# A Mational Institute of Information and Communications Technology





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2013 NOV

# **Towards the Realization** of a Multi-core Fiber Network

### -Dynamically controlled multi-core fiber network using SDN-



#### Werner KLAUS Senior Researcher, Photonic Network System Laboratory, Photonic Network Research Institute

After completing a doctoral course and a postdoctoral STA fellowship, he joined the Communications Research Laboratory, Ministry of Post and Telecommunications (currently NICT) in 1997. Over the past years he has been involved in various research projects ranging from optical space communications, micro-optics and quantum key distribution to waveguide optics and fiber communications. He was a Visiting Researcher at the Institute of Microtechnology, University of Neuchatel, in Switzerland in 2003. Ph.D. (Engineering).



### Jun SAKAGUCHI

Senior Researcher, Photonic Network System Laboratory, Photonic Network Research Institute

After completing a doctoral course and worked as a Researcher at Nara Institute of Science and Technology, he joined NICT in 2010. He is engaged in evaluation and development of multi-core fibers and related devices, as well as transmission technology and switching. Ph.D. (Science, Engineering).



Takaya MIYAZAWA Senior Researcher, Network Architecture Laboratory Photonic Network Research Institute

After completing a doctoral course and worked as a visiting scholar at University of California, Davis, he joined NICT in 2007. He is engaged in research about optical network, "AKARI" Architecture Design Project. Ph.D.(Engineering).

### Multi-core fiber technology: Supporting the ever-expanding data traffic

Due to the widespread use of bandwidth-consuming devices such as smartphones, the data traffic on the Internet is nowadays increasing at an annual rate of almost 30 percent. In order to support this high demand in data traffic, the backbone optical fiber network has expanded transmission capacity by increasing the number of wavelength channels and by using higher order modulation formats. However, with all these technologies, it is also necessary to enhance the optical signal power in the fiber, and there has been a growing concern that the conventional optical fiber will reach its physical limit of transmission capacity in a few years from now.

To overcome this limit, research on multi-core fiber technology is carried out worldwide. Multi-core fibers (MCF), which are fibers with multiple cores (i.e., individual optical transmission channels) of high spatial density surrounded by a single cladding, can dramatically improve the transmission capacity per fiber, as well as reduce the cost and number of fibers required for the fiber deployment (Figure 1). Previous studies were mainly concerned with long-distance and high-capacity point-to-point communications, and research on networks connecting multiple points has not been much reported. To take advantage of the MCF in a network, we need to develop technology for optimal routing and dynamic control beyond the framework of the conventional optical fiber network control.

### Software Defined Networking technology: Enabling flexible control of the optical network

In recent years, Software Defined Networking (SDN) has been attracting attention as a new network control technology. SDN allows one to control freely the communication flow in a network device with software developed independently from the device, and thus enables a flexible network control according to the user requests (such as data rate and latency) that may change over time. In this respect, the OpenFlow protocol has been proposed as a method for realizing SDN. Its standardization is promoted by the Open Networking Foundation which is a non-profit organization supporting various developments in the field of SDN. Also, many products supporting the OpenFlow protocol have already been released for applications in local area



Figure 1 Transmission capacity enhancement with multi-core fibers (by using many wavelengths and cores as individual transmission channels the overall data throughput can be increased)



Figure 2 Schematic of network control using OpenFlow (data traffic is controlled based on flow entries)

networks and data centers. In OpenFlow, one can identify the traffic (or flow) using the packet header field (e. g., MAC address and IP address), and flexibly (or dynamically) set the flow entry (which refers to the way of packet processing in a switch) from an external controller for each value of the header field (Figure 2). In an MCF network, switches must handle a huge number of flow entries to accommodate all possible combinations of wavelengths and cores. Using OpenFlow in MCF networks provides a simple and flexible means to deal with service requests from individual users. However, currently, OpenFlow controllers are commercially available only in electrically switched networks, and application of OpenFlow technology in the optical domain has been limited to single-core fiber optical networks. Moreover, unlike a bundle of single-core fibers, an MCF exhibits slightly different Quality of Transport characteristics depending on the location and the number of cores, which requires a more complex network control based on these transmission characteristics.



