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情報通信研究機構
NEWS
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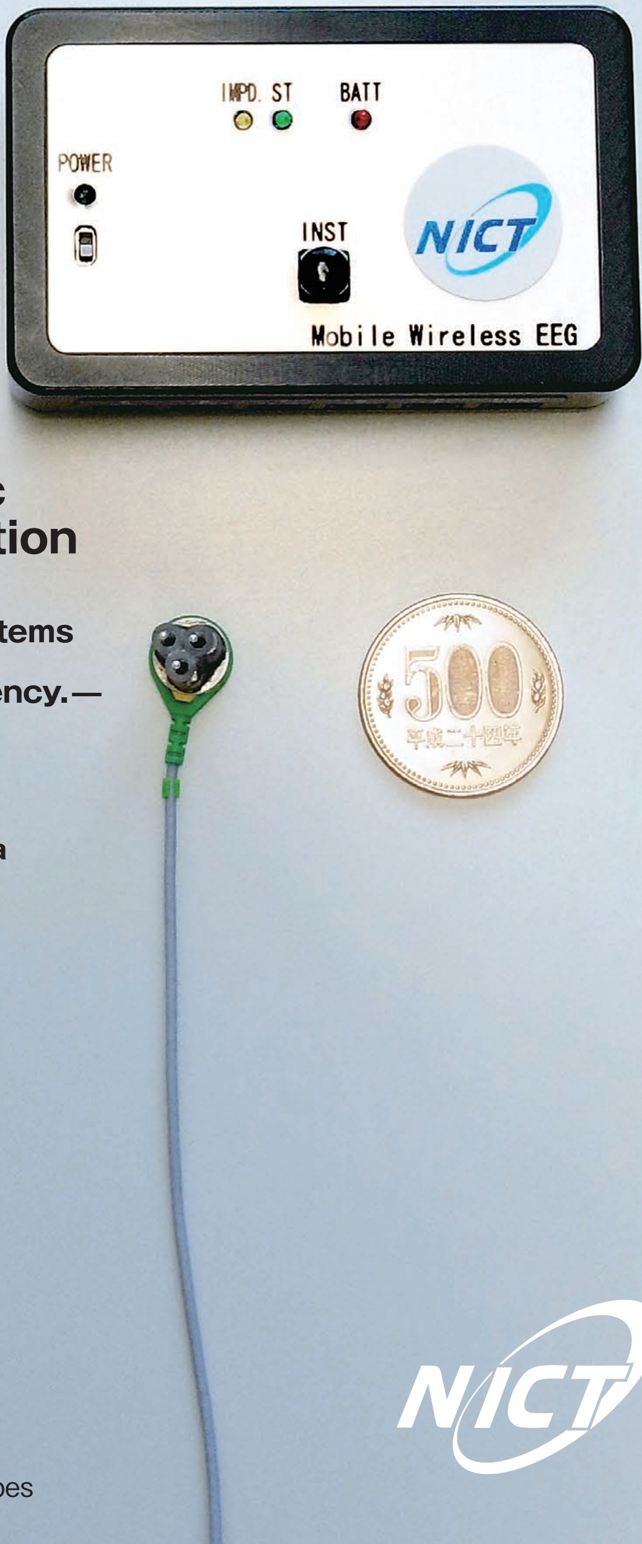


Cover image:
Compact EEG instrument and flexible electrode chip prototypes

A Wearable EEG Enabling Anyone to Take EEG Measurements Easily

—Returning research results to society through technology transfer—

Yasushi NARUSE

Associate Director of Brain Imaging Technology Laboratory, Center for Information and Neural Networks

After completing the doctoral course at a graduate school in 2007, entered NICT to work on the research and development of Brain ICT. Ph.D. (Science).

Introduction

Research on Brain-Machine Interface (BMI) technology, to support patients that have lost mobility or to support communication for patients that can no longer produce speech due to reasons such as brain damage, is currently quite active. In the future the results of this research must be utilized to improve the Quality of Life (QOL) for people with various types of disability, but there are still major difficulties that need to be overcome before BMI technology can be used by large numbers of people. Many BMI technologies use brain waves, but current equipment for measuring brain waves (the electroencephalograph, or EEG) can only be used by specialists such as researchers and technicians. Currently, a conductive paste must be used to take EEG measurements. This is the same type of paste used when making an electro-cardiogram as part of a health check-up, but special techniques are needed when making EEG measurements and attaching electrodes to the head using the paste. Thus, EEG measurements cannot be taken if someone capable of these techniques is not available. The paste is also sticky, like a hair styling product, so patients need to wash their hair after taking EEG measurements. For these reasons, we have developed an EEG that is able to measure anyone's brain waves without using conductive paste, by simply wearing the device on his or her head (Figure 1).

Technology for taking EEG measurements easily

To develop an EEG that does not require conductive paste, we had to consider why conductive paste is necessary in the first place. Brain waves are the electrical activity of nerve cells in the brain, detected through the skull and scalp. To do this, brain waves are measured by measuring potentials using electrodes attached to the scalp. The electrical potentials created by brain waves are extremely weak, so they can be measured more accurately if the electrodes adhere more strongly to the scalp, and conductive paste is generally used to improve this adherence (in technical terms, this is done to decrease the contact impedance between the electrode and scalp). Our goal was to implement this function of the conductive paste using only metal electrodes. EEG electrodes are generally disks of about 1 cm in diameter, and these cannot make contact with the scalp by simply placing them over hair on the

