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# Radio Spectrum Engineering and Interference Propagation Channel Model

Jun-ichi Takada

Department of International Development Engineering,  
Tokyo Institute of Technology



## 1. Introduction

This article is going to describe about the current approaches and challenges of radio spectrum engineering, i.e. efficient utilization of radio spectrum by sharing and coexistence among different radio services and how the propagation channel models influence to the coexistence conditions. As well, the difficulty is touched upon in the pure objective scientific approach to justify the coexistence condition in policy making.

## 2. Interference Study in Regulatory Context

When the frequency spectrum is shared among different services and systems, the mutual interference among them is a big concern.

Usually, interference limit at the victim receiver who suffers from interference is determined for individual services and systems. For example, interference signal power at the victim primary receiver should be about 10 dB below the receiver noise level from other primary users, or about 20 dB below from non-primary users, under the recommendation of ITU-R for fixed services and broadcasting [1]. These values correspond to 0.4 dB and 0.04 dB rises of equivalent receiver noise level. However, there are obvious criticisms about these conservative values: Such a low level is impossible to detect, or upper limit of radiated disturbance of class B information technology equipment (such as home PC) does not comply with this criterion [2], etc.

There are two different scenarios that the interference at the receiver is beyond the limit. One is so-called single entry interference scenario where one dominant transmitter causes the interference. The minimum separation distance is determined to restrict the interference below the limit in this scenario.

The other is aggregate interference scenario where the interference signals from multiple transmitters are aggregated at the receiver. Transmitter density is assumed and power from individual transmitters is accumulated in static or dynamic manner. In the latter case, Monte-Carlo simulation is introduced to calculate the outage probability of service availability, which is a more suitable criterion for mobile services.

## 3. Radio Channel Modeling for Interference Study

In either of the interference scenarios, propagation channel model plays an important role for the protection criterion of the victim receiver, in addition to antennas and their deployment model which can be rather easily specified within the system design.

Propagation channel models are usually established and extensively utilized within the service design of individual systems. However, it is hard to share these models between the interferer and the victim because the deployment and operation scenarios may not be common. Therefore, the most pessimistic and conservative propagation channel model, i.e. free space loss plus terrain shadowing, is often used. In many cases, even the building losses are not taken into account in the interference channel stating that the buildings are not the permanent structures and they may be scrapped so as to increase the interference level in future.

## 4. Radio Spectrum Engineering

Traditionally, the major focus of the interference study was the inter-system interference between adjacent spectra due to the unwanted emission in out-of-band domain.

However, due to the congestion of the radio spectrum and the increased demand for spectrum allocation, more aggressive technologies of spectrum sharing are taken into account. Spectrum Policy Task Force of FCC (Federal Communications Commission, USA) has reported two novel approaches in the radio spectrum engineering to be taken into their policy in 2002 [3]. First approach is the underlay technique to transmit the signal within very wide spectrum allocated to various different existing systems and at very low power spectrum density. This technique is now recognized as ultra-wideband (UWB). The second approach is the overlay technique to transmit the signal within the allocated but unused spectrum identified through the spectrum sensing or spectrum usage database. This technique is now known as white space (WS) or dynamic spectrum access (DSA) (Fig. 1).

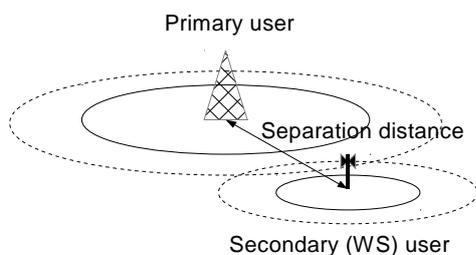


Fig. 1 White Space Approach [4]  
Solid lines show the coverage of users, while dashed lines show the interfering areas by users.

These aggressive approaches were inconsistent with the traditional spectrum management approach in the early deployment in other countries.

In addition to the protection criteria themselves, the propagation channel models were also the matter of discussion. The authors investigated the influence of the choice of propagation channel models to the separation distance for TV white space device, and showed that the separation distance ranges from 10,000 km to 50 km for 4 W user terminals by using very typical but different propagation channel models, i.e. free space and spherical earth models [5]. Therefore, the choice of the propagation channel model greatly influences the potential of the radio spectrum engineering. For example, Oyama et al. presented the difference of available TV WS resources in Japan by using different propagation channel models [6].

## 5. Challenges

Obviously, no spectrum management approach itself is 100 % purely scientific, as there are background policy and philosophy for resolving the conflicting interests. The precautionary principle is always applied in the deployment of any new technology into the policy, and therefore the early deployment tends to be conservative. However, how much it is conservative also depends on how strong the policy is formulated [7].

What scientific study can contribute in the spectrum management are 1) to provide more accurate but reasonably handy approach to predict the propagation loss in more realistic environment, and 2) to derive tighter criterion for the protection of the victim receiver in more practical manner. These results should be objectively accepted or approved by scientific community as well as the practical field engineers.

## 6. Author's Experiences

The author had an opportunity to involve in the study of the technical requirement of microwave UWB in Ministry of Internal Affairs and Communications (MIC) Japan from 2002 until 2006 [8]. There, the author has experienced series of intense discussions between the promoters of UWB and the operators of potential victim services. They remained as far apart as ever. Promoters followed the decision of FCC and the victims insisted to respect ITU-R. FCC has deployed the policy on UWB which is much more aggressive

than ITU-R recommendations, after the extensive discussion within US. In contrast, MIC respected ITU-R recommendations in the policy making in spectrum management. Both FCC and MIC prioritized their own policies, and the inconsistency in regulations was occurred due to the difference of the policies. The author felt that the international harmonization was easy to be said, but difficult to be achieved, as it was not mainly due to the scientific reasons.

Since then, the author has had the opportunities to involve in studies of the technical requirements for UWB and WS as well as other new radio services in MIC. No academic outcomes are presented by the author through these activities, though. The distance between science and policy is still very big for the author.

## 7. Conclusion

The challenges of interference channel model in the radio spectrum engineering have been described from the author's viewpoint and experiences. The author has not yet achieved anything to contribute to this aspect as a propagation engineer, so the author plans to emphasize the studies in the field in near future.

## Acknowledgement

The author deeply appreciates the colleagues in Technical Committee on Software Radio for the recommendation, and the Communication Society for the nomination of the author as IEICE Fellow for contributions to radio channel measurement and modeling, and their application to spectrum sharing.

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# Measurement of Optical Fibers Using Brillouin Scattering

Tsuneo Horiguchi  
Shibaura Institute of Technology



## 1. Introduction

Sound waves generated in a medium by thermal agitation scatter incident lightwaves with shifted frequency. This effect is called Brillouin scattering. Telecommunication people dislike generally Brillouin scattering since it backscatters lightwaves in optical fibers increasingly with raising the input power of the optical signals, resulting in no increase of transmitted signal power. In contrast, Brillouin scattering finds applications in many fields as well as in optical communication systems. This article describes measurement technique of optical fibers using Brillouin scattering and distributed strain/temperature sensors based on Brillouin scattering.

## 2. Finding applications for Brillouin scattering

In the late 1980s, two advanced optical communication technologies at least were developed: optical coherent transmission technologies and optical fiber amplifiers. Coherent detection realizes receivers with high sensitivity; and optical fiber amplifiers boost the optical signal power, extending the transmission distance. The use of both technologies, however, accelerates the occurrence of the Brillouin scattering; narrow linewidth lasers used in coherent systems make the Brillouin scattering interfere constructively; while the optical amplifiers easily make input power exceed the threshold of stimulated Brillouin scattering (SBS). Then researchers have developed countermeasures against SBS which include employing phase shift keying (PSK) for modulating optical signals rather than intensity modulation (IM) and specialty fibers having high threshold of SBS.

Besides these countermeasures, study on applications based on the Brillouin scattering was also covered by our research group. This is because high gain for Brillouin amplification can be achieved with relatively low pump power. One of these applications was for measuring loss distribution across optical fibers. In this application, pulse pump was injected at one end of the optical fiber while continuous wave (cw) probe at the other end; and the cw probe frequency is set lower than the pump frequency by Brillouin frequency shift (BFS); then the pulse pump amplifies the cw probe through SBS; thus the increase in the cw probe power is detected as a function of time as in a similar way for conventional optical time domain reflectometry (OTDR) based on Rayleigh scattering. We call this technique Brillouin optical time domain analysis (BOTDA). Since the signal intensity for BOTDA is usually much larger than that for OTDR, BOTDA finds

the potential application in precise measurement of loss distribution along the optical fiber. Another application we proposed was for measuring loss distribution of branched fibers of Passive Optical Network (PON) for subscriber lines. The BFS of optical fibers depends on dopant concentration as well as on fiber structures. This feature can be advantageously used for measuring the distribution of loss or other parameters of each branched fiber with differently shifted frequency by detecting the respective Brillouin scattering in frequency-discriminative way. We demonstrated the proof-of-principle experiments by constructing a set-up to measure local spontaneous Brillouin scattering with the frequency resolvable coherent detection. We call this measurement method Brillouin optical time domain reflectometry (BOTDR). Take note that conventional OTDR technique never evaluate branched fibers in the discriminative way since the Rayleigh scattering from the branched fibers, being simultaneously incident on the detector of OTDR, has the same frequency. We have further developed a way to measure change in strain and temperature across the optical fiber. This technique relies on finding that BFS depends on strain and temperature and that BOTDA and BOTDR can measure local Brillouin spectrum across the optical fiber [1]. This sensing technique will be described in detail in the following sections.

## 3. BFS dependence on strain and temperature

Our research group also aimed at developing truly distributed strain measurement technique that had never been established by then. This was because strain measurement is very important to assure the reliability of optical fibers used for communication systems. This was increasingly important as large capacity and high count optical fiber cables were required for trunk lines and subscriber loops.

The BFS  $\nu_b$  is given by  $\nu_b = 2nV_a/\lambda$ , where  $\lambda$  is the pump wavelength,  $n$  refractive index of the fiber, and  $V_a$  acoustic velocity. So, we expected that BFS should change with strain as well as temperature since environment should affect the acoustic velocity and the refractive index. As a matter of fact, we could experimentally obtain the BFS dependence on strain and temperature: 0.05 MHz /  $\mu$ -strain and 1 MHz / degree [2], [3]. By clarifying both the characteristics, we became to be able to accurately predict the BFS change of jacketed or cabled fibers due to temperature change since the jacket or the cable structure cause tensile/compressive strain in the fibers with the temperature change. Soon after the reports, we

demonstrated the first truly distributed strain and temperature measurement across optical fibers based on BOTDA with a spatial resolution of 100 m.

We also constructed a portable BOTDA with engineers of Ando Electric Co., Ltd. (now Yokogawa Electric Corporation), which helped us get a lot of data especially in the field.



Fig. 1 Portable BOTDA

#### 4. Examples of distributed strain measurements

To the best of our knowledge, we were the first to measure the distributed strain of an optical communication fiber cable installed in a conduit [4]. The cable was installed between two cities: Mito and Kasama in Ibaraki Prefecture, Japan. Measurements for reference were also performed before installing the cable through the courtesy of NTT Ibaraki. Measurements showed that the residual strain due to the installation was less than  $7 \times 10^{-4}$ , confirming the high reliability of the installed cable.

We also evaluated strain occurring in bent slot-type optical fiber cables. The high-count optical fiber cables developed for subscriber loops and trunk transmission lines at that time had employed a cylindrical rod with several slots having a helical pitch across the cable. In the slots, several sheets containing four parallel fibers were stacked. The optical fiber sheets, or fiber ribbons, were designed to move along the slots so that the bending should not exert large tensile and compressive strain in fibers. However, it was difficult for the conventional method, called time-of-flight (TOF) method, to measure the tensile and compressive strain occurring simultaneously since the TOF method measures the time it takes for lightwave to travel through the fiber. The average time cancels out even for long bent cables. In contrast, Brillouin technique can evaluate the strain change from the increase in the Brillouin spectrum width since the tensile and the compressive strain increases and decreases the BFS, respectively. Experiments validated that our Brillouin technique is a powerful tool for developing highly reliable optical fiber cables.