Figure 3 Schematic diagram of the OpenFlow controlled multi-core fiber network experiment (the OpenFlow controller determines the required number of cores, wavelength, data rate and modulation format, and sets the optical paths for the data signals in each node)

### Dynamic control of multi-core fiber network

NICT and the University of Bristol of UK have jointly set up a network testbed consisting of MCFs and optical switches, and demonstrated dynamic control of the network with an OpenFlow controller. In this experiment, NICT provided the MCFs as well as self-homodyne detection technology which fully exploited the common environment shared by all MCF cores, and the University of Bristol was responsible for the development of the optical switches and the control software based on the extension of the OpenFlow protocol.

The network used in the experiment (Figure 3) consisted of two MCF links (with a 19-core and a 7-core MCF) connecting 3 nodes (i.e., optical switches) and a single-core fiber link connecting node 1 and 3. We verified that the OpenFlow controller optimally assigned the number of cores, wavelength, data rate, and modulation format to each user according to the Quality of Transport and data rate request (as given, for example, by data signals 1 to 4 in Figure 3). As a result, appropriate optical signals were automatically transmitted to the required destinations. In the example shown in Figure 3, we demonstrated that various data rate requests ranging from 40 Gbps to 512 Gbps can be satisfied by providing 1, 4, 6, or 8 cores and using three types of modulation format. Our controller not only provides a simple core assignment, but also enables to configure self-homodyne detection for reducing the burden during demodulation processing. In a conventional optical communication system, recovery of the original data from the received signals becomes difficult when the signal light contains a large amount of noise, and usually a large amount of electrical power is necessary to accomplish the complicated demodulation processing. In the case of self-homodyne detection, however, we use one MCF core to



Figure 4 Working principle of self-homodyne detection

transmit a pilot tone (i.e., an unmodulated carrier) that carries the same noise as the light in the remaining cores with the data signals. By mixing the pilot tone with the data signal light at the receiver, we can optically remove the noise from the data signal, and thus reduce the complexity of the demodulation processing at the receiver (Figure 4).

### Prospect

It is expected that the success of this experiment accelerates the practical use of multi-core fiber networks based on Open-Flow, which recently has been quickly gaining popularity. As a next step, we need to develop a more flexible network control technology that can deal with new optical transmission technologies and optical devices currently under development. In this respect, NICT and the University of Bristol hope to promote the practical use of MCF networks by advancing the research and the development of their network technologies on both the hardware and software side.

## **Research and Development of New Satellite Communication Technologies to Support Safe and Secure Society**

 Development of technology to connect via satellite with usual mobile phones



### Amane MIURA Senior Researcher,

Space Communication Systems Laboratory, Wireless Network Research Institute

After completing graduate school, he joined the Communications Research Laboratory, Ministry of Posts and Telecommunications (CRL; currently NICT) in 1998. He engages in research on satellite communication and antenna. From 2004 to 2005, he was Visiting Researcher, UCLA, and from 2005 to 2009, transferred to Advanced Telecommunications Research Institute International. Ph.D. (Information Sciences).

### Background

In recent years, the need for secure communication method at a time of disaster is growing. It is well known that satellite communication is very effective as a means of communication at a time of disaster. During the Great East Japan Earthquake, functions of many mobile base stations were lost, and local government utilized satellite-based mobile phones. On the other hand, it has been pointed out that at a time of disaster, it is crucial to enable communication via the terminal used on a daily basis.