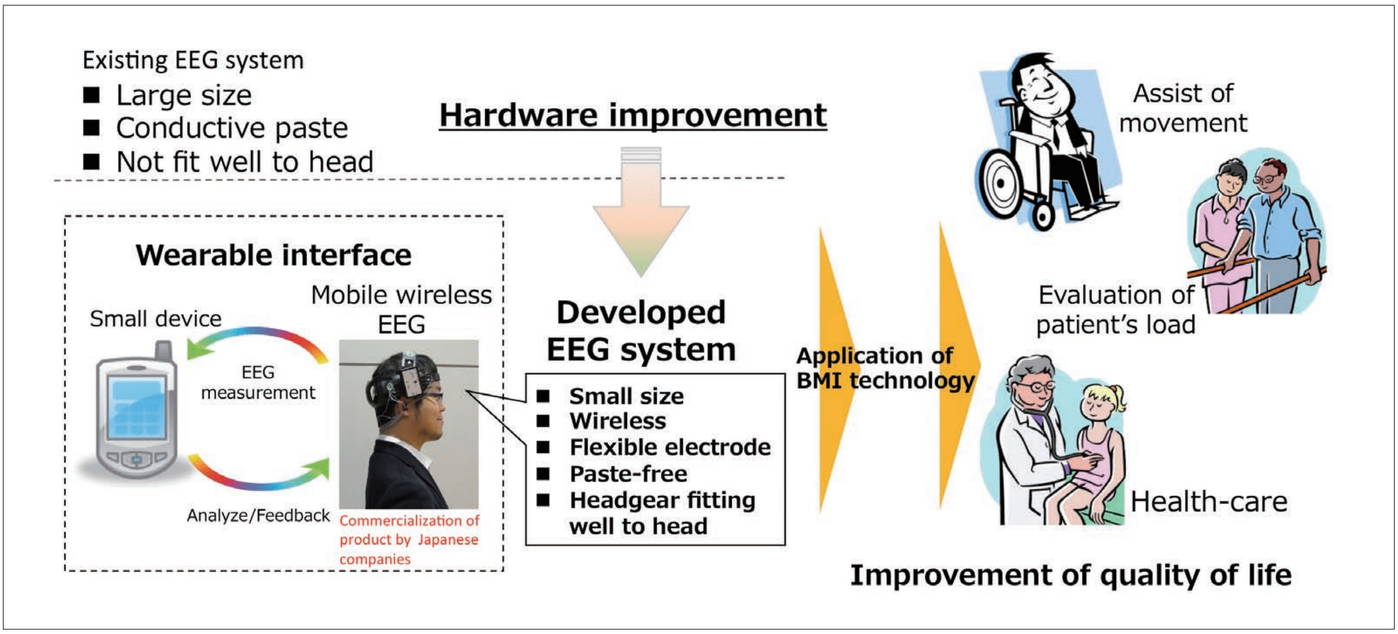


Figure 1 Research overview. Photograph shows the author wearing the wearable EEG

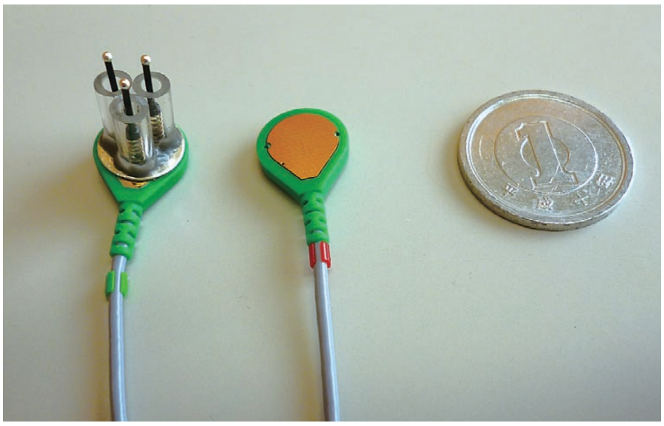


Figure 2 **EEG electrode equipped with the flexible electrode chip (left) and an ordinary EEG measurement electrode (right)**

head. The conductive paste permeates the hair, allowing it to create an electrical connection between the electrode and the scalp. If paste is not used, some other method must be used to connect the electrodes to the scalp. As such, we developed a flexible electrode chip (Figure 2), which can penetrate between the hairs to contact the scalp. Patents on these electrode chips are now pending. However, these electrodes alone do not achieve the adherence of electrode to scalp that we get using conductive paste, so we also use a high performance EEG electrode that is able to measure brain waves even when the adherence is not particularly good. This has allowed us to measure brain waves even without using conductive paste.

Developing a wearable electroencephalograph (EEG)

We were able to take EEG measurements without using paste, but in order for anyone to be able to take such measurements easily, it was necessary to develop the wearable EEG that enables the measurements to be taken by simply placing the instrument on the user's head. There were two hurdles to overcome in this development. The EEG had to be made smaller, and headgear that would fit anyone's head had to be developed. Conventional equipment for taking EEG measurements makes the basic assumption that measurements will be taken in a calm environment such as a hospital, so the equipment is large and difficult to use in everyday environments. For this reason, we created a compact encephalograph (Figure 3). As a result, we also reduced the weight to approximately half that of a smartphone.

For the second issue, we developed the headgear, like a hat with EEG electrodes in it, to enable anyone to take EEG measurements easily. The shape of each person's head is different, so ordinary hats do not fit everyone's heads. Through a trial-and-error process, we were able to develop a headgear that will fit anyone's head. We have also applied for patents for this headgear. This enabled us to develop a wearable EEG that allows anyone to take EEG measurements without using conductive paste, by just placing the device on his or her head (photo in Figure 1).

Figure 3 **Compact EEG instrument (left), and the instrument for the product based on it (right). To make EEG measurements, electrodes are attached to this instrument and then to the subject's head**

Outcomes in society through technology transfer

The market for brain-machine interfaces (BMI) is expected to expand greatly in the future. We believe that the wearable EEG is essential for this market. One of the motives for developing a wearable EEG was also to help Japan take a leading role in the brain ICT industry. As a result of proactive efforts to transfer technology related to the wearable EEG, the technology for the compact EEG has been transferred to DIGITEX LAB. CO. LTD., and the compact EEG produced by the lab is being sold by the TEAC Corporation. Also, the flexible EEG electrode technology was transferred to Unique Medical Co., Ltd., which is producing and selling it. Further, the headgear that can fit anyone will be transferred to SAWAMURA PROSTHETICS AND ORTHOTICS SERVICE CO. LTD., which co-developed it and is a co-applicant for the relevant patents.

Future prospects

The wearable EEG technology that we have developed has been transferred to industry and started to be returned to society in the form of products. We hope that this EEG will spread throughout the world as a foundation of the brain ICT industry, and will be used by many people. We aim to establish technologies that will increase the QOL of those with disabilities, and to advance research on technologies that improve QOL for the general population (Figure 4). We are also working to make the brain ICT industry an important growth industry for Japan.

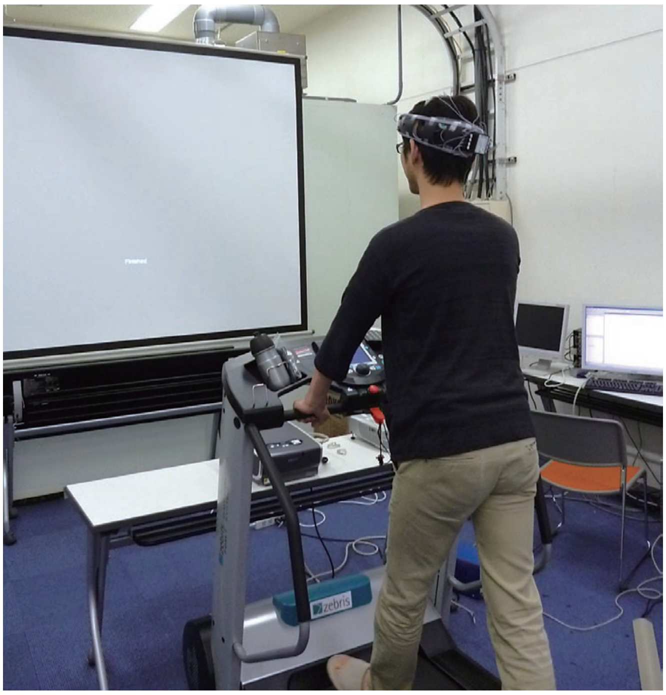


Figure 4 **Experiments taking EEG measurements while walking to show the device can be used during normal, daily activities**