Another example is measurements of optical fiber cables installed in a conduit which water happens to fill and then freezes. Local freezing and expansion of water may occur due to uneven temperature fall below zero in areas of intense cold and thus may damage the optical fiber cable due to a pressure occurring by the expansion. We encountered such case when we investigated the failure cause of optical fiber transmission lines in Hokkaido region. With BOTDA, we observed there a

strain as large as  $2 \times 10^{-3}$  occurring in a short section of the fiber. We never observed such large residual strain due to laying the cable. We soon performed experiments in NTT Tsukuba R&D center and reproduced the large strain, confirming that freezing water could exert critical strain in installed cables, and that this can be detected before cable failure by monitoring with BOTDA [5].

#### 5. High spatial resolution and fast measurement

It was expected that the Brillouin technique would find applications of distributed sensors in a similar way to the way Raman OTDR, or distributed temperature sensor (DTS) did. However, the spatial resolution of BOTDA and BOTDR of early days was about one meter at best. This is because narrowing the pulse width to less than 10 ns (1m spatial resolution) increasingly makes it difficult to measure BFS accurately; short pulse having a width of less than 10 ns broadens the Brillouin spectral width; then Brillouin signal intensity drops in inverse proportion to the broadened Brillouin spectral width. These effects can be accounted for by the fact that the amplitude of an acoustic wave involving Brillouin scattering decays with a time constant of about 10 ns in silica fibers. One meter of the spatial resolution was not satisfactory to most of applications of monitoring strain in civil structures. In addition to the spatial resolution, BOTDA and BOTDR of early days had a difficult problem of measurement time. Their measurement speed was slow so that they could only measure quasi-static strain, not dynamic strain. These problems had prevented BOTDA and BOTDR from being widely used for distributed fiber sensors in many fields.

However, a new approach, proposed by Hotate and Hasegawa, solved the problems in an elegant way called Brillouin optical correlation domain analysis (BOCDA) [6]. BOCDA has already achieved 1.6 mm spatial resolution and 1 kHz sampling speed. The measurement distance of BOCDA also has been extended with maintaining its high spatial resolution and fast sampling speed [7].

More recently, time domain measurement technique such as BOTDA and BOTDR also has achieved a spatial resolution of less than one meter by devising pulse configurations and signal processing methods to prevent the Brillouin spectrum width from broadening. My laboratory of Shibaura Institute of Technology also has studied on such techniques: phase shift pulse BOTDA (PSP-BOTDA) and its coding. These will be described in the next section.

#### 6. PSP-BOTDA and coding

In 1999, it was found experimentally that weak continuous-wave (cw) and a short pulse pump of high intensity yield a narrow Brillouin spectrum [8]. This is because the weak cw plays a role of pre-pump and excites the acoustic wave that backscatters the short pulse efficiently. Based on this finding, pre-pulse pump BOTDA (PPP-BOTDA) [9] was reported by Kishida et al. PPP-BOTDA has employed a long pulse instead of

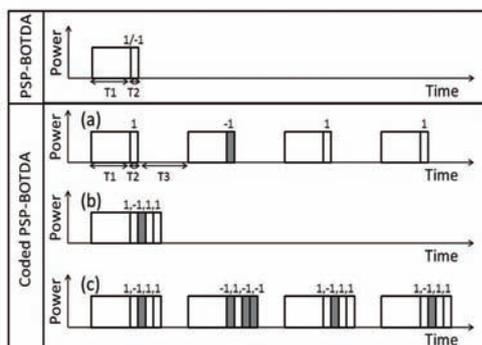


Fig. 2 Pulse pump of PSP-BOTDA

cw light as the pre-pump; and it has carefully set the intensity of the pre-pulse pump far below that of the following short pulse pump; thus the local Brillouin spectrum should not be exerted by those of other sections. In order to use the pre-pulse pump more efficiently, we have devised a pair of pulse pump of high intensity: 0-shift pump and  $\pi$ -shift pump, as shown in the top of Fig. 2. The former is composed of long and short pulses without phase shift while the latter with phase shift of  $\pi$ . So, we have called this method PSP-BOTDA [10]. Subtraction of the Brillouin signals obtained with the pair of pump enables measurement with the high spatial resolution determined by the short duration  $T_2$ . In addition, the Brillouin spectrum width measured is as narrow as that for the cw pump.

We have also reported coding the pulse pump of PSP-BOTDA to improve its signal-to-noise ratio (SNR). The increase in SNR will make measurement faster as well as more accurate. We also expect that for safe operation of BOTDA the coding will allow us to avoid launching an optical pulse of more than 1-W in peak power. We have proposed and demonstrated three types of coding for PSP-BOTDA as shown in the bottom of Fig. 2: (a) Return-to-Zero (RZ) pulse coding, (b) Non-Return-to-Zero (NRZ) pulse coding, (c) coding by combining RZ and NRZ pulses [11]. We have achieved 10 cm of spatial resolution based on these coded PSP-BOTDAs. To the best of our knowledge, we were the first to demonstrate such a high spatial resolution based on coded BOTDA. Now we are focusing on making faster measurement and extending measurement distance by using these coded BOTDAs

## 7. Conclusion

Brillouin scattering can be advantageously used to characterize optical fiber cables and to sense distributed strain/temperature across optical fibers. The distributed sensing technique continues to seek for enhancing performance in measurement time, distance, spatial resolution and accuracy of frequency measurement.

## 8. Acknowledgment

I wish to thank the R&D members of NTT for their contributions to this work during my study in NTT Laboratories. I also thank my students of Shibaura

Institute of Technology for their contributions to studying PSP-BOTDA and its coding.

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# Report on the Twelfth International Workshop on Assurance in Distributed Systems and Networks (ADSN2013)

Yoshiaki Kakuda  
Hiroshima City University



## 1. Introduction

The International Workshop on Assurance in Distributed Systems and Networks (ADSN) was initiated in Vienna, Austria in 2002, and after the great success of eleven continent events, the twelfth workshop was held in Philadelphia, USA on July 8, 2013 in conjunction with the 33<sup>rd</sup> IEEE International Conference on Distributed Computing Systems (ICDCS). The ADSN series were sponsored by the IEEE Computer Society Technical Committee on Distributed Processing in cooperation with the IEICE Technical Committees on Information Networks and Dependable Computing. The details of the workshop are seen in [1].

## 2. Objective and Definition of ADSN

The objective of the workshop is to provide an effective forum for original scientific and engineering advances in Assurance in Distributed Systems and Networks. In distributed systems and networks, heterogeneous requirements are independently generated and the requirements themselves are frequently changing. Assurance in distributed systems and networks is defined as capability of guaranteeing functional and nonfunctional properties such as dependability, security, timeliness and adaptivity to heterogeneous and changing requirements.

## 3. ADSN2013 Organization

ADSN2013 organizers are as follows.

General Chair: Miroslaw Malek, University of Lugano, Vice Chair: Yoshiaki Kakuda, Hiroshima City University

Program Chair: Chin-Tser Huang, University of South Carolina, Vice Program Chairs: Hidenori

Nakazato, Waseda University, Kaliappa Ravindran, CUNY City College of New York, Felix Salfner, SAP

The Program Committee consists of 25 members from Asia, Europe and Americas.

## 4. ADSN2013 Program

Twelve papers have been submitted to the workshop. As a result of comprehensive reviews by the Program Committee, seven high quality papers were selected to be included in the program of ADSN2013 [2].

The program consists of the following three sessions.  
Session 1: Assurance in Wireless Networks  
(Chair: Supratik Mukhopadhyay) 3 papers  
Session 2: Assurance in Data Processing  
(Chair: Kenji Ishida) 4 papers  
Session 3: Panel Discussion on Assurance in Future Distributed Systems and Networks  
(Chair Chin-Tser Huang) 3 panelists

About twenty participants joined the workshop and enjoyed paper presentations and a panel discussion.

## 5. Panel Discussion

In the panel discussion, the panelists Yoshiaki Kakuda, Wojciech Golab, University of Waterloo and Feng Li, Indiana University-Purdue University at Indianapolis discussed assurance in future distributed systems and networks (see Fig. 1). They introduced the concepts of assurance networks [3], consistent storage systems, moving target defense, respectively.

## 6. Summary

This report has concisely explained ADSN2013, which is the longest workshop in ICDCS2013. We are grateful to the founder of ICDCS, Ming T. (Mike) Liu, Ohio State University for his continuous advice and support to ADSN. We have a plan to propose ADSN2014 to be held in Madrid, Spain in June/July, 2014 in conjunction with ICDCS2014.

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Fig. 1 Panel Discussion

# Report on 2013 IEICE Information and Communication Technology Forum (2013 IEICE ICTF)

Amir Ligata  
IPSA Institute, Bosnia and Herzegovina



## 1. Introduction

2013 IEICE Information and Communication Technology Forum (ICTF2013) has been held on 29<sup>th</sup> – 31<sup>st</sup> of May 2013, at Hotel Europe in Sarajevo the capitol of Bosnia and Herzegovina. Sarajevo is one of the most important cultural centers on the Balkans, often called “Europe’s Jerusalem” due to its cultural diversity and very eventful history.

The Forum was organized by IEICE Europe Section and technically sponsored by the IEICE. In addition, the Forum has been technically sponsored by Communications Society of IEICE (IEICE-CS).

The aim of ICTF2013 was to gather researchers in Europe around IEICE Europe Section and encourage the collaboration of national and research institutions outside Europe. The Forum also promoted the IEICE Europe Section and its activities in Europe.

## 2. ICTF 2013 program

Professors and researchers from Japan, China, UK, France, Belgium, Denmark, Switzerland, Slovenia, Serbia, Montenegro, Poland, Romania and Bosnia and Herzegovina, in their presentations addressed the most recent issues in information and communication technologies making a very interesting ICTF 2013 program.



Fig. 1 Dr. Haris Gacanin opening remarks.



Fig. 2 Invited speech by Dr Yuji Inoue.

The Forum has been opened by Dr. Haris Gacanin, IEICE Europe Section Chair (see Fig. 1). Dr. Gacanin expressed his joy with the organization of ICTF 2013 and underlined that the number of Forum participant is increasing year by year, as the quality of presentations is improving. He stressed that the IEICE Europe Section is working hard on promoting its activities and that it is gaining significant attention in Europe as more people are joining organization.

The ICTF 2013 program covered three main categories;

- Communications;
- Engineering;
- Electronics.

The Forum consisted of keynote, industry and invited speeches and technical paper presentations which were accepted for presentations on ICTF 2013.

The Forum presentations started with the keynote speech of Dr Yuji Inoue, (IEICE President and Toyota ICT) entitled “Inter-industry Innovation”. In his talk, Dr Yuji Inoue (see Fig. 2) stressed the importance of change of industry formation from competition basis to collaboration basis, not only within the same industry but among different industries.



Fig. 3 Invited speech by Professor Fumiyuki Adachi.

The second keynote speech was provided by the ICTF 2013 General Chair, Professor Fumiyuki Adachi, (Tohoku University) entitled “Disaster-resilient Multilayered Communication Networks” (see Fig. 3). Prof. Adachi gave an overview of the research efforts in order to design a new communication system in the case of a disaster or emergency. Final keynote speech was given by Professor Maciej Stasiak (Poznan University of Technology, Poland) with title “Modeling Traffic Control Mechanism in Mobile Networks”. In his talk, Professor Stasiak (see Fig. 4) addressed the issues of analytical modeling interfaces in the radio access network.

The Industry speakers from Docomo Beijing Labs, Toshiba Research Europe, Alcatel-Lucent Bell N.V. and Bell-Labs provided very interesting recent topics in the area of communications and information technologies.

Over 40 participants visited the Forum during two days making a very successful event. The Forum speakers expressed their joy with the quality of presentations and the event organization.

At the end of the second day, Dr. Haris Gacanin gave the closing remarks. He expressed his delight with the ICTF 2013, and gratitude to all speakers who made this year event a true success.