Currently, the technology to increase the performance of satellite communication by embedding a large deployable antenna with over 10 m diameter on a satellite is being realized, therefore, miniaturization of satellite-based mobile phone is on progress. Also, "satellite/terrestrial integrated" mobile communication system that allows communication beyond areas covered by terrestrial link by mounting both terrestrial and satellite commu-



Figure 1 Conceptual diagram of STICS

nication device on a small mobile terminal, is being developed in Europe and the United States, and is likely to be realized. At NICT, we have conducted "Research and development of satellite/terrestrial integrated mobile communications system" in FY2008-2012 as a commissioned research from Ministry of Internal Affairs and Communications, and advanced the research of satellite/terrestrial integrated mobile communications system (STICS) as shown in the conceptual diagram of Figure 1. In this system, a very large deployable antenna with about 30 m diameter is mounted on a satellite, and covers Japan and its exclusive economic zone with about a hundred of high-gain, small-diameter spot beams. By bringing connect function of both satellite and terrestrial link to satellite/terrestrial integrated mobile terminal of the same size as the current terrestrial mobile phone, reliable communication through the everyday device can be realized at a time of disaster. While there have been a lot of challenges to fully realize this system, we will introduce some of the fundamental research subject and what has been achieved to date.

### Frequency sharing between terrestrial link and satellite link

STICS supposes that bandwidth of 30 MHz within 2 GHz band allocated for mobile satellite service (MSS) defined in Radio Regulations (RR) to be used commonly by satellite link and terrestrial link in order to use limited frequency resource efficiently. The concept is shown



Figure 2 Frequency band sharing of terrestrial link and satellite link



Figure 3 Measurement of transmitting power of terrestrial mobile phone

in Figure 2: the entire frequency band is divided into several sub-bands, and allocates different sub-bands for satellite link of each satellite beam and terrestrial link used in corresponding area. By doing so, in terms of frequency, you can effectively use idle bandwidth of satellite link for terrestrial link. However, in reality, it generates interference. For example, because the satellite antenna has a certain sensitivity outside the satellite beam, it is considered that the satellite antenna will receive some interference from a number of terrestrial links that use the same sub-band outside of a particular satellite beam.

To examine whether frequency sharing can be realized in cases of various interferences including the one mentioned above, NICT measured the transmitting power of W-CDMA (3G) terrestrial mobile phone terminals and base stations in all over Japan using the test vehicle and aircraft (see Figure 3). As a result, it revealed that the average transmission power of terrestrial mobile device is extremely smaller than the standard maximum power, and that the interference from base stations to the satellite is greater than the one from mobile terminals to the satellite. And, as a result of interference evaluation after constructing interference model based on the experiment data, we have confirmed that frequency sharing is quite possible under terrestrial/satellite interference.

### Satellite onboard digital beam former/ channelizer

"Digital beam forming (DBF) technology", which operates beam forming by digital signal processing in a satellite antenna, is effective in forming a hundred of spot beams and sustaining beam forms to cover wide service area of Japan and its exclusive economic zone. Another technology is required to dynamically change the distribution of communication resources such as channel assignment in order for in satellite link to accommodate the demands of traffic that rapidly increases in disaster-stricken region at a time of disaster. Therefore, "digital channelizer technology" is effective in enabling efficient signal transmission between the satellite and the ground station by flexibly reconstructing the channels to be allocated for each satellite beam by digital signal processing in the satellite repeater.

To examine the possibility of satellite-borne communication technology, we have developed a partial prototype of satellite-borne tele-



Figure 4 Partial prototype of Satellite-borne telecommunication equipment



Figure 5 Example of dynamic resource allocation test

The bandwidth of 28 MHz was allocated to 7 beams and the beams are identified by the difference in levels. In test pattern 1, we allocated 4 MHz to each beam. In test pattern 2 and 3, the allocated bandwidth to specific one beam gradually increases. In test pattern 4, 25 MHz is allocated.

communication equipment (see Figure 4) and conducted evaluation combined with simulation. As a result, we have verified that by utilizing the digital technology, it is capable of forming multiple beams in 100 beam class, and that it is capable of concentrating the allocation of channels to a particular satellite beam as shown in Figure 5.

