependent on individual skills and being with difficulty both data management and know-how inheritance. (One of the research achievements based on "Promotion program for private sector's fundamental technologies research")

Leap second inserted July 1, 2012

NICT, which performs Japan Standard Time maintenance and notifications, inserted 8:59:60AM between 8:59:59AM and 9:00:00AM as a leap second on July 1, 2012. To witness this rare moment, 1,500 people gathered in front of the main building clock at NICT Headquarters (Koganei).

Led by Dr. Toshio Iguchi, Director General of Applied Electromagnetic Research Institute, NICT held a total of four briefing sessions on the leap second for visitors, two sessions before 9:00AM and another two after. The exhibition hall, normally closed Saturday and Sunday, was also specially opened until noon.

Video of the event can be viewed on our YouTube NICT channel.

http://www.youtube.com.user/nictchannel

●Many visitors waiting for the moment a leap second is inserted

●Clock display on the main building's wall showing the leap second moment

●Visitors listening to an explanation by Director General Dr. Iguchi

●The specially opened exhibition hall

Information for Readers

Our next issue will feature topics including a general principle in collective behavior by self-propelled particles, a clue to unlocking the chromosome "arranged meeting" mystery, and a security risk visualization system.

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4-2-1 Nukui-Kitamachi, Koganei, Tokyo 184-8795, Japan
Tel: +81-42-327-5392 Fax: +81-42-327-7587
E-mail: publicity@nict.go.jp
<NICT URL> http://www.nict.go.jp/

Editorial Cooperation: FULFILL co., ltd.