### 3. IEICE Europe Section

At the end of the first day the IEICE Europe Section held its meeting. On this meeting following issues were discussed:

- IEICE Europe Section in 2013-2015;
- Events in 2014-2015;
- Election of IEICE Europe Section General Secretary;
- Special issue of IEICE Transactions on Communications;
- New activities.



Fig. 4 Invited speech by Professor Maciej Stasiak.

Dr Piotr Zwierzykowski from Poznan University of Technology (Poland) has been elected as General Secretary of IEICE Europe Section.

It has been decided that starting from next year, the Forum will move on, from Sarajevo and different cities are considered as hosts in the forthcoming years. For 2013, that will be Poznan, Poland, while for 2014 the IEICE Europe Section received proposal from Manchester Metropolitan University (UK).

### 4. Future Event

The next Forum “2014 IEICE Information and Communication Technology Forum” will be held on 29<sup>th</sup> and 30<sup>th</sup> of May, 2014 in Poznan, Poland. Dr Piotr Zwierzykowski (ICTF 2014 Organizing Committee Chair) gave a very nice presentation on the next year host, Poznan city. The detailed information on 2014 IEICE ICTF will be distributed to IEICE members and provided on the web page, once defined.

Dr Bamidele Adebisi proposed Manchester Metropolitan University (UK) as host of IEICE ICTF 2014. In addition, Dr Adebisi gave a presentation of the University and town of Manchester.

# Report on CLEO-PR & OECC/PS 2013

Kenko Taguchi<sup>†</sup>, Kimio Oguchi<sup>‡</sup>, and Akihiro Maruta<sup>#</sup>

<sup>†</sup> Kyoto University, <sup>‡</sup> Seikei University, <sup>#</sup> Osaka University



## 1. Introduction

CLEO-PR & OECC/PS 2013 conference was held from June 30<sup>th</sup> through July 4<sup>th</sup>, 2013 at the Kyoto International Conference Center, Kyoto, Japan (Fig. 1). The conference brought together international leading researchers, scientists and engineers who have been actively working in lasers and their applications, nanophotonics, optical devices, optical transmission and optical networking, optical fibers, optical switching system, and related technologies. For the first time, the conference combined the following three major international conferences, which widely covered in the field of “optics (photonics)” from lasers and devices to systems and networks.



Fig. 1 Kyoto International Conference Center

- The 10<sup>th</sup> Conference on Lasers and Electro-Optics Pacific Rim (CLEO-PR 2013)
- The 18<sup>th</sup> OptoElectronics and Communications Conference (OECC 2013)
- Photonics in Switching 2013 (PS 2013)

The combination of these conferences made this the most significant and valuable conference for participants from all over the world, and also provided forums for the discussion of significant progress of research and development of appropriate technologies.

CLEO-PR 2013 was cosponsored by IEICE Communications Society, IEICE Electronics Society, and The Japan Society of Applied Physics, and technically cosponsored by IEEE Photonics Society, the Optical Society, Optical Society of Korea, and the Korean Physical Society. On the other hand, OECC/PS 2013 was cosponsored by IEICE Communications Society and IEICE Electronics

Table 1 Statistics of CLEO-PR&OECC/PS2013

|                              |                      |
|------------------------------|----------------------|
| Submitted contributed papers | 1,180 (40 countries) |
| Accepted contributed papers  | 968 (82.0%)          |
| Oral presentation papers     | 588 (49.8%)          |
| Poster presentation papers   | 380 (33.2%)          |

Society, and technically cosponsored by IEEE Photonics Society, IEEE Communication Society, and The Optical Society.

## 2. Outline and results of the Conference

Statics of the conference is summarized in Table 1. As shown in this table, 1,180 papers (CLEO-PR: 625, OECC/PS: 328, JOINT: 227) were submitted to the conference from all over the world (40 countries), and each paper was reviewed by each category expert researchers. After the review, total 968 papers were accepted for the oral (588) and poster presentation (380), hence the total acceptance ratio of the conference was 82%. The accepted 588 oral papers were categorized into 19 technical scopes. The technical scopes were:

(For CLEO-PR 2013 scopes)

- C1. Solid State, Fiber, and Other Laser Sources
- C2. Ultrafast and Nonlinear Phenomena
- C3. Infrared and Terahertz Technologies and Applications
- C4. High Power, High Energy Lasers
- C5. Laser Processing
- C6. Optical Metrology and Sensing
- C7. Quantum Optics, Quantum Information
- C8. Nitrides, Other Widegap Semiconductors and Emitters
- C9. Nanophotonics
- C10. Biomedical Photonics

(For OECC/PS2013 scopes)

- OP1. Access Network
- OP2. Core Network
- OP3. Transmission Systems and Their Subsystems
- OP4. Optical Fibers, Cables and Fiber Devices
- OP5. Optical Switching Systems and Related Technologies

(For joint sessions of CLEO-PR and OECC/PS)

- J1. Semiconductor Active Optical Devices
- J2. Optical Passive Devices and Modules
- J3. Silicon Photonic Platform
- J4. Optical Signal Processing

The conference was started with the six workshops in the afternoon of June 30: C-Special. Photon Frontier Network, J1. Optical Interconnects II: Challenges and Opportunities for Ultra-dense Inter-Chip and On-Chip Interconnects, J4. Optical Interconnects I: State-of-the-art Optical Interconnects: Moving from the Rack to the Chip, OP1. What will be Killer Devices and Components for the Next-generation Optical Access



Fig. 2 Plenary session



Fig. 3 Discussion after presentation

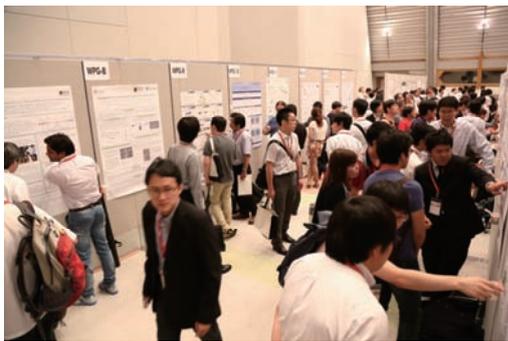


Fig. 4 Poster session

Networks?, OP2+OP5. Software Defined + Elastic Optical Networks =?, OP3+OP4. Future Perspective of Photonic Transport Network (Part I: Beyond 100G Technologies and Standardization / Part II: Space Division Multiplexing for Petabit / Fiber Transmission).

The plenary session was organized on July 1<sup>st</sup> (Fig. 2). In the first, Prof. A. Asai, the University of Tokyo, addressed recent research topics about Higgs Boson: Dawn of physics to explore the vacuum. The second by Dr. M. D. Feuer, AT&T Labs, presented space-division multiplexing – Do we have a choice? The third by Prof. Y-H. Lee, KAIST, addressed toward the smallest possible laser & resonator. The fourth by Prof. K. Kikuchi, the University of Tokyo, introduced coherent optical communications: past, present and future. The fifth by Prof. Z. Zhang, UCB, addressed photonics beyond diffraction limit: plasmon waveguide, cavities and integrated laser circuits.

In the technical sessions, there were 1114 presentations (Fig. 3) in 152 technical sessions (4 days 12 parallel tracks) with including two poster sessions (Fig. 4), 9 tutorial sessions (Attosecond Optics – from genesis to revelation by Z. Chang, Digital signal processing for coherent optical communication systems by S. J. Savory, Hollow core photonic crystal fiber



Fig. 5 Banquet at Grand Prince Hotel Kyoto

optical guidances and applications by F. Benabid, Software-defined optical access networks for multiple broadband access solutions by N. Cvijetic, Femtosecond laser processing for biochip applications by K. Sugioka, Challenges and opportunities of photonic networking technologies by K. Sato, Frequency combs and applications by T. Udem, The role of photonics in future computing systems and data centers by S. J. B. Yoo, and Optical fiber cable technology and related study items toward space division multiplexing by M. Ohashi) and 22 symposium sessions (9 topics: C1-1. Laser Display, C1-2. Novel Fiber Designs for Lasers, C4. High Power Lasers and Applications, C5. Biochip Fabrication by Femtosecond Laser, C6. New Trends in Frequency Comb: Application of Light with Ultraprecision, C8. New Frequency, Novel LDs and LEDs-Innovative Works on Widegap Semiconductors-, J1-J3. High-density Photonic Integration Platforms and Their Applications, OP1. Recent R&D Activities of Telecommunication Technologies for Resilient and Sustainable Society, OP4. Fiberoptic Technologies for the Next Era (Part I: New Fiber Amplifiers / Part II: Mode Control Technology).

On July 3, we enjoyed the banquet where the Grand Prince Hotel Kyoto was offered and Japanese traditional dance was performed by Geiko- & Maiko-san (Fig. 5). And, the best paper awards (15, one paper in each sub-committee) and the best student/young scientist paper awards (15, one paper in each sub-committee) of CLEO-PR & OECC/PS 2013 were introduced in the banquet.

The post deadline papers of 64 were submitted to the conference from all over the world and each paper was reviewed by the technical committee members. After the review, total 14 papers were accepted. The post deadline paper presentations were performed with 3 parallel sessions on July 4, the last day.

### 3. Conclusion

CLEO-PR & OECC/PS 2013 was closed with great success. Finally 1,469 participants (registrations) with including 622 international participants (about 42%) and 459 students (about 31%) have enjoyed discussion in this conference.

CLEO-PR 2015 is announced to be held at Busan, Korea, OECC/ACOFT 2014 at Melbourne, Australia, and PS 2014 at San Diego, USA and PS 2015 at Florence, Italy.

# Summer Topicals 2013 – Space-Division Multiplexing for Optical Communication

Kunimasa Saitoh<sup>†</sup> and Takashi Sasaki<sup>‡</sup>

<sup>†</sup>Hokkaido University

<sup>‡</sup>Sumitomo Electric Industries Ltd.



## 1. Introduction

The IEEE Photonics Society annually organizes two Topical Meetings, which are the Summer Topicals and the Winter Topicals. The Topical Meetings of the Photonics Society are the premier conference series for exciting new areas in photonic science, technology, and applications, creating the opportunity to learn about emerging fields and to interact with the research and technology leaders in an intimate environment. The conference topics are selected from emerging new areas in which a focused meeting of interested researchers will help sustain and grow new topical areas.

This year the Summer Topicals were composed of five different meetings. The “Space-Division Multiplexing for Optical Communication” (SDM) was one of the selected topics. This topic was also adopted in the last year Summer Topicals 2012, so this Summer Topicals 2013 on SDM was the second successive meeting. The topic co-chairs were Benn Thomsen (University College London) from Europe, Roland Ryf (Alcatel-Lucent Bell Labs) from USA, and Takashi Sasaki (Sumitomo Electric Industries) from Japan. It was technically co-sponsored by Technical Committee on Extremely Advanced Optical Transmission Technologies (EXAT), IEICE, Japan, working for 3-M (multi-core, multi-mode, multi-level) technology lead. The meeting was held at Hilton Waikoloa Village, Hawaii, USA from July 8<sup>th</sup> to 10<sup>th</sup>, 2013. It was located on the Big Island of Hawaii, and the hotel has an impressive 62 acres of oceanfront views as shown in Fig. 1. The number of pre-registered person was 140 and in total approximately 200 participants enjoyed stimulated discussion on SDM.



Fig. 1 Conference site in Waikoloa, Hawaii

## 2. Why Space-Division Multiplexing?

We experience Internet traffic growth of 100 times every 10 years. The capacity of existing standard single-mode fiber is approaching its limits regardless of significant realization of transmission technologies which allow for high spectral efficiencies. Space division multiplexing (SDM) has emerged as a solution to the problem of saturation of the capacity of optical transmission systems. The idea behind SDM is to transmit simultaneously over several different spatial modes of propagation, and the research community is exploring in parallel several different avenues that would allow this to happen; the use of fibers comprising multiple cores, multimode fibers, and even the use of optical vortices are the prime examples. In addition, it is essential that the capacity increase should be generated at lower cost with reduced energy consumption. The Summer Topicals on SDM was intended to address the implications of SDM on optical communication networks at various levels, such as the top down perspective, the subsystem perspective, and the transmission perspective. The program agenda of this meeting is shown in Table 1. There were 3 plenary talks, 15 invited talks, and 22 contributed talks. The number of technical sessions was 12 slots and there was no vacant slot for three days.