### **Prospects**

We are working on applying the result of fundamental technology of the satellite/terrestrial integrated mobile communications system to practical use, and conducting research on technical tasks for the implementation of the technology as well as international standardization to prepare the system with an aim to contribute to realization of safer, more secure society. As a part of the effort, we are proposing our achievement to the AWG (APT Wireless Group) meeting and contributing to making cooperation with neighboring Asian countries.

# **3D Audio System Suitable to 200-inch Glasses-free 3D Display**

-Viewers feel the sounds come from the 3D images at any view point-



### Toshiyuki KIMURA

Multisensory Cognition and Computation Laboratory, Universal Communication Research Institute

After completing a doctoral course, worked as Research Fellow of the Japan Society for the Promotion of Science, Research Fellow of Nagoya University, Research Associate of Tokyo University of Agriculture and Technology, and he joined NICT in 2007. He is engaged in research about three-dimensional system, spatial perception, and array signal processing. Ph.D.



### Hiroshi ANDO

Director of Multisensory Cognition and Computation Laboratory, Universal Communication Research Institute

After completing a doctoral course, joined Advanced Telecommunications Research Institute International (ATR) in 1992 and worked as Head of Department of Perceptual and Cognitive Dynamics until 2011. He has been involved in NICT's R&D project for ultra-realistic communications from 2006. He is engaged in research about brain and cognitive sciences and multisensory information processing technology. Ph.D. (Computational Neuroscience).

### Background

At Universal Communication Research Institute, we are advancing research and development on ultra-realistic communication technology. If this technology realizes the expression of more realistic images and sound, it would enable more realistic, presence-giving communications such as 3D teleconference that were formerly unachieved.

We have developed 200-inch glasses-free 3D display (REI: Ray Emergent Imaging), a display with a 200-inch monitor that enables viewers to see 3D images without wearing glasses (Figure 1). REI allows multiple viewers to observe natural stereoscopic images simultaneously, enabling multiview image of approximate 200 viewpoints to be displayed, according to the position of viewers as they move horizontally. However, this



Figure 1 Overview of 200-inch glasses-free 3D display

display only provides visual information, and because of that, we needed to develop 3D audio system optimized for REI in order to provide auditory information simultaneously.

### Technical requirement of 3D audio system

There are three technical requirements for developing 3D audio system. Since the biggest characteristic of 200-inch glasses-free 3D display (REI) is to allow multiple viewers in every view point to see stereoscopic image at the same time without wearing glasses, the first technical requirement is "to enable multiple viewers to hear sounds at the same time in every position as if it were outputted from the stereoscopic images". Second technical requirement is "not to set up loudspeakers in the back of the screen", in order not to disturb image projecting, because REI is structured to project image from behind the screen using approximately two hundred projectors. Lastly, the third technical requirement is "to realize the natural, realistic sound quality" to suit with the natural, realistic 3D image of REI, because REI is developed with an aim to achieve such quality.

### Newly developed 3D audio system (MVP method)

Conventionally, in the research area of sound, various 3D audio systems have been developed, but no 3D audio system have fulfilled the technical requirement as mentioned above. Therefore, in order to develop 3D audio system suitable for 200-inch glasses-free 3D display (REI), we have created a system with a brand new method from scratch.



Figure 2 Basic composition of newly developed 3D audio system (MVP method)

Figure 2 shows the basic composition of the system we developed. As shown in the figure 2 (a), we arranged two loud-speakers above and beneath the position where there is a sound (the mouth of the elephant) among the images of three dimensional objects on screen (the elephant, as of Figure 2). By playing sound with differentiated volume of the sound coming from two different loudspeakers, (this is so called vertical panning), viewers feel that the sound is coming from the mouth of the elephant. In developing the system, we conducted vertical panning by placing two speakers above and below the screen of the REI. Our psychological experiment proved for the first time that the audio sounded like it was coming from between the two loudspeakers.

The sound is coming from the two loudspeakers located on top and beneath the mouth of the elephant, and this is verified even when viewers move horizontally. Therefore, without wearing headphones, viewers always feel that the sound is coming from the mouth of elephant, wherever they stand. Also, the fact that only two loudspeakers are making sounds, the system can realize the sound quality similar to conventional sound systems such as the stereophonic sound.