Development and Applications of a UWB Indoor Positioning System

—Demonstration test in shopping mall and distribution warehouse—

Huan-Bang LI

Senior Researcher, Dependable Wireless Laboratory, Wireless Network Research Institute

Joined Communications Research Laboratory, the Ministry of Posts and Telecommunications (currently NICT) after completing his doctorate in 1994. Engaged in R&D on technologies including mobile satellite communications, UWB, body-area networks (BAN), and peer-aware communication (PAC). He is a Visiting Professor at the Graduate School of Information Systems, The University of Electro-Communications. He holds positions as Vice Chair of IEEE802.15 TG6 and Vice Chair of IEEE802.15 TG8. Ph.D. (Engineering).

Ryu MIURA

Director of the Dependable Wireless Laboratory, Wireless Network Research Institute

Joined Radio Research Laboratory, the Ministry of Posts and Telecommunications (currently NICT) in 1984 after completing a master's degree. Worked on research in satellite communications, a stratospheric platform communication relay network, and intelligent transport systems (ITS) before moving on to his current research, which includes disaster relay systems using a small unmanned aircraft system, a high-precision indoor positioning system using UWB, and infrastructure-less terminal-to-terminal communication networks. Ph.D. (Engineering).

Toshinori KAGAWA

Researcher, Dependable Wireless Laboratory, Wireless Network Research Institute

Joined NICT in 2013, after completing his doctorate. Currently engaged in R&D on a high-precision indoor positioning system using IRUWB, a vital-signs sensing system using sheet-medium communication, a wireless relay transmission system using unmanned aircraft, and a sub-Gigahertz-band indoor robot control and communications system. Ph.D. (Engineering).

Introducution

As social media has advanced and mobile terminals have spread, use of location information is expanding and it is expected to play an important role in realizing next-generation M2M and D2D networks and a robotic society. Due to ultra-wide-band (UWB) characteristics, indoor positioning systems using UWB technology will provide positioning accuracy within tens of cm, which is an order of magnitude higher than that of systems based on conventional technologies such as Wi-Fi (which provide accuracy of several m). They also promise to yield reductions in cost and power consumption. In 2013, the Ministry of Internal Affairs and Communications relaxed regulations on UWB positioning, and NICT made proactive contributions to the relevant deliberations. However, UWB ranging only works over small distances, which presents problems for implementing a practical ranging system in terms of system cost. For example, it may require many anchor devices.

At NICT, we have expanded the ranging distance of a UWB indoor positioning system to 30 m, making it possible to build a practical system. We have installed this UWB indoor positioning system in a shopping mall and a distribution warehouse, and performed various demonstration tests.

UWB indoor positioning system

The UWB indoor positioning system developed uses the UWB high-band frequencies of 7.25 to 10.25 GHz, and uses very short time pulses on the order of 1 ns (10^{-9} s) . This yields high time resolution and enables highly-accurate distance measurements. The circuits used for sending and receiving pulses can also be simplified, reducing system cost and power consumption. Positioning is computed by measuring the distances from a portable device to three anchor devices whose positions have been registered beforehand.

Normally, the anchor devices contain a single communications module and antenna set, but by increasing this to four sets, and by using a common base-band component and shifting each of their transmit times a small amount to transmit consecutively as shown in Figure 1, we were able to expand the range. The peak power density for each module is kept below the regulated value, and by adjusting the transmission intervals between each module, the combined transmit power can be increased. Figure 2 shows the waveforms from each of the four modules as well as the combined waveform. A large combined waveform is obtained without increasing the amplitudes of each of the individual waveforms. We also developed technology to detect the combined waveform efficiently when it is received by the UWB portable device, and in actual measurements, distances of 30 m or more were achieved using four modules. This is three-times greater than when using a single module. Note that these anchor devices have been examined and approved by certification agencies. This UWB positioning system can also be adjusted to conform to technical standards in other countries by just adjusting the frequency band used.

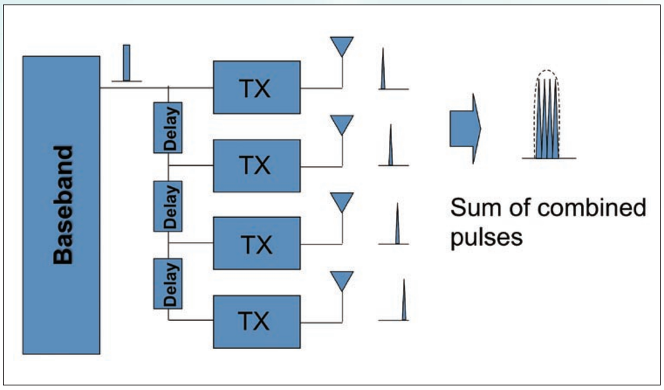


Figure 1 Transmitter block diagram for the anchor device

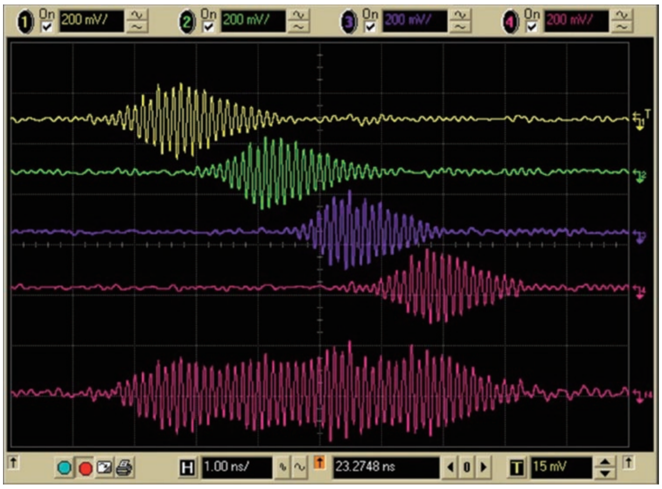


Figure 2 Example of measured combined waveform

We used techniques to increase the positioning accuracy further, such as filtering received signals that exceed the expected time to reduce or eliminating the effects of reflected radio waves and other phenomena. Multi-lateral positioning, with four or more anchor devices can also be used to improve accuracy.