Table 1 Program agenda

| Date    | Session   |
|---------|---|
| 8 July  | MC1: The Next Frontier<br>MC2: Multicore Fiber Design and Components<br>MC3: Few Mode Fiber Design<br>MC4: Spatial Modes<br>Welcome Reception               |
| 9 July  | TuC1: Multicore Systems<br>TuC2: Modal Multiplexers<br>TuC3: Spatial Amplification<br>TuC4: New Fiber Structures  |
| 10 July | WC1: Networks: Opportunities and Challenges<br>WC2: Few Mode Fiber Transmission<br>WC3: Multicore Fiber Transmission<br>WC4: MIMO Digital Signal processing |

### 3. Plenary Talks

In the morning session on each day, the session started with a plenary talk. Three distinguished speakers (Fig. 2) were invited from Europe, Japan, and USA, respectively. The following is the list of the plenary talks.

- “Unleashing the Spatial Domain in Optical Fiber Communications”, Prof. David J. Richardson, University of Southampton, Southampton, UK.
- “Recent Progress in Space-Division Multiplexing R&D in Japan”, Dr. Masatoshi Suzuki, KDDI R&D Laboratories, Saitama, Japan.
- “SDM Pipes: Fibers to Enable Network Scaling”, Dr. David J. DiGiovanni, OFS Laboratories, Somerset, NJ, USA.

On the first day, 8<sup>th</sup> July, Prof. Richardson reviewed recent progress on SDM researches to date and discussed some of the technological/commercial challenges and opportunities that lie ahead. He also explained two fundamental attractions of SDM. Firstly, it offers a means to increase the information flow-per-unit-area by allowing a more intimate proximity of information channels than conventional fibers, and thereby increased per-fiber capacity. Secondly, the increased information flux should allow for far higher levels of device integration than possible in single-mode fiber based systems, thereby promising a lower cost-per-bit and reduced energy demands.

On 9<sup>th</sup> July, the second plenary talk was given by Dr. Suzuki. In Japan, in order to break the capacity limit of current optical communication system, a study group called “EXAT” was organized in 2008, and based on the suggestion of EXAT, two national projects on SDM have been started. One was a three-year (FY2010-2012) project on R&D of innovative optical fibers. Another is a five-year (FY2011-2015) project on R&D of innovative infrastructure for optical communications, which is the ongoing project. He talked about the needs of SDM technologies as a carrier perspectives followed by recent achievements in these R&D projects in detail.

On 10<sup>th</sup> July, Dr. DiGiovanni presented the third plenary talk. In order to realize integration of parallel data streams, whether in multiple waveguides or multiple optical modes, special fibers are required. He reviewed the opportunities for such fibers for applications from short interconnections to long-haul transmission.



Fig. 2. Plenary speakers: from the left, Prof. David J. Richardson, Dr. Masatoshi Suzuki, and Dr. David J. DiGiovanni

### 4. Technical Sessions

The technical sessions were held in the hotel room “Kohala III” in Hilton Waikoloa Village. From Europe, two invited papers and five contributed papers were presented. On the other hand, from Asia-Pacific region (Japan and Australia), six invited papers and nine contributed papers were presented. Also, from USA, six invited papers and eight contributed papers and one tutorial were presented. Table 2 shows the summary of the number of papers from Europe, Asia-Pacific, and USA.

Regarding the multicore fiber, Mr. Katsuhiro Takenaga from Fujikura and Mr. Tetsuya Hayashi from Sumitomo Electric Industries presented invited talks on the multicore fiber design and Mr. Ryuichi Sugizaki from Furukawa Electric talked on the multicore fiber amplifier. For the few-mode fiber design, Dr. Yi Sun from OFS and Dr. Ming-Jun Li from Corning presented their recent works as invited speakers. Prof. Siddharth Ramachandran from Boston University presented a nice tutorial talk on mode content and properties in a fiber. Invited talks on mode multiplexers were given by Dr. Joel Carpenter from University of Sydney and Dr. Nicolas Fontaine from Bell Laboratories, and Dr. Peter Winzer from Bell Laboratories presented interesting invited talks on capacity considerations for optical MIMO-SDM systems. In addition, as for the new fiber structures, invited talks on orbital angular momentum and hollow-core photonic bandgap fibers were presented by Dr. Steven Golowich from MIT and Dr. Francesco Poletti from University of Southampton, respectively. For the transmission technology, Dr. René-Jean Essiambre from Bell Laboratories and Mr. Vincent Sleiffer from Eindhoven University of Technology presented invited talks on few mode fiber transmission, and Dr. Itsuro Morita from KDDI and Dr. Akihide Sano from NTT presented invited talks on multicore fiber transmission.

Table 2 Summary of the number of papers

|              | Plenary | Invited             | Contributed |
|--------------|---------|---------------------|-------------|
| Europe       | 1       | 2                   | 5           |
| Asia-Pacific | 1       | 6                   | 9           |
| USA          | 1       | 6<br>(+ 1 Tutorial) | 8           |
| Total        | 3       | 15                  | 22          |

### 5. Conclusion

Summer Topicals 2013 on SDM for optical communication was successfully organized and in total 40 talks were presented. The active leaders at the front of SDM research community from Europe, Japan, and USA have gathered in Hawaii and lots of constructive and fruitful discussions were performed. The next year topic of Summer Topicals has not been determined yet, but SDM will be a good candidate again for the “hot topic” in next summer.

# Report on URSI Commission B 2013 International Symposium on Electromagnetic Theory

Makoto Ando  
Tokyo Institute of Technology



## 1. Introduction

The “2013 URSI Commission B, International Symposium on Electromagnetic Theory” (EMTS 2013) was held in Hiroshima, Japan, from May 20 to 24, 2013. It was organized by Commission B (Fields and Waves) of the International Union of Radio Science (URSI) and the Electronics Society (ES) of The Institute of Electronics, Information and Communication Engineers (IEICE). EMTS 2013 is the 21st event in a triennial series of international symposia with a long history since 1953, and this is the first time held in Japan. After more than 20 years campaign of invitation by the members of technical commission of EMT in IEICE, we had the chance to host this historical event of URSI EMTS. It was technically sponsored by URSI, one of the members in ICSU, Japan National Committee of URSI, IEEE Antennas and Propagation Society (AP-S) and IEICE Communication Society, while it was in cooperation with Science Council of Japan, the Institute of Electrical Engineering of Japan (IEEJ). Local organizations such as Hiroshima City, Hiroshima Convention & Visitor Bureau, Hiroshima City University together with the local companies and artists provided the strong supports both in the invitation campaign and throughout the Symposium.

Main symposium venue was the International Conference Center Hiroshima (ICCH), located in Peace Memorial Park, where we had Opening Reception, Opening Ceremony, all Technical (oral and poster) Sessions, Technical Exhibitions, and Plenary Talks, as well as Commission B Business Meetings. On the third day, the venue was moved to Aki Grand Hotel at Miyajima-guchi, and two Plenary Talks and Poster

Presentations by YSA awardees were given. After these sessions, registrants have enjoyed a late-afternoon Miyajima-island visit, followed by the Banquet at the ANA Crowne Plaza Hiroshima Hotel.

## 2. Organization

Historically, EMTS has the internationally organized the Technical Advisory Board under the Commission B chair (B-TAB) as the standing Technical Program Committee for the series of EMTS. Prof. Giuliano Manara (Pisa Univ.) is serving as the current chair. Local organization committee (LOC) formed in ES-IEICE, with the Co-chairs Prof. Tsuneki Yamasaki (Nihon Univ.) and Prof. Makoto Ando (Tokyo Inst. of Technology) was responsible for the Symposium including finance. LOC consists of International Advisory board (IAB), Organizing committee for fund raising, local committee for technical program and Steering committee in Table 1. Mr. Keisuke Hisasue of DUPLER CORP and Mr. Takami Aizawa of Real Communications served as EMTS 2013 Japan Secretariat.

## 3. Opening Ceremony and Reception

Opening Ceremony was held on Tuesday, May 21, 2013 chaired by Prof. Hiroshi Shirai. It consists of

1) Welcome address: (Fig. 1)

- \*Giuliano Manara (Chair, URSI Comm.B)
- \*Makoto Ando (Co-Chair, EMTS 2013 LOC)
- \*Kiyomichi Araki (President, IEICE ES)
- \*Piergiorgio L. E. Uslenghi (Vice President, URSI)
- \*Tapan K. Sarkar (President-Elect, IEEE Antennas and Propagation Society)



Fig. 1 Opening Ceremony



Fig. 2 Banquet at ANA Crowne Plaza Hiroshima

## 2) Announcement:

\*Prof. Masahiro Nishi (Hiroshima City University)

Before starting the Symposium, Opening reception was held for all participants on Monday 20, 2013.

After the welcome speech from Prof. Manara, about 200 participants enjoyed free drinks and light snacks.

## 4. Conference Statistics

We have received 338 paper submissions and totally 368 persons including 28 accompany persons from 31 countries have attended the Symposium. Total of 290 papers (110 from Japan, 180 from outside Japan) were presented in 54 Technical Sessions and 5 invited Plenary Talks. The statistics are presented in Table 2. Noteworthy is that about 2/3 of papers are coming from foreign countries and the Symposium was really international.

## 5. Conference Schedule and the Miyajima Day

The 5 day Conference schedule is given in Table 3. On May 22, LOC planed the special event of the leisurely walk on the island of Miyajima for more than 200 participants including their accompany persons in this symposium. After 2 plenary talks and YSA poster sessions in the AGH, all attendees went to Miyajima by bus and ferry and enjoyed free walking for two and half hours from 14:30 to 17:00. They could go to Itsukushima Shrine of world heritage and watch the big torii gate located in the sea. After walking on Miyajima, they went back to downtown Hiroshima by ferry and bus, most of them attend the Banquet held at ANA Crowne Plaza Hiroshima. (Fig. 2)

## 6. Activities for Young Scientists

Total of 24 Young Scientist Award (YSA) papers were selected from 45 applications and local costs of travel and stay were covered. Countries of Awardees are: Italy(3), Japan(3), Sweden(3), Russia(3), Israel(2), Czech Republic(1), Finland(1), France(1), Germany(1), India(1), Saudi Arabia(1), Switzerland(1), Ukraine(1), United Kingdom(1), USA(1).

Three papers were selected among these as YSA best paper awards as in Table 4. (Fig. 3)



Fig. 3 YSA Best Paper Awards

In conjunction with this symposium, the “URSI Commission B School for Young Scientists” was organized for the first time. This one-day School was held on May 20 at ICCH, prior to the symposium, and is sponsored jointly by URSI Com. B and LOC. Two fundamental lectures were delivered to about 50 attendees by two leading scientists. This school is adding a new history in series of EMTS. (Fig. 4)

1) "The Method of Moments (MoM) Applied to Problems in Electromagnetic Scattering, Radiation, and Guided Waves," by D. R. Wilton (Univ. of Houston, USA).

2) "A Summary of Asymptotic High Frequency (HF) Methods for Solving Electromagnetic (EM) Wave Problems," by P. H. Pathak (Ohio State Univ., USA).