Furthermore, as shown in Figure 2 (b), by locating multiple pairs of loudspeakers in top and beneath the screen, and panning vertically, we can expand the position of the sound expression from vertical to horizontal. This makes viewers, regardless of when and where they stand, to feel the sound is coming from the stereoscopic image projected on the screen. We call this method of employing multiple pairs of loudspeakers to operate vertical panning, "MVP method", an acronym of Multiple Vertical Panning. We conducted an audio-visual psychological experiment which examined the performance of MVP method by asking participants to experience the 3D image and the sound of MVP method altogether and judge the location of the sound. As a result, we found that viewers felt the sound was coming from the 3D image wherever they viewed the image,



Figure 3 Snapshot of the bird watching game

### Prospect

and proved that MVP method is effective.

Currently, we are exhibiting 200-inch glasses-free 3D display (REI) on the third floor of The Lab., Knowledge Capital, Grand Front Osaka located in the north of JR Osaka Station, and displaying a bird watching game as part of a content with sounds (Figure 3). The evaluation experiment for presence using the exhibition content is also taking place.

In the future, towards the implementation of MVP method we developed, we will conduct psychological experiments to see what happens when fewer loudspeakers are arranged. Also, we will examine the number of microphones required to develop the sound capturing/transmission method to emit realistic sound from remote places.

# Awards

### Recipients • Lira HAMADA / Senior Researcher, Electromagnetic Compatibility Laboratory, Applied Electromagnetic Research Institute Soichi WATANABE / Research Manager, Electromagnetic Compatibility Laboratory, Applied Electromagnetic Research Institute

### OAward Date: May 17, 2013

OName of Award

ITU-AJ Encouragement Award for International Activities in 2013

ODetails:

For contribution to ITU activities and Japan's ITU related activities and in recognition and expectation to continuous contribution to the field in the future

OAwarding Organization: The ITU Association of Japan OComment from the Recipients

We have been continuously contributing to the development of the international standardization activities in ITU about the compliance method such as radio wave protection regulations of mobile phone systems, and to the research about the bio-electromagnetic compatibility. Though this award is given to individual names, we could not have won such a prestigious prize without the cooperation by our team who are involved in the bio-electromagnetic compatibility, and we are very thankful to them.



From left, Lira HAMADA, Soichi WATANABE

Recipients • Haruki MIZUSHINA / Researcher, Multisensory Cognition and Computation Laboratory, Universal Communication Research Institute Hiroshi ANDO / Director of Multisensory Cognition and Computation Laboratory, Universal Communication Research Institute

Co-recipients: Junva NAKAMURA (Tokyo University of Agriculture and Technology) Yasuhiro TAKAKI (Tokyo University of Agriculture and Technology)

OAward Date: June 28, 2013

OName of Award: Best Paper Award

ODetails

In recognition to outstanding poster presenta-Vergence and Accommodation Responses tion of to Super Multi-View Display'

OAwarding Organization:

The 5th International Conference on 3D Systems and Applications (3DSA2013)

#### OComment from the Recipients:

In joint research with Takaki Lab. of Tokyo University of Agriculture and Technology, we conducted an evaluation experiment on reduced-view super multi-view 3D display. The award acknowledges us for experimentally proving reduction of conflict between accommodation and vergence responses, which is said to be the cause of visual fatigue when people view 3D images. We'd like to express our gratitude to those who supported us in the research. We'd like to take this award as an encouragement to strive for contribution to the advancement of human-friendly image technology.