Shopping mall demonstration test

In commercial facilities such as shopping malls, locating customer positions in real-time could be used to provide guidance to a desired product or store, to provide advertising linked to customer position, to improve customer services such as order processing or location-certified payments, or to promote sales. It also has potential for use in navigation systems, helping pedestrians with visual disabilities by computing routes to their destinations, taking into consideration the main obstacles that they face, such as stairs, level changes and the width of walkways, reading out distances and directions, and accepting voice commands.

We conducted the shopping mall examination and demonstration with the cooperation of the Northport Mall in Yokohama City. We installed 58 anchor devices on the main floor (Figure 3). The positioning area of approximately 98 m × 25 m in the center of the mall encompassed the common space and passage ways between stores, and is shown enclosed in the dotted red line in the figure. The current location of a dedicated smartphone or tablet equipped with the UWB portable device is displayed on the screen in real time. This location is also sent to the positioning server, and was used for the demonstration test.

Figure 4 shows an example tracing the movements of a customer carrying a smartphone or tablet equipped with the UWB portable device. The customer's movements can be obtained in real time.

Distribution warehouse demonstration test

Workplaces such as distribution warehouses require efficiency and management of work safety. Knowledge of movements within a warehouse can contribute to handling or eliminating such issues.

This demonstration was conducted with the cooperation of the Funabashi distribution center of Seino Information Service Co., Ltd. As shown in Figure 5, the warehouse is divided into long product racks with many narrow passageways, so 98 anchor devices were installed in a 45 m × 33 m area. A tag-shaped UWB portable device as shown in Figure 5 was used in the warehouse, which workers placed in a pocket of their uniforms, or attached to a forklift. In this way, the movements of workers and forklifts were visualized.

Figure 6 shows an example of the movements obtained from a worker in the warehouse. With data obtained in this way, it should be possible to improve work safety and efficiency by rearranging product placement and re-examining staff deployment.

Future prospects

UWB indoor positioning provides the best positioning accuracy when compared with other indoor positioning systems such as Wi-Fi, and movement tracking can be implemented using a small number of anchor devices.

We intend to continue our research, through testing in the shopping mall and distribution warehouse, working toward further improvements in the UWB positioning system and a practical implementation.

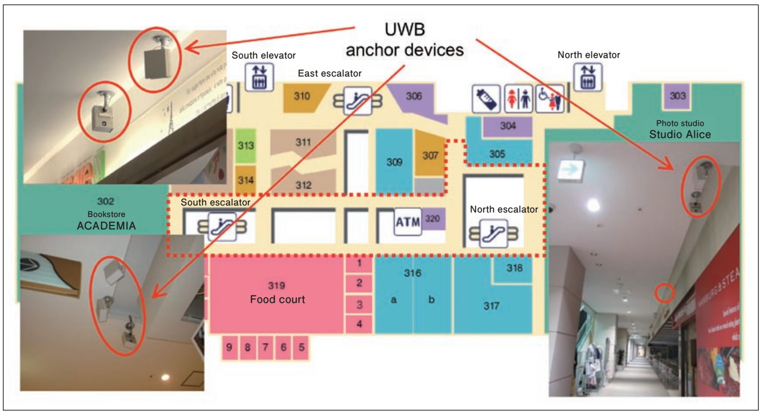


Figure 3 Floor layout and examples of anchor device installation

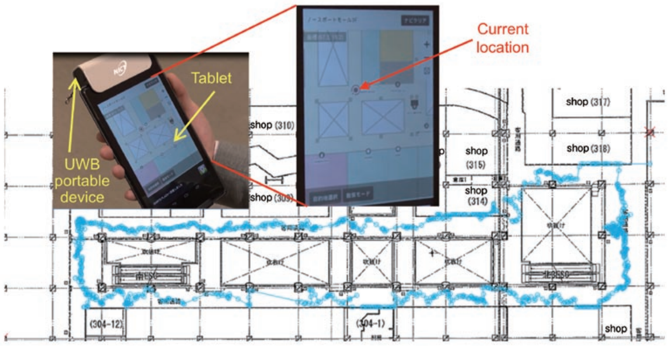


Figure 4 Trace example in shopping mall

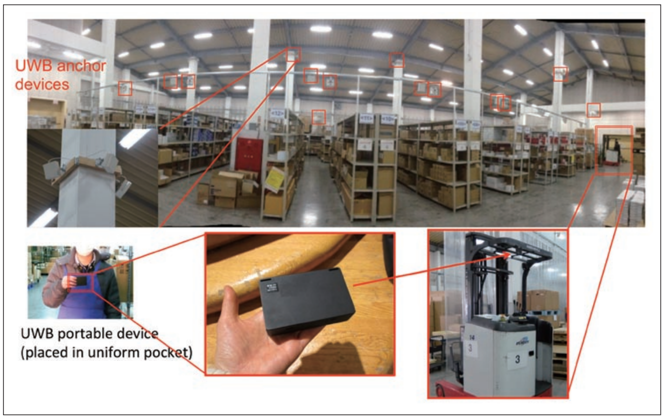


Figure 5 Example of anchor device layout and portable device in distribution warehouse

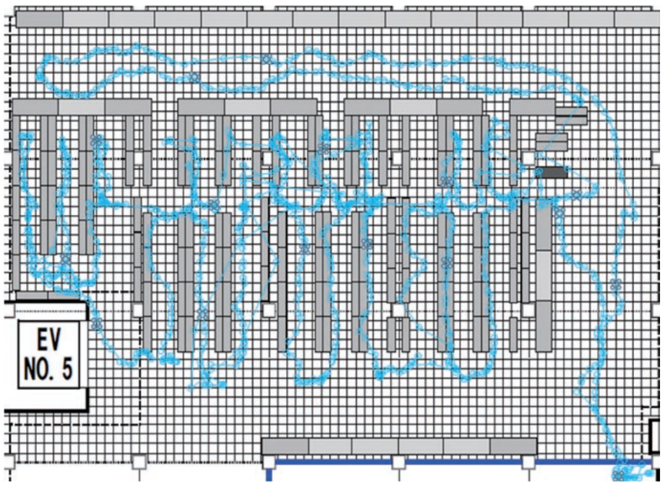


Figure 6 Trace example in distribution warehouse

Finally, we would like to take this opportunity to express our gratitude to all who cooperated with us in conducting these demonstration experiments.

Implementation of Automatic Network Address Configuration Technique in Layer3 Switch

—Reduced the number of configuration items of network addresses down to 1/100. Achieved drastic change in work efficiency. —

Kenji FUJIKAWA

Senior Researcher, Network Architecture Laboratory, Photonic Network Research Institute

After completing a graduate course, he served as a Kyoto University Graduate School assistant professor from 1997 and as a senior researcher at ROOT Inc. from 2006 and joined NICT in 2008. He is engaged in new-generation network architecture research.