## 7. Banquet/YSA Ceremony and Tours

The EMTS 2013 Banquet was held at "ANA Crowne Plaza Hiroshima" on Wednesday, May 22, 2013 with the big attendees over 250. It starts with the performance of Koto and Shakuhachi by Mr. and Mrs. Nakagawa in Hiroshima, the Prize winner of all-Japan contest, and the Japanese traditional pieces “Haruno Umi” and “Kibitaki no Mori” were played. (Fig. 5) After the welcome speech by Giuliano Manara of Comm. B, Teruaki Yoshida of Hiroshima City Univ. as Vice Chair of LOC and Mr. Kazumi Matsui, the current Mayor of Hiroshima City followed by the toast by Akira Ishimaru of Washington Univ., attendees enjoyed the local foods and drinks. The Kagura, a traditional form of music and dance dedicated to Shinto Gods was performed. The second part of the banquet was the award ceremony where 24 YSA are introduced and 3 papers are awarded as the best papers and the certificates and prize money were presented. Before closing the Banquet, Ari Sihvola, made the invitation to next EMTS in 2016 in Espoo Finland as its general chair. (Fig. 6)

As for the technical tour on Monday, 18 participants made the visit to Mazda. Special course for EM engineers were prepared which included three 20min technical presentations in EM-related



Fig. 4 URSI Commission B School for Young Scientists



Fig. 5 Performance of Koto and Shakuhachi



Fig. 6 Prof. Sihvola

topics and their long-term vision “zoom zoom”. On Wednesday, an accompanying persons tour was conducted. The 23 participants made the sightseeing at Miyajima and walked up the mountain to Momijidani station and went to Shishi Iwa by the Miyajima Ropeway, which commands the top view of the beautiful Seto Inland Sea. Finally this tour for accompanying persons merged into the program for the symposium attendees to continue the leisure walk. (Figs. 7 and 8)

### 8. Other Activities

Commission B business meetings were held twice during the symposium, each with about 50 participants, and the future activities of URSI were discussed. B-TAB, IAB and plenary speakers as well as VIP meeting was held in casual and Japanese style “Izakaya” which was also a good chance for LOC members to communicate directly with the world authorities. An exhibition with 12 exhibitors was held during the Symposium.

### 9. Publications

IEICE keeps the copyright of the Symposium proceedings and archives it on IEICE proceedings archives [1], while it will be included in IEEE Xplore based upon the MOU. The selected papers will also be included in the special section in Radio Science after another review.



Fig. 7 Sightseeing at Miyajima



Fig. 8 Sightseeing at Miyajima



Fig. 9 Profs. Yoshida, Manara, and Yamasaki

### 10. Conclusion

EMTS2013 steering committee thanks for all the contributions to the Symposium. It also thanks for all the supports from local, domestic and international organizations which made EMTS2013 successful.

### 11. Reference

- [1] [http://www.ieice.org/jpn/books/p\\_a.html](http://www.ieice.org/jpn/books/p_a.html)

Table 1 Steering Committee (Chairs)

| Role                                | Name               | Affiliation                         |
|-------------------------------------|--------------------|-------------------------------------|
| Co-Chair                            | Makoto Ando        | Tokyo Inst. of Tech.                |
| Co-Chair                            | Tsuneki Yamasaki   | Nihon Univ.                         |
| Vice-Chair (General Affairs)        | Hiroshi Shirai     | Chuo Univ.                          |
| Vice-Chair (Ceremony)               | Teruaki Yoshida    | Hiroshima City Univ.                |
| Vice-Chair (Finance)                | Masahiko Nishimoto | Kumamoto Univ.                      |
| Vice-Chair (Social Program, Chair)  | Michiko Kuroda     | Tokyo Univ. of Tech.                |
| Secretary                           | Akimasa Hirata     | Nagoya Inst. of Tech.               |
| Secretary                           | Shinichiro Ohnuki  | Nihon Univ.                         |
| Secretary, Local Arrangement, Chair | Masahiro Nishi     | Hiroshima City Univ.                |
| Finance, Chair                      | Mitsuhiro Yokota   | Miyazaki Univ.                      |
| Registration, Chair                 | Kiyotaka Fujisaki  | Kyushu Univ.                        |
| Ceremony, Chair Social Program      | Yoshio Inasawa     | Mitsubishi Electric Corp.           |
| Publicity, Chair                    | Masahiro Tanaka    | Gifu Univ.                          |
| Publication, Chair                  | Yoshiaki Ando      | The Univ. of Electro-Communications |
| International Advisory Board, Chair | Kazuya Kobayashi   | Chuo Univ.                          |
| Technical Program (Japan), Chair    | Jiro Hirokawa      | Tokyo Inst. of Tech.                |

Table 2 Number of Paper Submissions and Presentations

| Countries/Region | No. of Submitted Papers | No. of Presented Papers |
|------------------|-------------------------|-------------------------|
| Japan            | 114                     | 110                     |
| USA              | 37                      | 34                      |
| Italy            | 17                      | 17                      |
| Germany          | 13                      | 13                      |
| Sweden           | 12                      | 12                      |
| Russia           | 12                      | 11                      |
| Taiwan           | 12                      | 9                       |
| Finland          | 9                       | 8                       |
| India            | 14                      | 7                       |
| United Kingdom   | 9                       | 7                       |
| Australia        | 6                       | 6                       |
| Canada           | 8                       | 6                       |
| Israel           | 6                       | 6                       |
| France           | 10                      | 5                       |
| The Netherlands  | 5                       | 5                       |
| Belgium          | 4                       | 4                       |
| Iran             | 13                      | 4                       |

|                |     |     |
|----------------|-----|-----|
| Korea          | 6   | 4   |
| Saudi Arabia   | 3   | 3   |
| Turkey         | 3   | 3   |
| Hong Kong      | 2   | 2   |
| P.R. China     | 3   | 2   |
| Singapore      | 3   | 2   |
| Spain          | 2   | 2   |
| Brazil         | 1   | 1   |
| Czech Republic | 1   | 1   |
| Denmark        | 1   | 1   |
| Ireland        | 1   | 1   |
| Portugal       | 1   | 1   |
| Serbia         | 1   | 1   |
| Switzerland    | 1   | 1   |
| Ukraine        | 2   | 1   |
| Bangladesh     | 2   | 0   |
| Egypt          | 1   | 0   |
| Malaysia       | 1   | 0   |
| Mexico         | 1   | 0   |
| Sri Lanka      | 1   | 0   |
|                | 338 | 290 |

Table 3 Conference schedule

|        | Morning  | Afternoon                | Evening               |
|--------|--|--------------------------|-----------------------|
| May 20 | EMTS School, Registration                      |                          | Opening Reception     |
| May 21 | Opening Ceremony, Plenary Talk1, Oral Sessions | Oral Sessions            | Business Meeting      |
| May 22 | Plenary Talks 2 and 3(AGH)                     | YSA Poster Session       | Banquet, YSA Ceremony |
| May 23 | Plenary Talk4, Oral Sessions                   | Oral and Poster Sessions | Business Meeting      |
| May 24 | Plenary Talk5, Oral Sessions                   | Oral Sessions            |                       |

Table 4 Young Scientist Best Paper Award

|     | Name                | Affiliation and Country   | Paper Title   |
|-----|---------------------|---|---|
| 1st | Ariel Epstein       | Technion - Israel Institute of Technology, Israel                     | On the Relevance of Two-Dimensional Sources for Modelling Optical Emission from Layered Media                       |
| 2nd | Francesco Andriulli | Ecole Nationale Supérieure des Telecommunications de Bretagne, France | Rapidly Converging Electromagnetic Simulations in the Entire Frequency Spectrum without the Search for Global Loops |
| 3rd | Martin Štumpf       | Brno University of Technology, Czech Republic                         | Impulsive Electromagnetic Response of Thin Plasmonic Metal Sheets   |

Young Scientist Best Paper Award is sponsored by CST-AG.

# Report on Collaboration Activity of TM Forum and IEICE-ICM

Masafumi SHIMIZU\*, Haiying JIANG\*\*

\* NTT CORPORATION

\*\* NTT COMWARE CORPORATION



## 1. Introduction

IEICE-ICM (Information and Communication Management) is a Technical Committee of the Communications Society of the IEICE [1]. This article briefly reports the activity about collaboration of TM Forum[2] and ICM, and also reports Management world 2013.

## 2. About TM Forum

TM Forum is a global, non-profit industry association that seeks to vitalize the communications industry by enabling service providers' agility and creating services based on collaboration and standards.

## 3. Liaison agreement between TM Forum and ICM

Liaison agreement between TM Forum and ICM was signed by TM Forum CFO Norm Fornella and ICM Chair Makoto Takano on January 30th, 2013.

The two associations had a long-time collaboration relationship in many events before then. For example, TM Forum has been supporting the Asia-Pacific Network Operations and Management Symposium (APNOMS), an annual international conference sponsored by ICM, by delivering keynote speeches and promoting the event. On the other hand, ICM has been providing its help in the promotion of TM Forum related activities in Japan, including Tokyo Spotlight 2012, by delivering invited talks etc. They also agreed to strengthen the collaboration in future events, like APNOMS 2013, in which TM Forum is invited to present a keynote speech.

## 4. Report on Management World 2013

### 4.1 Overview

TM Forum Management World (TMW) 2013[3] was held in Nice France, May 13th - 16th, with over 3,000 delegates from more than 665 companies, across 81 countries. There were thirty-six attendees from Japan.



Fig. 1 Nice France

TMW2013, dealing with challenges in “navigating the digital storm” as its main theme(Fig.2), brought keynote speeches and case studies from communications industry to afford an opportunity for a rethink of business approach in the highly competitive digital service era.



Fig. 2 TMW2013: “Navigating the Digital Storm”

### 4.2 Keynotes

There were seven keynote speeches from TM Forum and member companies.

In the speech, “Navigating the storm – surviving and thriving in a turbulent environment”, from TM Forum chairman Keith Willetts, he mentioned that under a dynamic environment driven by a fast growth of digital services, the communications industry as a whole is facing three major challengers, continual cost reduction, improving customer retention, and growing new lines of digital service business through partner collaboration, and to provide support for the challenges, TM Forum sets its vision to bring best practice and standards for the efficient creation, delivery and management of digital services (Fig.3).



Fig. 3 Keynote Speech by Mr. Keith Willetts

### 4.3 Conference

The conference consisted of eight forums, “Agile IT”, “Customer Experience Management (CEM)”, “Big Data Analytics”, “M2M & Digital”, “Enterprise Cloud”, “Revenue Management”, “Security & Privacy”, and “Cable”.

Many carriers shared their real case studies of improving customer experience and reducing operation cost by application of Frameworkx.

**4.4 Framework 13.0**

In TMW2013, Framework 13.0 was officially released as a support for the challenges faced by communications service providers. Framework defines an enterprise architecture reference model tailored for communications service providers. Framework 13.0 consists of core Framework, business metrics and best practices. The central portion of Figure 4 shows the core Framework, including Business Process Framework (eTOM), Information Framework (SID), Application Framework (TAM) and Integration Framework. Framework also provides business metrics and best practices based on the core component.

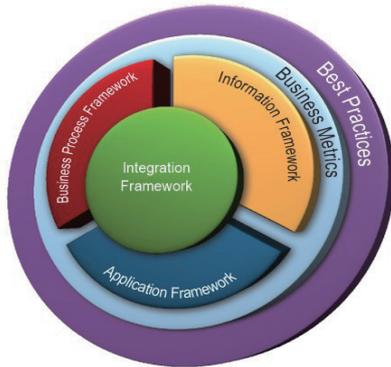


Fig. 4 Framework 13.0 structure

In the latest Framework, there are some new features focusing on two major challenges.

- Improving customer retention
  - The Big Data Reference Model defines the major function layers and outlines twenty-six use cases of big data analytics
  - The Customer Experience Management (CEM) guidebook outlines key principles in implementing CEM program and contains a new maturity model and nearly 250 metrics for measuring customer experience.
- Driving new digital services revenue growth
  - Simple Management API, a part of the Multi-Cloud Management Packs[4], introduces a common set of management interfaces for any digital service across multiple partners.

**5. Conclusion**

Since TM Forum and IEICE-ICM have many interest areas in common, it is expected that these collaboration activities could be an important step to bridge between academia and industries.