From left, Hiroshi ANDO, Haruki MIZUSHINA

Recipients • Shoichiro IWASAWA / Senior Researcher, Ultra-realistic Video Systems Laboratory, Universal Communication Research Institute Naomi INOUE / Associate Director General of Universal Communication Research Institute

Co-recipients: Masahiro KAWAKITA Former Associate Director of Ultra-realistic Video Systems Laboratory, NICT (Currently at NHK Science & Technology Research Laboratories)

OAward Date: June 28, 2013

OName of Award: Best Paper Award ©Details:

In recognition of oral presentation of "REI: An Automultiscopic Projection Display OAwarding Organization:

The 5th International Conference on 3D Systems and Applications (3DSA2013)

#### OComment from the Recipients:

I received guidance and generous support from inside and outside of NICT to advance the research and development of ultra-multi-view 3D video technology, and as a result, the introduction of Umekita experiment site and its daily operation were made possible. The award acknowledges the horizontal-parallax glasses-free 3D display technology, REI, which is a core technology to support high definition auto-stereoscopic images. We'd like to take this award as an encouragement to continue to work on the research and development in the field where video information and human beings meet.



From left, Naomi INOUE, Shoichiro IWASAWA

### Recipient • Ved Prasad KAFLE / Senior Researcher, Network Architecture Laboratory, Photonic Network Research Institute

Co-recipients: Hong-Jong JEONG (Kyungpook National University, (Korea)) Hongseok YOO (Kyungpook National University, (Korea)) Dongkyun KIM (Kyungpook National University, (Korea))

OAward Date: July 4, 2013

OName of Award: Excellent Paper Award ©Details:

In recognition to outstanding research paper "HIMALIS-C-ITS: Fast and Secure Mobility Man-agement Scheme Based on HIMALIS for Coop-erative ITS Service in Future Networks"

OAwarding Organization: IWIV2013

OComment from the Recipient:

I am delighted to be awarded for our research on the ID/locator split-based new-generation network, called HIMALIS, which is superior to current Internet in supporting heterogeneous network protocols, mobility, multihoming, and security. In this research, HIMALIS has been extended to ITS (Intelligent Transport System), which would be a major means of communications in the near future. This research was carried out in the Network Architecture Laboratory in collaboration with a professor and students (one of who had staved at NICT under HSTEC Winter Institute Program) of Kyungpook National University, Korea.



#### Recipients • Shin-ichi YAMAMOTO / Senior Researcher, Space Communication Systems Laboratory, Wireless Network Research Institute Naoko YOSHIMURA / Senior Researcher, Space Communication Systems Laboratory, Wireless Network Research Institute Naoto KADOWAKI / Senior Executive Director Yuichi KAWAMOTO OComment from the Recipients: Co-recipients: (Tohoku University) Hiroki NISHIYAMA We are deeply honored to receive Best Paper Award at IEEE IWCMC2013. This research is (Tohoku University) Nei KATO about the link control of the satellite sensor (Tohoku University) network, and it is an important technology to collect data from sensor stations allocated in OAward Date: July 5, 2013 various places in real time by using the satellite OName of Award: link for the purpose of early detection of disaster. IEEE IWCMC2013 Best Paper Award It is considered to provide more precise evacuation orders and rescues by early detection of ©Details: disaster, and reduce the damages. In recognition to outstanding research paper "A Divide and Conquer Approach for Efficient Band-width Allocation in Next Generation Satellite We will continue to make further efforts towards the realization of early detection system From left, Naoko YOSHIMURA, Shin-ichi YAMAMOTO, Routed Sensor System (SRSS) for disaster in the future. Naoto KADOWAKI ©Awarding Organization: We would like to thank everyone in the Space IEEE IWCMC2013 Communication Systems Laboratory and people involved for giving us support and advices. It should be noted that this research study is the result of commissioned research collaborative with Tohoku University. Recipients • Tao BAN / Senior Researcher, Cybersecurity Laboratory, Network Security Research Institute Rvoichi ISAWA / Researcher, Cybersecurity Laboratory, Network Security Research Institute Daisuke INOUE / Director of Cybersecurity Laboratory, Network Security Research Institute Kouji NAKAO / Distinguished Researcher, Network Security Research Institute Co-recipients: Shanqing GUO (Shandong University, (China)) OComment from the Recipients: Our research paper on malware analysis was evaluated at the international conference OAward Date: July 26, 2013 ASIAICIS2013, and I am extremely honored to OName of Award: Best Paper Award receive Best Paper Award. In order to decipher ©Details: the packing technology to obfuscate the malware, In recognition to the research paper "Efficient we proposed a method to identify the packer in Malware Packer Identification Using Support machine learning method based on the spectrum Vector Machines with Spectrum Kernel" for kernel in this paper. We would like to thank contribution to academic and technological deeply to everyone involved as well as Cybersecupromotion rity Laboratory for always giving support and OAwarding Organization: advice to proceed the research.