Introduction

For the size of an enterprise network over 1,000 PCs, several tens of L3 switches are usually installed in the network systems in each building or on each floor. The network administrators design the infrastructure to connect relevant L3 switches and configure the necessary individual settings in each of them or in the server. Among them, network addresses are so essential information that the administrators need to make proper configuration of the multiple values such as IPv4 addresses and IPv6 addresses at the input/output ports of each L3 switch and each server. Therefore, when it comes to newly constructing networks, it always requires an additional labor of configuration. What is worse, any modification, whether it is small or subtle, adversely affects the whole system and an enormous amount of workloads follows. To be short, this architectural issue has been a bottleneck to hinder flexibility of today's network structure. Consequently the idea of automatic configuration of network addresses has long been awaited over the past years.

R&D of HANA Technology

In order to make this idea a reality, NICT has committed to develop a new technology called HANA (Hierarchical Automatic Number Allocation). While it is quite common knowledge of today that DHCP is widely used for automatic IP address allocation to the terminal equipment, such as PCs and smartphones, HANA is available to allocate network equipments in the upper layer's level. The multiple values of IPv4 addresses and IPv6 addresses are there to be automatically configured. Moreover HANA enhances flexibility of network administration to make it easy to alter network configurations. One of the distinguished characteristics of HANA is that it can configure multiple numbers of network addresses to be implemented in one single device at a time. These multiple numbers of addresses play a significant role, especially, in an emergency. Since they are interoperable one after another, it makes the system fault-resilient enough to secure an alternative path without fail (Figure 1).

A brief description of HANA technological expertise is as follows.

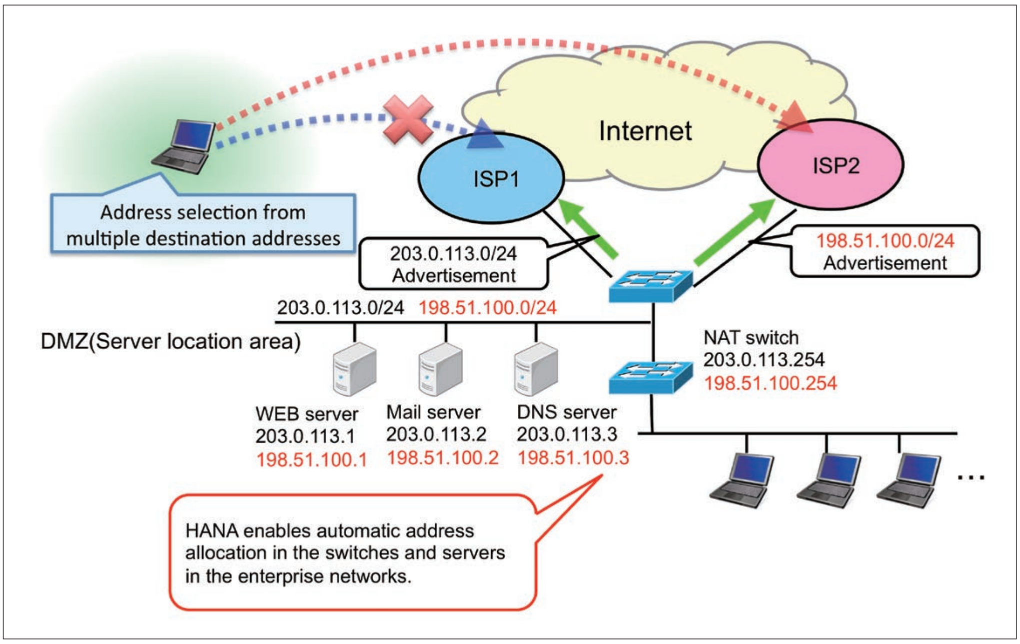


Figure 1 Outline of automatic address allocation in the enterprise networks, using the HANA protocol

Once a system failure is detected in ISP1 network, the HANA protocol automatically switches it to ISP2 in the way of the detour function.

Limitations of L3 switches in network construction

L2 switch settings are virtually unnecessary when constructing a network because the MAC address tables displace them. However it limits the number of node devices up to several hundreds to be accommodated in the bottom layers. Also fault-tolerance mechanism does not work properly in case of trouble. On the other hand, L3 switches have the capacity of IP protocol processing, embedded with L2 switch's capacity. Therefore it is possible to build even a larger network with several L2 networks together in a bundle.

In this case, the network administrators make sure to use network addresses in L3 switches in each port and try to build more connections between them in order to achieve high-speed processing and fault-tolerance capability. However, they face the difficulty in configuring all the network addresses and thus find it very much time-consuming, hampered by requirements of address allocation (Figure 2). Moreover, when a necessary change of network connections or device replacement occurs, it affects the whole system. This has become the bottleneck that hinders a flexible network.

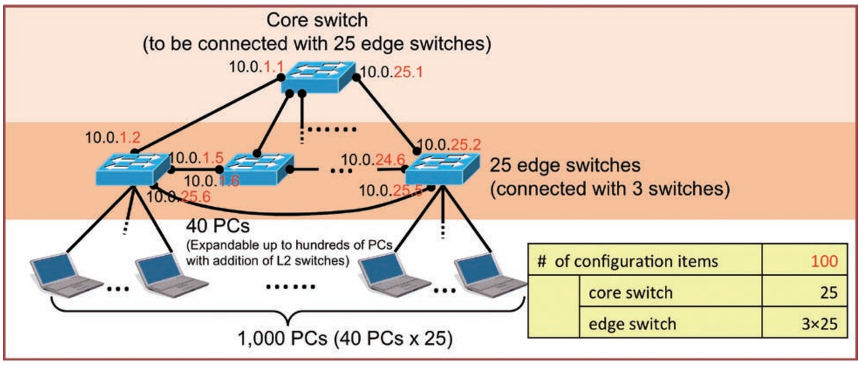


Figure 2 Allocation model in the enterprise networks by the current L3 switches

Restrictions on network addresses numbering:
1) When constructing a network, all the addresses are numbered within a certain range. (e.g., 10.0.0.1 ~10.0.255.255)
2) All the addresses are different from one another.
3) The addresses of the ports of L3 switches connected by the cable have sequence numbers. (e.g., connect 10.0.1.1 and 10.0.1.2)

Implementation of HANA: Technical expertise

One single core L3 switch implemented with HANA protocol enables itself to manage the whole network addresses at a time. This automatic allocation technique works the same in the other ports or even in the edge switch ports (Figure 3). Thus, it reduces the number of configuration items related to addresses down to 1/100.