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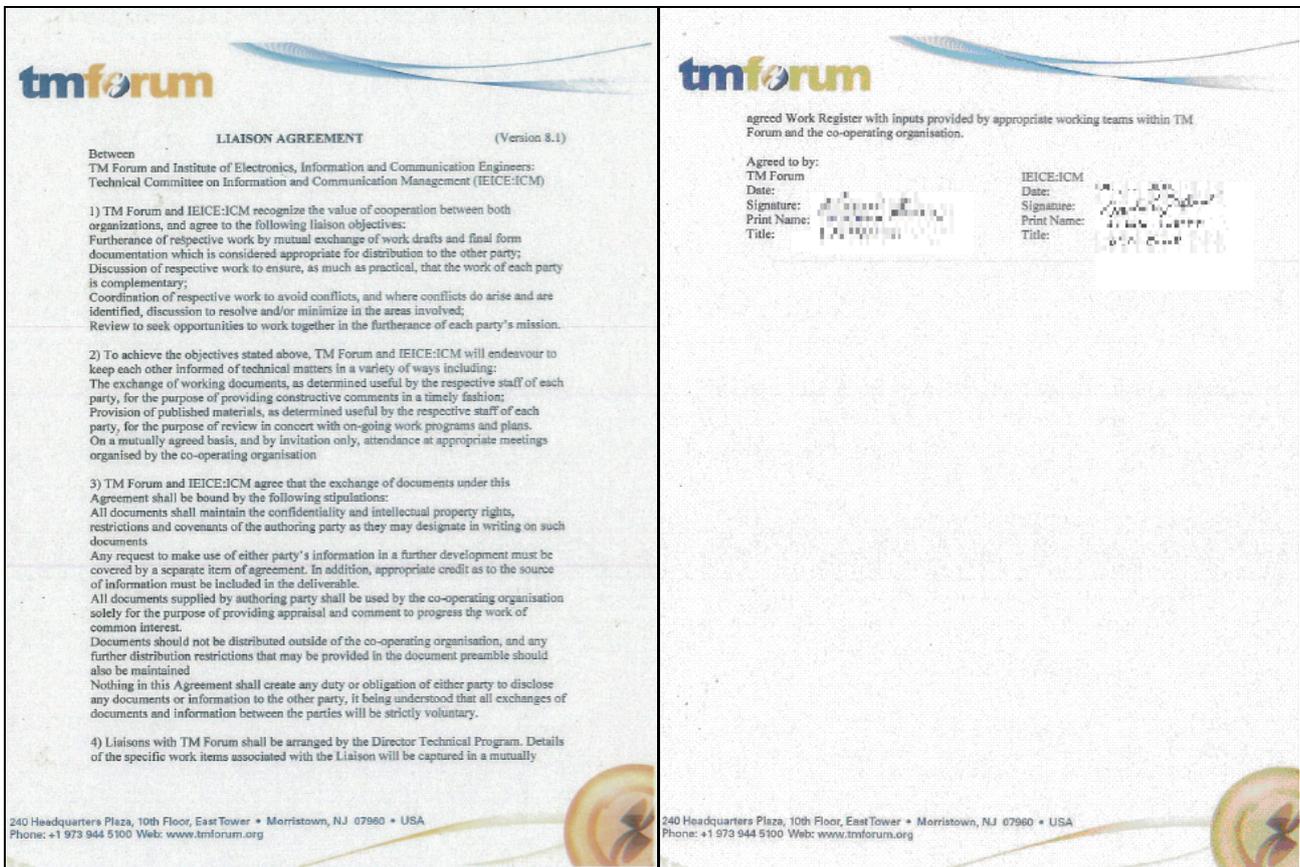


Fig. 5 Liaison agreement between TM Forum and ICM

# Annual Report of Technical Committee on Communication Systems

Daisuke Umehara†, Kyoto Inst. of Tech.; Jun Terada†, NTT;  
Toshinori Tsuboi\*\*, Tokyo Univ. of Tech.; Hisaya Hadama\*, NDA;

\*Chair, \*\*Vice-Chair, †Secretary, CS Technical Committee

Web page: <http://www.ieice.org/cs/cs/>



## 1. Introduction

Technical Committee on Communication Systems (CS) actively organized seven technical conferences and one special workshop at various cities in Japan, in FY2012. In this report, we describe our activities which include seven technical conferences, Communication Systems Workshop (CSWS), special and general sessions on IEICE Society Conference 2012 and IEICE General Conference 2013, and CS Technical Committee's Prizes. Visit our web site (<http://www.ieice.org/cs/cs/>) to obtain the up-to-date information. Our topics of interest include (but are not limited to) the followings:

- Transport technology,
- Modulation, coding and signal processing,
- Network architecture,
- Wireless network and application,
- Network service and application.

We are welcome to make your presentations to our conferences.

## 2. Summary of CS Technical Committee in 2012

In Table 1, we summarize the activities of CS Technical Committee in FY2010, FY2011 and FY2012.

The number of presented papers on technical conferences was around 100 each year in three years. The total number of presented papers on IEICE Society and General Conferences is increasing every year and

particularly more than 80 papers had presented in IEICE General Conference 2013. Special sessions on those conferences were very well attended because there were latest technical topics and its trends. The number of participants of CS workshop was around 40 in average.

We had many interesting special invited talks by outstanding speakers in each conference. One of the most impressive talks was presented by Dr. Shin Miyakawa of NTT Communications in CS Workshop on 21st November 2012 in Date city, Hokkaido (Fig. 1). He visited the United States at a young age and actively has cooperated in the implementation of IPv6 and career grade NAT against the depletion of IPv4 addresses. His talk provided us some light on the promotion of standardizations internationally. Another talk, impressively embedded in our memory, was presented by Prof. Makoto Kawashima of Chubu Univ. in CS technical conference on 6th December 2012 in Fukui city. He provided his students' valuable experiences of making things from scratch. For example, his students developed reflow soldering device by controlling microwave oven. It can be easily anticipated that his alumnus will be active in various fields in technology.

Through the FY2012, we had many valuable special invited talks. To refer them, please visit our archive web page (<http://www.ieice.org/cs/cs/special-e.html>).

Table 1 Summary of CS Technical Committee activities.

|        | Number of presented papers |   | Special session on<br>IEICE Society Conference<br>(Number of participants)                        | Special session on<br>IEICE General Conference<br>(Number of participants)                        | Number of<br>participants<br>of CSWS |
|--------|----------------------------|---|---|---|--------------------------------------|
|        | Technical<br>Conferences   | IEICE<br>Society/General<br>Conferences |   |   |                                      |
| FY2010 | 100                        | 33/49 (82)                              | Digital media with utilizing<br>network – Latest trends of the<br>technology and business (18)    | Green ICT: Technology of<br>power reduction for<br>communication equipment<br>and data center (*) | 49                                   |
| FY2011 | 102                        | 45/56 (101)                             | Latest trend and future vision<br>of optical access network<br>technology (40)                    | Latest trend of high speed<br>Ethernet technology and<br>forwarding technology (49)               | 36                                   |
| FY2012 | 104                        | 32/83 (115)                             | Current status and trend of<br>optical access and wireless<br>access network technologies<br>(40) | Communication technology<br>for M2M (45)  | 38                                   |

\*: No participants in FY2010 IEICE General Conference because of the Great East Japan Earthquake.



Fig. 1 Dr. Shin Miyakawa giving a special invited talk at CS workshop in Hokkaido on November 2012.



Fig. 2 Prof. Masato Masuya giving a special invited talk at CS technical conference in Yonaguni Island on July 2013.

### 3. Activities of CS Technical Committee in 2013

#### 3.1 Technical Conferences

We have already held July's conference on 4 – 5th July 2013, in Yonaguni Island, successively, with two special invited speakers on ICT related to isolated islands, 18 invited and general session speakers, and more than 30 participants. One invited speaker, Prof. Masato Masuya of Kagoshima Univ. presented the development and utilization of broadband infrastructure on small isolated islands in Kagoshima (Fig. 2). Another invited speaker, Prof. Ichiro Kukita presented the seeds and needs of ICT for emergency and disaster medicine in southwestern islands in Okinawa.

We are planning to have seven conferences in this year, which are shown in Table 2. We appreciate your

entry to them. You can obtain detailed information at our web site (<http://www.ieice.org/cs/cs/>).

#### 3.2 Special Sessions on IEICE Society and General Conferences

CS Technical Committee will organize a tutorial session: “Low power and energy efficient technologies for wired and wireless Networks” on 19th September 2013, in the IEICE Society Conference 2013 (Sep. 17 – 20th, 2013, Fukuoka Inst. of Tech., Fukuoka). Outstanding five speakers will be invited.

For the IEICE General Conference 2014 (Mar. 18 – 21st, 2014, Niigata Univ., Niigata), we are now planning to have a highly motivated panel session: “How to teach and learn ICT.”

Table 2 Technical conferences schedule, May 2013 – April 2014.

| Date         | Venue   | Joint committee       | Topics   |
|--------------|---|-----------------------|--|
| Jul. 4 – 5   | Fukugogata-Kokyo-Shisetsu (Yonaguni Island)       | –                     | Next Generation Networks, Access Network, Broadband Access System, Power-Line Communications, Wireless Communication System, Coding System, etc.   |
| Sep. 12 – 13 | Tohoku University                                 | NS, IN                | Post IP networking, Next Generation Network (NGN)/New Generation Network (NWGN), Contingency Plan/BCP, Network Coding/Network Algorithms, Session Management (SIP/IMS), Internetworking/Standardization, Network configuration, etc. |
| Nov. 14 – 15 | Noboribetsu-onsen Dai-ichi Takimotokan (Hokkaido) | CSWS                  | Broadband Access Systems, Home Networks, Network Services, Applications for Communications, etc.   |
| Dec. 5 – 6   | Kyoto Institute of Technology                     | IPSJ-AVM, IE, ITE-BCT | Image Coding, Streaming, etc.  |
| Jan. 23 – 24 | Hachijo Island                                    | OCS                   | Core/Metro System, Optical Access System/Next Generation PON, Broadband Access System, (Wide Area) Ethernet, Optical Transport Network (OTN), High-Speed Interface, Analog Optical Transmission, Quantum Communication, etc.         |
| Mar. 6 – 7   | Osaka City University                             | CAS, SIP              | Network Processor, Signal Processing for Communication, Wireless LAN/PAN, etc.   |
| Apr. 24 – 25 | Hiroshima City University                         | CQ                    | SDN (Software-Defined Network), Cloud, Network Virtualization, Service Quality, Contents Delivery, etc.  |

### 3.3 CS Workshop

CS Workshop 2013 will be held in Hokkaido, on 13 – 14th November 2013, please visit to the web site (<http://www.ieice.org/cs/cs/jpn/cs/ws/index-e.html>). The subject of the workshop is “Innovation of information and communication technology by interdisciplinary fusion.” Prof. Toshinori Tsuboi, as General Chair of the workshop, invited eleven outstanding researchers for providing talks about state-of-the-art innovative ICT to achieve interdisciplinary fusion. In addition, IEICE Fellow Session will be organized for a special talk by Tomohiro Ishihara of Fujitsu Laboratories Ltd.

### 3.4 CS Prizes

CS Technical Committee provides prizes to authors or speakers who made good presentations and excellent papers every year. The detailed information on the committee’s prizes is described in Table 3.

Table 3 CS committee’s prizes.

|                   |   |
|-------------------|---|
| Chairman’s prize  | Summary: The aim of the chairman’s prize to the superior papers is activating investigations on communication systems engineering.  |
|                   | Candidates: The paper must be submitted to the IEICE committee on communication systems. At least one of authors must be a member of the IEICE on the presentation day. Invited and special talks are excluded. |
| Encouraging prize | Summary: The aim of the encouraging prize to the excellent speakers is encouraging young researchers who are engaged in communication systems engineering.  |
|                   | Candidates: The speaker must be less than 33 years of age and a member of the IEICE or a student on the presentation day. His/her paper must be submitted to the IEICE committee on communication systems.      |

The winners of the chairman’s prize in 2012 are the authors of three papers [1] – [3]. The speakers of the papers are Mr. Dinh Nguyen, Ms. Yumiko Senoo, and Prof. Saeko Oshiba.

The winners of the encouraging prize in 2012 are the speakers of four papers [4] – [7], Mr. Yuya Hasegawa, Mr. Yukiaki Yoshizawa, Mr. Yu Nakayama, and Mr. Ryochi Kataoka.