The 8th Asia Joint Conference on Information Security

FY2012 Special Fellow Selection Committee

Japan Society for the Promotion of Science

For great contribution to the committee as a document examiner for providing fruitful opinions and fair and impartial evaluation of papers

Recipient

ODetails.

◎Name of Award:

@Award Date: July 31 2013

OAwarding Organization:

#### OComment from the Recipient:

I am very delighted and honored to receive the award When I became the examiner, I took the role in return to what they have helped me in the past, and thought, "I should do what I can to contribute to the society because they used to help me with Grant-in-Aid for Scientific Research". But once started examining research papers of young researchers filled with passions, it gave me inspiration and made me eager to study in order to examine the papers. Instead of me giving back to the society, it made me learn a lot of things. I'd like to express my gratitude for giving me such opportunity.

• Ichiro UMATA / Researcher, Multisensory Cognition and Computation Laboratory, Universal Communication Research Institute



From left, Rvoichi ISAWA, Tao BAN, Daisuke INOUE

### Recipient • Hiroyuki TSUJI / Senior Researcher, Space Communication Systems Laboratory, Wireless Network Research Institute

Co-recipients: Kiyofumi SUZUKI (Mitsubishi Electric Corporation, Japan) OComment from the Recipient: The widespread use of smartphone in recent Hiroyuki NAGAYAMA

(Mitsubishi Research Institute, Inc., Japan) OAward Date: August 6, 2013

OName of Award: Best Paper Award ODetails

The recipients developed the system that enables broadband communication between the ground surface and an aircraft using millimeter wave and conducted an experiment using an aircraft. Its result was presented at the Second Asia-Pacific Conference on Antenna and Propagation, and was chosen as Best Paper by the selection committee. OAwarding Organization:

The Second Asia-Pacific Conference on Antenna and Propagation (APCAP2013)

years is attracting attention on the Internet connectivity and broadband communication applications on airplanes. In this award, we received an evaluation regarding the results of the evaluation experiment using the actual airplane and proposal of a system for direct communication with millimeter wave frequency band (40 GHz band) between an aircraft and the ground. I would like to thank everyone who have been involved, and would like to promote the system in the future.



# Report on the Exhibition at "CEATEC JAPAN 2013"

Entrepreneur Support Office/Key Technology Research Promotion Office, ICT Industry Promotion Department

NICT exhibited a booth in CEATEC JAPAN 2013 held in Makuhari Messe (Chiba Prefecture) on October 1–4, 2013, and showcased the 5 research results of the Commissioned Research by the Private Key Technology Research Promotion Program, and the contents of 5 enterprises that had presented in ICT Venture Business Plan Contest 2012.

This time, we introduced exhibitors by digital signage using a large monitor of 70 inches, and held mini seminars to appeal visitors with a new approach.

On the first day of the event, Mr. Toshiyuki TAKEI, Director-General for Policy Coordination, Minister's Secretariat, Ministry of Internal Affairs and Communications and other related parties visited the booth. In addition, the exhibition welcomed visitors from a variety of fields including manufacturer companies in the field of ICT, academic researchers, relevant parties of local governments, and students. In front of each exhibition, we could see visitors engaged in lively discussion about exhibited devices, research results and new services by startup companies and exchanged business cards. The total number of visitors for this event was over 110,000, and NICT was able to successfully produce an efficient result for both the exhibitors and the visitors as having more than 3,400 visitors to the research results, exhibition and mini seminars. In the questionnaire for exhibitors, we received positive responses such as "the event had visitors from television industry, and gives the opportunity to connect with people from the new fields" and "after the mini seminar, we had people asking for more information, and now we have new business leads that we plan to visit". The responses show that the exhibition provided a good opportunity to publicize the activities of exhibitors.