With collaboration with the companies, NICT successfully embedded HANA in L3 switches in the most commonly-used hardware (Figure 4). HANA works with L3 switches of which capacity is 48 ports × 10Gbps (each) when embedded in the hardware, while it limits their capacity to 8 ports × 2Gbps (each) in the software installed in the conventional standard-type of PC. Configuring network addresses on one single core L3 switch with HANA implementation will make the other L3 switches and PCs available for automatic address setting. That realizes drastic reduction of network administrators' workloads and construction of highly efficient productivity of network without human errors in manual configuration.

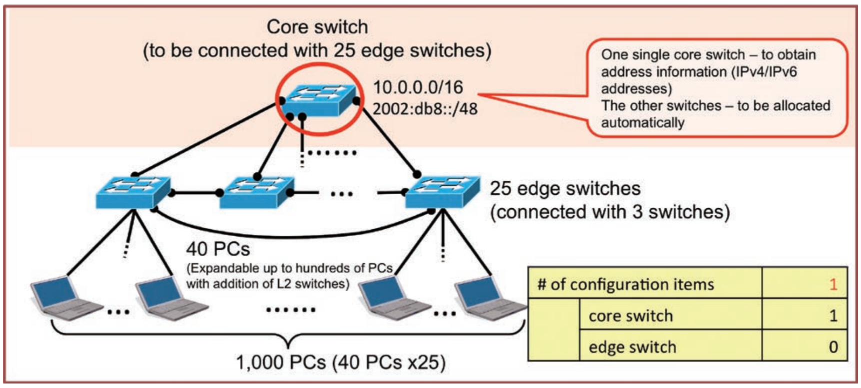


Figure 3 Allocation model in the enterprise networks by HANA-capable L3 switch

Figure 4 HANA-capable L3 switch

Future prospects

The goal is to yield practical applications in the enterprise networks and the data centers based on collaboration with enterprise partnerships, to take full advantage of HANA-capable L3 switches. This automatic configuration technique is also available for collaborating with the network administrative technique, SDN (Software Defined Network) (Figure 5).

SDN's communications protocol is defined by software and an SDN controller manages the whole system to keep it as flexible as possible. It is capable of centralizing the management of dataflow and configuration of the protocols. But network construction is only available if SDN has obtained L3 switch addresses in advance. Therefore, it is very much anticipated that HANA makes it easier to configure addresses and to facilitate flexible network construction.

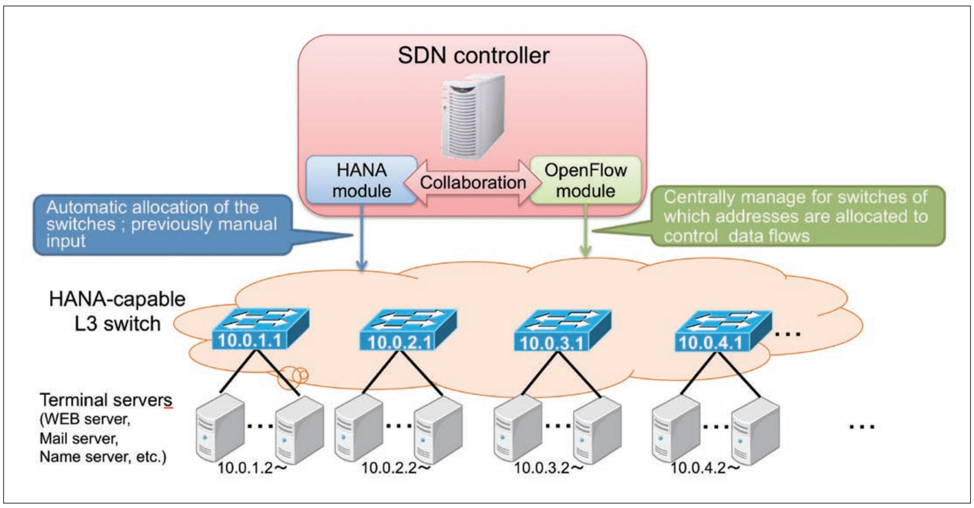
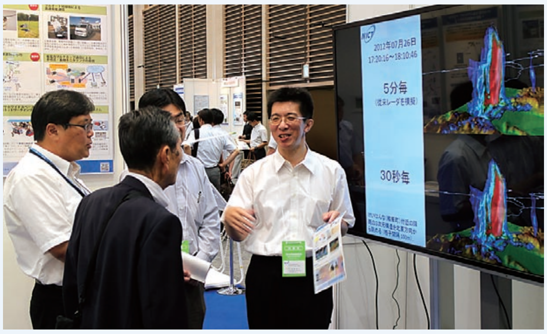


Figure 5 Collaboration between HANA server and SDN

Exhibits at the First Earthquake Technology Expo Osaka and Report on the Disaster Prevention Technologies Lectures 2014

NICT and the ICT Forum for Security and Safety were exhibitors at the First Earthquake Technology Expo Osaka, held at the Knowledge Capital Congrès Convention Center in Grand Front Osaka on June 17 and 18, 2014. The Disaster Prevention Technologies Lectures 2014 was also held in the same conference rooms on June 18.

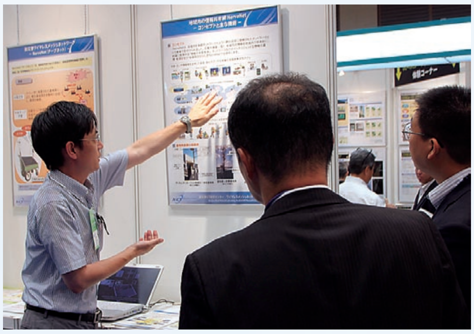
At the Expo, NICT exhibited various technologies using panel displays and with actual equipment, including: "Surveillance of disasters such as tornados and Guerrilla rainstorms (unexpected strong rain) using phased array weather radar," "Technology for connecting isolated regions to networks using a system with small, unmanned aircraft," "Transmission of marine buoy data by satellite using the Engineering Test Satellite-VIII for early detection of Tsunamis," and "Mesh-type Disaster-prevention Network System that Maintains Connection During Disaster." 8,923 people attended the Expo, and many people visited the NICT booth and gained a deeper understanding of NICT's disaster prevention technologies.



Phased array weather radar

Marine buoy data transmission via Satellite

Radio relay link system via small unmanned aircraft



Mesh network system

In the lectures 2014, two lectures were given introducing R&D and deployment of wireless communications systems and commercial communications systems for natural disasters and other emergencies. They were titled "Disaster-prevention wireless systems: Current state and future developments toward expansion," and "Software radio technology trends and applications in commercial wireless communication." After that, Mamoru ISHII, Director of the Space Weather and Environment Informatics Laboratory, Applied Electromagnetic Research Institute, gave a lecture with the title, "Threats, safety and security due to space weather phenomena." These lectures were attended by many people, including disaster-prevention staffs from local and national governments, universities, manufacturers of disaster-prevention products, and the general public.