Five invited talks by the speakers of CS2012-74, CS2012-100, CS2012-106, CS2012-47, and CS2012-62 were conducted and the prize ceremony 2012 was held at the banquet in the technical conference of Yonaguni Island on July 4th, 2013. The ceremonial photograph is illustrated in Fig. 3.

### 4. Conclusion

This report has summarized activities of Technical Committee on Communication Systems. Any



Fig. 3 The prize ceremony 2012 on Yonaguni Island on July 4th, 2013. From left, Prof. Toshinori Tsuboi (CS Vice-Chair), Mr. Yu Nakayama, Mr. Yukiaki Yoshizawa, Ms. Yumiko Senoo, Mr. Dinh Nguyen, Prof. Saeko Oshiba, and Prof. Hisaya Hadama (CS Chair).

comments and feedbacks are appreciated to improve our activities. We welcome your submission to our conferences (<http://www.ieice.org/cs/cs/>).

### 5. Reference

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# Annual Report of Technical Committee on Network Systems

Shigeo URUSHIDANI<sup>†</sup>, National Institute of Informatics

Atsushi HIRAMATSU<sup>††</sup>, NTT

Kazuhiko KINOSHITA<sup>†††</sup>, Osaka University

Akira SHIBATA<sup>†††</sup>, NTT

Takashi KURIMOTO<sup>††††</sup>, NTT

<sup>†</sup>Chair, <sup>††</sup>Vice Chair, <sup>†††</sup>Secretary, <sup>††††</sup>Former Secretary



## 1. Introduction

This report covers the annual activities of the IEICE Technical Committee on Network Systems (NS). It describes activities at the monthly technical meetings, recent research topics of the committee, and the research awards for 2012.

## 2. Technical Meetings

The schedule from April 2012 to March 2013 consists of 10 technical meetings and one workshop (as shown in Table 1). Several meetings are co-located with the OCS (Optical Communication Systems), PN (Photonic Network), RCS (Radio Communication Systems), CS (Communication Systems), IN (Information Networks), ICM (Information Communication Management), or CQ (Communication Quality) committees.

Recently presented papers mainly focus on technologies that support new generation network, SDN, network virtualization, cloud computing, green ICT, ad-hoc and P2P networking, traffic control / measurement, quality of service (QoS), and security issues. At each technical meeting, we host lectures by invited speakers who are experts in their fields. During

this fiscal year, we have had invited lectures on Disaster Recovery (especially for the great earthquake), Advanced Ethernet, Green Network, Software Radio, SDN, and other topics. The number of papers presented at our meetings in recent years is continuously increasing. In fiscal 2012, we had 204 presentations from academia and 95 from industry.

Since June 2003, we have fostered the work of young researchers who have presented papers at technical meetings by inviting them to give a follow-up talk some months later. We call these the “incentive lectures.” We invited 10 young researchers to give such lectures in the past year. We will continue this activity.

## 3. Research Awards 2012

The Technical Committee selected recipients of the Network System Research Award from among 243 regular papers that had been presented at monthly technical meetings from January to December 2012. The award is given to the authors of the three or four best papers of each year. The 2012 recipients attended the award ceremony at the NS/IN Workshop (Fig. 1) held in Okinawa in March 2013. The abstracts of the four papers that won awards in 2012 are as follows.

Table 1 Technical Meeting Schedule for Fiscal 2012

| Date               | Location  | Theme  | Co-location with |
|--------------------|---|--|------------------|
| April<br>19-20     | University of Kochi<br>(Hiroshima)                          | Traffic, Performance Evaluation, Resource<br>Management, Network Reliability |                  |
| May<br>17-18       | NII<br>(Tokyo)  | Protocol, Multicast, Routing, P2P, Architecture                              |                  |
| June<br>21-22      | Yamagata University<br>(Yamagata)                           | Photonic Network, Traffic Engineering, Ethernet,<br>Optical Switching        | OCS, PN          |
| July<br>19-20      | Iwate University<br>(Iwate)                                 | FMC, Distributed MIMO, MANET, Sensor<br>Network                              | RCS, USN         |
| September<br>20-21 | Tohoku University<br>(Miyagi)                               | Post-IP Network, New Generation Network,<br>TCP/IP, Network Modeling         | IN, CS           |
| October<br>11-12   | Kyoto University<br>(Kyoto)                                 | Network Architecture, Scale Free Network, Active<br>Network, Grid            |                  |
| November<br>15-16  | Nagahama Institute of Bio-Science<br>and Technology (Shiga) | Network Quality, Network Virtualization, Network<br>Measurement              | CQ, ICM          |
| December<br>13-14  | Ehime University<br>(Ehime)                                 | Mobile Network, Ad hoc Network, Access<br>Network, Security                  | RCS              |
| January<br>24-25   | Kumamoto University<br>(Kumamoto)                           | Network Software, Distributed Control, SOA, IMS                              |                  |
| March<br>7-8       | Okinawa Zanzanpamisaki Royal Hotel<br>(Okinawa)             | General, NS/IN Workshop (March 6-7)  | IN               |

**Nozomi Kimura, Shogo Imai, Motomitsu Adachi, Masatsugu Ichino, and Naohisa Komatsu: “Study on monitoring the server method by the distribution of packet response time” [1]**

Internet traffic volumes continue to increase rapidly with the spread of the broadband access and the increase in internet backbone capacities. Moreover, it is important to provide service considering the QoS. IT system becomes more complexity by open and multivendor of IT system. It needs to check the complexity system that a variety of hardware, OS and middleware are implemented when failure of open system is happened. So it is difficult to specify the reason of the failure and understand the performance. Moreover, it is difficult for system administrator to understand the performance and quality of service exactly. Therefore methods for understanding the situation of system become extremely important for IT system management.

In this paper, study on monitoring the server method focusing the distribution of packet response time is described. In previous studies, found that increasing in server load cause dividing into fast and slow group of packet response time. In this paper, to further these studies, discussed the factors that affect about server load with the packet response time. First, we can identify where bottlenecks in the server by modeling process of packet in the server. And, by modeling the bottlenecks in the processing of packet, examines the causes fall into two groups of the packet response time, made improvements in this technique. In addition, this paper also mentioned the usefulness of this method. This technique enables to monitor the server when there is less load on the server. This technique will be more useful for understanding the situation of system.

**Sou Koyano, Shingo Ata, and Ikuo Oka: “Grained Traffic Prediction Method for Performance Adjustable Energy-aware Routers” [2]**

This paper proposes a new method for traffic prediction to achieve microsecond-order standby control of hardware devices in high-speed routers. The energy consumption of ICT infrastructures has become enormously large, in particular, routers and network switches is one of key challenges for future green communication architecture.

One promising approach is to reduce the energy consumption of routers by adjusting routers' performance on the basis of the volume of network traffic. Sliced Router Architecture, we proposed so far, can reduce power consumption in routers on the basis of ingress traffic by focusing on reducing power consumption in memory-based large-scale integrations (LSIs), which is a dominant factor of the overall energy consumption of a router. To obtain optimal power efficiency at the operation level of hardware components, a fine-grained traffic prediction method in microsecond-order intervals is mandatory.

We propose in this paper a finer-grained traffic prediction method, which supports microsecond-order

prediction by using moving average and moving standard deviation. To support wire rate transfer in routers, prediction calculator is implemented only by simple bit calculators.

Real traffic traces are conducted for trace-driven simulation to verify the energy efficiency of proposed method. Through numerical discussions we determine an optimal set of parameters to obtain the most gain of energy reduction. Our result shows that the proposed method can control power consumptions with less than 10% overhead compared to the line utilization.

This paper addresses an important topic on ICT infrastructure, the approaches presented in this paper is simple, easily deployable, and effective for energy savings. The technical impact of the paper would be high since it shows a possibility of the realization of micro-scale power control in high-speed routers.

**Hiroki Kawabata, Kensuke Hashimoto, Yumi Takaki, Chikara Ohta, and Hisashi Tamaki: “A Study on Content/Location Mapping for In-network Guidance” [3]**

In recent years, because of the increased demand for large contents such as high-definition videos and music, content servers holding popular contents suffer from high access loads, and core networks also suffer from the massive amount of traffic thus generated. More efficient content delivery is, therefore, one of the most important issues for future as well as current networks.

Breadcrumbs (BC) scheme has been proposed for efficient content distribution in next-generation networks. In BC scheme, when the query which a user issues toward the content server location encounters a corresponding BC on the way to the server, it is guided along the BC trail toward a cache which may store the content. If the query heads toward a prospective cache location initially instead of the server location, it is expected that the content server loads and the amount of traffic on core networks can be reduced.

In practice, when a user obtains a content, first, by using Mapping Server (MS) such as search engines (Google, yahoo, etc.), he/she needs to resolve a location of the server which stores the content desired. Some portal sites such as yahoo provide lists of contents and redirect users to actual web sites. On this occasion, they can collect users' access histories. A user who accesses certain content via such a portal site is expected to have the content, and it is also highly possible that a corresponding content cache exists near the user for some time. Thus, MS has potential ability to collect and resolve the prospective cache location.

In this paper, we propose a Mapping Server with Cache-location Resolution (MSCR), which resolves not only content server location but also prospective cache location close to the requesting user. Sending a query to a nearby prospective cache location enables the user to obtain the content more efficiently. Our simulation results show that MSCR can reduce content server load and the amount of traffic on core networks compared with MS.

**Gen Morita, Takahiro Iihoshi, Yoshikazu Watanabe, and Shuichi Karino: “A Proposal of a Scalable OpenFlow System for Mobile Terminal Control” [4]**

In recently, mobile data offload technologies attract attention as solutions for increased data traffic in mobile carrier networks. As one of the technologies, we had proposed communication control of mobile terminal using OpenFlow from network side in the past. However, the method may cause congestion of mobile networks by OpenFlow signals between the controller and enormous terminals by uni-cast. In addition, these signals may be delayed or lost in a crowded network, because these are carried in a data plane on the best effort basis.

To resolve the problems, we proposed a scalable OpenFlow system for mobile terminal control using CBS. CBS is a text message broadcast system specified in 3GPP. It enables operators to broadcast a message to all mobile terminals in some designated areas. It can deliver a message on low-latency, on high-reliability, and on low-cost. We use it as an additional control path to a main control path as known as secure channel in OpenFlow. On the additional control path, a message to control multiple terminals is delivered, such as a FlowMod to change the access network. In addition, terminals are identified by Group-ID. When a terminal received a control message on the additional path, if the message doesn't have a Group-ID of the terminal own, the terminal ignores the message. This method enables to multiplex control messages with several terminal groups in one CBS message. The Group-ID is delivered from OFC, and the information can exchange in safely on main path because the path is secure channel. By these schemes, our proposed system achieves a high scalable OpenFlow system.



Fig. 1 Research award recipients with chair Prof. Urushidani.

We estimated the efficiency of the proposed system. From the result, this system is effective to reduce the amount of control signal. Moreover, if the capacity of mobile terminals in a Cell is increased or the length of CBR message is longer, the efficiency is bigger.

#### 4. Future Plans

The Technical Committee will have also 10 technical meetings in this fiscal year. In addition, it will organize open Symposia in the IEICE Conferences, one of which will be on “Future Network Technologies for Advanced Information and Communications Society” at the IEICE General Conference in March 2014.

(For more information, please see our home page.