We will continue to work hard to promote business activities and publicize research results and achievements of NICT by utilizing the event as an opportunity to present our activities of "support programs for private sectors related to ICT industry".



Overview of NICT booth



Snapshot of mini seminar

Snapshot of visitors



Taking interview by the press

# **Report on the Exhibition at "Tokyo International Fire and Safety Exhibition 2013"**

**Outcome Promotion Department** 

Tokyo International Fire and Safety Exhibition 2013 was held on October 2–5, 2013 at Tokyo Big Sight (Tokyo International Exhibition Center). This event is hosted by Tokyo Fire Department and other organizations, and supported by Fire and Disaster Management Agency of the Ministry of Internal Affairs and Communications, and is held every five years as the biggest general exhibition of disaster countermeasures in Japan. It was the third time for NICT to exhibit at the event, after exhibiting in 2003 and 2008. This time, we exhibited the regional distributed wireless network (NerveNet), to directly appeal the achievement of technology transfer to assumed users such as local governments. We demonstrated the capability of message distribution by using a temporary base station equipped with a solar panel, which enables to communication with family members and inquire safety information in different shelters at a time of disaster.

A number of members of local governments, fire departments and companies related to disaster prevention visited our booth, and asked and answered questions eagerly. We will refer to the feedback of visitors in order to improve the system for the future.

You can watch a promotional video of Nervenet, which was created for the exhibition, in the following video library on NICT Website. http://www.nict.go.jp/video/nervenet.html (Japanese only)



Snapshot of the temporary base station equipped with solar panel, which attracted attention of the visitors





The exhibition crowded with families with children on Saturday, the last day of the event

Demonstration to inquire safety information using smartphone, tablet device, and digital signage



Members of Boys and girls Fire Club took part in the demonstration with enthusiasm

# Introduction to Speech Translation Applications NICT Developed for Smartphones

At NICT, we provide multi-lingual speech translation applications to help conversation of travelers, etc., as a part of the research on speech translation technology. Some of them are provided by private companies by means of license contract. All application is available for free download. Please try the applications. For more information, please visit NICT Website: http://www.nict.go.jp/en/



### VoiceTra4U

"VoiceTra4U" helps multiple users (up to 5) communicate in different languages in real time, either face to face or remotely. This application covers 31 languages including Japanese, English, Chinese and Korean.



### VoiceTra+

Speech translation functions are provided by NICT. This application covers 21 languages. The application is provided by

FEET Limited.



### NariTra

This application employs the multi-lingual speech translation engine developed by NICT. By registering proper nouns related to Narita International Airport, names of the tourist destinations, stations, and products, this application is specialized for use in the airport and travel destinations. Applicable languages: Japanese ⇔ English, Chinese, Korean.

The application is provided by Narita International Airport.

iPhone Android

iPhone



### iPhone Android

### KoeTra

Using text and speech, this application helps smooth communication between the hearing impaired persons and normal listeners. NICT developed this application using highly precise speech recognition technology and high-quality speech synthesis technology.

(Japanese version only)

iPhone



Published by

### AssisTra

AssisTra provides multilingual Kyoto tourist information in Japanese, English, Chinese and Korean. It also allows you to search for nearby sightseeing places based on your current location.

iPhone



### Kyo no Osusume

Users can explore sightseeing spot using this application which provides recommendation to the specific sightseeing spot in Kyoto that matches user's feeling such as "healing", "refreshing". (Japanese version only)

iPhone

### Information for Readers

The next issue will feature the meteorological phenomena's effect on ionosphere, the superconducting single-photon detection technology, and verification system of SSL vulnerability.



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