ICT Forum for Security and Safety URL: http://ictfss.nict.go.jp/index.html (Japanese only)

Presentation Venue

Presentation by Director ISHII

Report on Participating and Exhibiting at the ITU-T SG 16 Meeting in Sapporo

NICT participated in the ITU-T Study Group 16 meeting (ITU-T SG16), held at the Sapporo Convention Center from June 30 to July 11, 2014. ITU-T SG16 is a study group of the ITU Telecommunication Standardization Sector (ITU-T), working on standardization related to multimedia. The current Chairman of SG16 is Mr. Yushi NAITO, from Mitsubishi Electric Corporation, and this was the first time that the meeting was held in Japan. 197 members from 14 countries including Japan (and not including members that participated remotely) attended and they had many active discussions.

View of meeting

At the same time as the ITU-T SG16 meeting, the Japan meeting support committee* also held a workshop on July 1, and a showcasing of the latest multimedia technologies under the theme, "Cutting edge of Multimedia Technologies," from July 1 to 4.

At the workshop, attendees gained a deeper understanding of NICT through the keynote speech given by Dr. Fumihiko TOMITA, Vice President of NICT, and a technical presentation on multi-lingual speech translation, given by Dr. Chiori HORI, the Director of the Spoken Language Communication Laboratory.

Vice President TOMITA giving the keynote speech

Director of the Spoken Language Communication Laboratory, Dr. HORI, giving a technical presentation

At the Showcasing, we exhibited various technologies related to ITU-T and other international standards, including the "VoiceTra4U" multi-lingual speech-to-speech translator application, the "Koe-tora" application for supporting communication between those with hearing disabilities and listeners, and a Simple 3D Format (Global View and Depth).

We also collaborated technically with Oki Electric Industry Co., Ltd. and Mitsubishi Electric Co., Ltd. for a demonstration of IPTV using NICT's JGN-X network. On the first day, July 1, we received greetings from the State Secretary for Internal Affairs and Communications, Ms. Yoko KAMIKAWA, and the Director-General of the Minister's Secretariat, Ministry of Internal Affairs and Communications, Mr. Toshiyuki TAKEI. Members of the public that attended were able to try the VoiceTra4U application, asked questions such as how to download it and how many languages it supports, and provided many other valuable comments. We also had visitors that had seen the TV broadcast news, so that approximately 300 people attended over four days. Many had an opportunity to try our latest multimedia technologies.

Students visiting the NICT booth

IPTV demonstration using JGN-X

* Japan meeting support committee members (in no particular order):
Ministry of Internal Affairs and Communications (MIC), NICT, Mitsubishi Electric, Nippon Telegraph and Telephone Corp. (NTT), Fujitsu Ltd., Hitachi, Ltd., NHK, Oki Electric Industry Ltd., NEC, KDDI, Sony, Toshiba, Softbank Mobile, Softfront, TTC, and the ITU Association of Japan.

Awards

Recipient ● **Shin'ichiro MATSUO**/ Managing Director, Outcome Promotion Department

◎Award date: March 24, 2014
◎Name of Award: International Standards Development Award
◎Details:
ISO/IEC 20009-2 Anonymous Entity Authentication
For the remarkable contributions to work completing standardization of anonymous authentication protocols, as editor of: "Anonymous Entity Authentication Part 2: Mechanisms based on signatures using a group public key."

◎Award date: May 19, 2014
◎Name of Award: Contribution to Standardization Award
◎Details:
For activity as a committee member and the Japanese head delegate for SC27/WG2 since 2004, and as a committee member of SC27/WG3 since 2007, and also for major contributions to standardization of Japanese technologies and for establishing international standards as an editor for ISO/IEC29128 and ISO/IEC20009-2.
◎Awarding Organization:
Information Processing Society of Japan/Information Technology Standards Commission of Japan (IPSJ/ITSCJ)

◎Comment from the Recipient:

This Award recognizes many years of contributions to international standardization of information security technologies. I was also able to work as editor in completing the standardization of anonymous entity authentication technologies, which has received much attention recently as a privacy enhancing technology. Many Japanese technologies have become international standards in the world of security, and I hope to contribute to standardization of more technologies from Japan as the Japanese head delegate for ISO/IECSC27/WG2.

Recipients ● **Naokatsu YAMAMOTO**/ Senior Researcher, Lightwave Devices Laboratory, Photonic Network Research Institute
Kouichi AKAHANE/ Senior Researcher, Lightwave Devices Laboratory, Photonic Network Research Institute
Tetsuya KAWANISHI/ Director of Lightwave Devices Laboratory, Photonic Network Research Institute

Co-recipient: Toshio YAMANOI
(Koshin Kogaku Co., Ltd.)

◎Award date: April 1, 2014

◎Name of Award: Poster Award, The 61st JSAP Spring Meeting, 2014

◎Details:
For an excellent poster presentation and its results contributing to the development of applied physics at the 61st Annual Spring Meeting of the Japan Society of Applied Physics (2014).
Presentation title: "Characterization on power stability of quantum dot comb laser."

◎Awarding Organization:
The Japan Society of Applied Physics

◎Comment from the Recipients:

Development of quantum dot technology, an area of nano-technology, as a medium for ultra-wide-band optical gain, contributes to cultivating optical frequency resources for data communications. In this research, we developed quantum-dot comb lasers, which promise to be useful in various areas such as generating wavelength-multiplexed light sources, generating short pulses, and electro-optical conversion. We are very pleased and encouraged to receive this award at this time, since we are promoting collaboration among industry, academia and government in research to realize quantum-dot technology in society. We would like to express thanks to the many related people that have supported us in this research.

From the left: Kouichi AKAHANE, Naokatsu YAMAMOTO, Tetsuya KAWANISHI

Recipients ● **Takashi UEGUCHI**/ Senior Researcher, Brain Imaging Technology Laboratory, Center for Information and Neural Networks
Ikuhiro KIDA/Senior Researcher, Brain Imaging Technology Laboratory, Center for Information and Neural Networks
Guoxiang LIU/ Research Manager, Brain Imaging Technology Laboratory, Center for Information and Neural Networks

◎Award date: April 13, 2014

◎Name of Award: The Congress Award, The 107th Scientific Meeting of the Japan Society of Medical Physics

◎Details:
Development of a novel technique to reduce physiological noise due to heartbeat fluctuation in brain MRI signals in ultra-high magnetic fields. In recognition of publication of this method and the excellence of the research results.

◎Awarding Organization:
Japan Society of Medical Physics

◎Comment from the Recipients:

In our laboratory, we are developing highly-accurate functional brain imaging techniques using ultra-high field MRI to overcome current limitations of spatial and temporal resolution. This research addressed cardiac-induced physiological noise and its temporal variation, which hinder the improvement of spatial and temporal resolution in functional brain imaging. We are extremely happy and honored to receive the award. We would like to express our deep gratitude to everyone else involved in this research.

From the left: Ikuhiro KIDA, Takashi UEGUCHI, Guoxiang LIU

Recipient ● **Shinsuke SATOH**/ Senior Researcher, Radiowave Remote Sensing Laboratory, Applied Electromagnetic Research Institute

Co-recipients:
Tomoo USHIO (Osaka University)
Fumihiko MIZUTANI (TOSHIBA Corporation)

◎Award date: April 15, 2014

◎Name of Award:
The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology, Prizes for Science and Technology (Development Category)

◎Details: Development of Phased Array Weather Radar

◎Presenter of Award: Minister of Education, Culture, Sports, Science and Technology

◎Comment from the Recipients:

This award recognizes contract research at NICT done by a joint industry, academia, and government team over a five-year period, developing phased array weather radar. As three relatively young researchers, we cooperated in designing the system using out-of-the-box ideas and each in charge of our own field, be it functional requirements, signal processing, or system production. In this way we were able to achieve results that have attracted attention, not just in academia but in wider society. We would like to thank all those involved in this work.

From the left: Fumihiko MIZUTANI, Tomoo USHIO, Shinsuke SATOH

Recipients ● **Miho FUJIEDA**/ Senior Researcher, Space-Time Standards Laboratory, Applied Electromagnetic Research Institute
Motohiro KUMAGAI/ Senior Researcher, Space-Time Standards Laboratory, Applied Electromagnetic Research Institute
Tetsuya IDO/ Research Manager, Space-Time Standards Laboratory, Applied Electromagnetic Research Institute

◎Award date: April 18, 2014

◎Name of Award:
The 46th Ichimura Academic Award

◎Details:
For development of technology for transmission and comparison of optical frequency standards over inter-city fiber network

◎Awarding Organization:
The New Technology Development Foundation

◎Comment from the Recipients:

We have developed technology to transmit optical frequency standards, compensating for noise due to vibration and temperature fluctuation, over inter-city optical fiber. We used this transmission technology to connect NICT and University of Tokyo with optical fiber, and for the first time, verified the reproducibility of frequencies from atomic clocks at each location to 16 decimal places. For this we have been awarded the Ichimura Academic award.

Receiving this award has been due to the cooperation from many at the Space-Time Standards Laboratory, the Katori Laboratory at the University of Tokyo, and the JGN executive office, and we would like to take this opportunity to express our thanks.

From the left: Motohiro KUMAGAI, Miho FUJIEDA, Tetsuya IDO

Recipient ● **Satoshi ISHII**/ Researcher, Nano ICT Laboratory, Advanced ICT Research Institute

◎Award date: April 19, 2014

◎Name of Award:
2013 Funai Young Researcher Award

◎Details:
Controlling diffraction and scattering of light by metallic nanostructures

◎Awarding Organization:
Funai Foundation for Information Technology

◎Comment from the Recipient:

We demonstrated that the phase and propagation direction of diffracted and scattered light can be controlled using metallic nanostructures. This work was done at Purdue University and NICT. I greatly appreciate fruitful discussions with Profs. Shalaev, Kildishev and Drachev and Drs. Otomo and Inoue.

Satoshi ISHII (right)
Photo: Provided by the Funai Foundation for Information Technology

Recipient ● **Takuya TSUGAWA**/ Senior Researcher, Space Weather and Environment Informatics Laboratory, Applied Electromagnetic Research Institute

◎Award date: May 2, 2014

◎Name of Award:2013 EPS Award

◎Details:
Takuya TSUGAWA, as the first author of the following paper published in Earth, Planets and Space (EPS), received the EPS award.
T. Tsugawa, A. Saito, Y. Otsuka, M. Nishioka, T. Maruyama, H. Kato, T. Nagatsuma, and K. T. Murata, "Ionospheric disturbances detected by GPS total electron content observation after the 2011 off the Pacific coast of Tohoku Earthquake", Earth Planets Space, Vol. 63 (No .7), pp. 875-879, 2011, doi:10.5047/eps.2011.06.035

◎Awarding Organization:
The Society of Geomagnetism and Earth, Planetary and Space Sciences, The Seismological Society of Japan, The Volcanological Society of Japan, The Geodetic Society of Japan, and The Japanese Society for Planetary Sciences

◎Comment from the Recipient:

We detected ionospheric variations such as concentric waves expanding from the tsunami source after the 2011 Tohoku Earthquake using a dense GPS receiver network in Japan. This award recognizes this research as the first detailed observations of the overall phenomenon of ionospheric variations after an earthquake, and the potential for monitoring tsunamis by real-time ionospheric observations in the future. We are very honored to receive the prestigious EPS Award, and would like to express sincere thanks to everyone that supported us in this research and in preparing press releases.

Recipient ● **Yuuki TAKANO**/ Researcher, Cyber Range Laboratory, Cybersecurity Research Center

◎Award date: May 17, 2014

◎Name of Award:
Poster award in WIDE 2014 May meeting

◎Details:
For presentation of the poster exhibit, "Report of the Experiment of Web Tracking Visualization," which presented particularly inspiring ideas to meeting participants.

◎Awarding Organization: WIDE Project

◎Comment from the Recipient:

Web tracking secretly gathers private information from Internet users for purposes such as targeted advertising. In this research, we analyzed this sort of Web Tracking to identify risks associated with using the Internet. The existence of Web Tracking is not a theoretical problem, but presents practical problems in terms of privacy, and we are very happy that our research addressing such problems has been evaluated highly.

Completion of the Solar Radio Observation System in the Yamagawa Radio Observation Facility

External view of the Solar Radio Observation System

NICT has installed a new solar radio observation system in the Yamagawa Radio Observation facility in Ibusuki City, Kagoshima Prefecture. This system will be the successor to a solar radio observation system in the Hiraiso Solar observatory in Hitachinaka City in Ibaraki Prefecture, which has become obsolete. The new system is able to quickly detect solar activity that can cause phenomena such as artificial satellite malfunctions, degraded wireless communication, and decreased accuracy of GPS measurements. The system has world-class performance in terms of observation frequency range and time resolution, and promises to contribute to greatly increased accuracy in space weather forecasts. NICT is continuing R&D to provide more rapid delivery of more-accurate, more-reliable space weather information.

With the completion of this system, a completion ceremony, facility tour and presentation were held in the Yamagawa Radio Observation Facility on July 5, 2014. More than 60 people attended to the ceremony, including the Mayor of Ibusuki City, the Ibusuki Board of Education and principals of surrounding elementary, middle and high schools. Approximately 200 people, mainly local residents, participated in facility tours and presentations.

Completion ceremony

Antenna inside the dome of the Solar Radio Observation System

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