URL: <http://www.ieice.org/cs/ns/index.html>)

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## Technical Committee of Software Radio: 8<sup>th</sup>-Year

Osamu Takyu, Toshiyuki Nakanishi,  
Gia Khanh Tran, Akinori Ohashi,  
Keigo Hasegawa, Shinji Murai,  
and Shigeru Tomisato  
Technical Committee of  
Software Radio



### 1. Introduction

Technical Committee on Software Radio (TCSR) has promoted research on software radio, cognitive radio, and their related technologies since 1999. It was 8th year of TCSR since it was restructured to a permanent committee of IEICE in 2005. The steering committee members of TCSR in 2012 are shown below:

**Chair:** Yukitoshi Sanada (Keio Univ.)  
**Vice Chair:** Kei Sakaguchi (Osaka Univ.)  
Takeo Fujii (Univ. of Electro-Commun.)  
**Secretary:** Masayuki Ariyoshi (NEC)  
Suguru Kameda (Tohoku Univ.)  
**Assistant:** Kazuto Yano (ATR)  
Osamu Takyu (Shinshu Univ.)  
Kentarō Ishizu (NICT)

TCSR organized five technical conferences in fiscal year of 2012 (FY2012). The technical conferences were held on all over the country. TCSR gives not only the exciting discussion about technical research but also the understanding of local culture to the attendee.

This paper describes the overview of the interesting research results and the characteristic local cultures of Japan.

### 2. The 1st Technical Conference in May 2012

- ✓ Topics: Software & Cognitive Radio Technical Expo
- ✓ Date: May 24-25, 2012
- ✓ Venue: Hiyoshi Campus, Keio Univ.
- ✓ Number of papers: 24 (Invited talks: 4, Regular talks: 4, Technical exhibitions: 16)
- ✓ Number of participants: 133

#### *Software and Cognitive Radio Technical Expo 2012*

TCSR hosted 10 technical exhibitions listed below and 8 product exhibitions in its 7th annual Software and Cognitive Radio Technical Expo (Fig. 1).

- 60GHz Band Beamforming Array Antenna Using 3-D SiP Structure (Tohoku Univ.)
- Frequency-dependent I/Q Imbalance Compensation for Wideband Quadrature Modulator using Sub-band Circuit Parameter Estimation (Tokyo Inst. of Tech.)

- Timing Synchronization Scheme for OFDM Signal in General Purpose Processor Based Software Defined Radio Receiver (Keio Univ.)
- Wireless Network System for TV White Space with Coordination of Database (NICT)
- FPGA Implementation and Evaluation of a Simplified MIMO-OTA System (Univ. of Electro-Comm.)
- Field Tests of Multi-hop Vehicle to Vehicle Communication with Autonomous White Space Channel Selection (Kyusyu Institute of Technology)
- 8x8 MIMO-OFDM Experimental System Employing Software Defined Radio Architecture for Super High Bit-Rate Mobile Communications (Tokyo Inst. of Tech.)
- 1-bit RF Digital Transmitter Using a Bandpass  $\Delta\Sigma$  Modulator (Tohoku Univ.)
- Hardware Demonstration on Distributed Electric Power Control Network (Tokyo Inst. of Tech.)
- Flexible Wireless System Prototype using 1-bit Compressed Sensing with Partial Random Circulant Measurement Matrices for User-centric Wireless Networks (NTT)



Fig. 1 Technical Expo 2012

### **Panel session “Reconfigurable Techniques for Multi-Standard Wireless Communication in Traffic Offloading Era”**

Amid ongoing data explosion, off-loading the traffic using multiple communication standards has become a world-wide trend. Transceivers are preferred to be multi-standard compatible, and therefore reconfigurable analog and digital circuit technologies have become more important than ever. In the panel session, TCSR invited the following four speakers, all of whom being experts of reconfigurable analog/digital circuits in academia and industry. They presented their future perspectives and emphasized that researchers should continuously exchange the latest trends and requirements from both analog and digital sides.

- Prof. Kenichi Okada (Tokyo Inst. of Tech.)
- Dr. Ryuichi Fujimoto (Toshiba)
- Prof. Yukitoshi Sanada (Keio Univ.)
- Dr. Shoichi Narahashi (NTT Docomo)

### **3. The 2nd Technical Conference in July 2012**

- ✓ Topics: Cognitive radio, HetNet, Cross layer
- ✓ Date: July 26-27, 2012
- ✓ Venue: Yakushima Island (Kagoshima)
- ✓ Number of papers: 22 (Panel: 8, Regular talks: 14)
- ✓ Number of participants: 40
- ✓ Special plan: Open air discussion (Fig. 2), organized by the activation subcommittee (July 28, 2012)

#### **General Session**

In the general session, 14 papers were presented and accompanied by fruitful discussions on the first and second days. The session included diversified topics e.g.

- Occupancy ratio model/estimation in cognitive radio
- Spatial domain spectrum sharing
- Cognitive radio employing TV white space
- DPD for wideband PA in flexible wireless system



Fig. 2 Jomon Sugi – Destination of Open Air Discussion

### **Panel Discussion (Profitable Wireless, Innovative Technical Committee, Delightful Japan)**

The panelists consist of 8 members from both academia, institutes and industrial companies. Each respectively gave a 15-min presentation about their perspective toward the topic. Prof. Kato (Univ. of Tokyo) pointed out the weakness of current Japan education system and gave suggestions on how to improve challenging spirit. Prof. Sampei (Osaka Univ.) emphasized the importance of nurturing the new generation who would be interactive and intelligent. Dr. Harada (NICT) expressed worries about Japan’s ICT industry and research society nowadays, which is lacking of flexibility. Prof. Sanada (Keio Univ.) called for positive participation of students in academic conference as a chance of appealing themselves to the industry as well as improving communication skill. Prof. Sakaguchi (TokyoTech) pointed out issues of the technical committee and suggested about more intensified international collaboration. Dr. Uehara (NTT) gave advices for SR committee to further enhance its activity by introducing strategic management thinking. Dr. Ariyoshi (NEC) revisited the significance of international standardization and suggested to organize more international workshops and conferences. Finally, Prof. Morikawa (Univ. of Tokyo) indicated the requirement for a new research methodology as ICT technologies have been sufficiently matured. Subsequently, an hour was used for discussions and Q&As from the floor and among the panelists.

### **4. The 3rd Technical Conference in October 2012**

- ✓ Topic: Workshop on wireless distributed networks
- ✓ Joint TCs: AN, RCS, RRRC and USN
- ✓ Date: October 17-19, 2012
- ✓ Venue: Fukuoka University
- ✓ Number of papers: 39 (Special invited talk: 1, Invited talks: 5, WDN special session talks: 13, Organized session: 8, Regular talks: 12)
- ✓ Number of participants: 328

#### **General Session**

In the general session, 12 papers were presented and accompanied by fruitful discussions on first and third days. The session included technical fields as follows:

- Spectrum sensing
- Spectrum sharing
- Low latency wireless network systems
- IEEE802.19.1 white space coexistence systems
- Distributed sensing systems
- TV white space communication systems

#### **Organized Session**

In the organized session, many interested results for the European research project called QoS MOS were presented. There were eight presentations in this session. The topics of these presentations are listed as follows.



Fig. 3 The 3rd technical conference in October 2012:  
Evening session

- Overview of QoS/MOS
- System Architecture and Reference Model
- Spectrum Sensing
- Multicarrier modulation
- Spectrum Management
- SDR platform for TV white space

#### **Special Session**

In the session specialized on the wireless distributed networks, 13 papers were presented. Their technical fields were as follows:

- Ad hoc network
- Multi-hop network
- Smart meter network
- Sensor network
- Distributed MIMO systems
- Multi-user MIMO systems

#### **Invited Talks**

There were five invited talks in this session. The invited speakers and topics of presentations are listed as follows:

- Prof. Furukawa (Kyushu Univ.), "Practice of Wireless Backhaul for Small Cell"
- Prof. Katayama (Nagoya Univ.), "Academic and Industrial Impacts of Reliable Robust Control Communication"
- Dr. Kakura (NEC), "Status of standardization for LTE-Advanced and trend for beyond LTE-Advanced"
- Prof. Lee (Univ. of Tokyo), "Applications of Compressed Sensing in Wireless Communication Systems"

#### **Special Invited Talk**

Prof. Taromaru (Fukuoka Univ.) introduced the history of amateur radio and explained the reason why the current system has been chosen clearly. In particular, the audience was interested in the fact that multi-hop wireless communication was implemented in amateur radio by a method called degipeter. In the evening session (Fig.3) held after this talk, we had an animated conversation about the future of amateur radio.

#### **4. The 4th Technical Conference in January 2013**

- ✓ Topics: Cognitive radio network, Cross layer, International workshop
- ✓ Date: January 24-25, 2013
- ✓ Venue: University Factory of Nagano (inside of Nagano-Engineering campus, Shinshu University), Nagano
- ✓ Number of papers: 15 (Invited talk: 1, International workshop: 2, Regular talks: 12)
- ✓ Number of participants: 58

#### **Invited Talk**

On the first day, the TC invited Dr. Shingo Ohmori (CTIF-Japan) as an invited speaker. In this talk, R&D project of multilayered communication network systems for disaster-resilient communications was introduced. The main objective of R&D project is to establish communication network systems which are robust and resilient under disaster situation. In the proposed system, once cellular system becomes unavailable by traffic congestion and/or physical damage of infrastructure, the proposed system performs traffic detour to surviving system such as Wi-Fi. Furthermore, traffic control is performed by processing data.

#### **International Workshop**

On the first day, the TC had international workshop. In this workshop, two papers were presented. The speakers and topics of presentations are listed as follows:

- Prof. S. Choi (Hanyang univ.), "SDR Researches in HY-MC Research Center of Hanyang University"
- Mr. M. Uhm (Wireless Innovation Forum), "New Strategic Directions of the Wireless Innovation Forum"

#### **General Session**

In the general session, 12 papers were presented and accompanied by fruitful discussions on the first and second days. The session included technical fields as follows:

- Processor for SDR and its functional requirements
- Spectrum sensing method, device and field test
- Interference management for protection of primary system by power control and channel allocation
- Measurement and estimation of channel occupancy ratio
- Routing and resource allocation in cognitive wireless mesh networks using TVWS
- TV band devices with UHF converter

Heterogeneous cognitive radio systems for public mobile communication systems

#### **5. The 6th Technical Conference in February 2013**

- ✓ Topics: Workshop on mobile communications
- ✓ Date: February 27-28, March 1, 2013
- ✓ Joint TCs: RCS SRW and CCS
- ✓ Venue: Waseda University

- ✓ Number of papers: 21 (Requested talks: 5, Special session talks: 6, Regular talks: 12)
- ✓ Number of participants: 425

### **General Session**

We annually cosponsor mobile communications workshop at Waseda Univ. In this year, we cosponsored the workshop with RCS, SRW and CCS. There were 12 presentations during the three day workshop. Their technical fields are listed as follows:

- Signal detection
- Spectrum sensing
- IEEE 802.11af and 802.22 white space radio systems
- Coexistence among TVWS devices
- Estimation of TV White Space in Japan
- Wideband non-contiguous OFDM
- Multiband MIMO Receivers
- Fractional Sampling MIMO-OFDM

### **Requested Talk**

We had five requested talks on the subject of TV white space, MAC protocol, and a PHY-MAC cross-layer simulator for software / cognitive radio. The speakers and topics of the talks are listed as follows:

- Dr. Oyama (Fujitsu Labs.), “Effect of Propagation Models on the Estimation of TV White Space”
- Prof. Takyu (Shinshu Univ.), “An Elemental Study of MAC Protocol for Cognitive Radio and Introduction of Integrated Simulator”
- Dr. Yano (ATR), “Development of Multi-System/Multi-Channel PHY-MAC Cross-Layer Simulator for 2.4 GHz ISM Band”
- Prof. Tsukamoto (Kyushu Inst. of Tech.), “Development of Autonomous Vehicle-to-Vehicle Cognitive Radio System over White Space”
- Dr. Song (NICT), “Performance of a Small Size Sensing Device under Interference Produced by Secondary Users”

### **Special Session (Cloud Coordinated Heterogeneous Networks)**

In the session specialized on the cloud coordinated heterogeneous networks, there are 6 invited talks in this session. The invited speakers and topics of presentations are listed as follows:

- Prof. Sakaguchi (Osaka Univ.), “Future Perspective of Cloud Cooperated Heterogeneous Networks”
- Dr. Kishiyama (NTT DOCOMO), “LTE Small Cell Enhancements and Phantom Cell Concept”
- Dr. Yokota (KDDI Labs.), “Study on Network-cooperated WiFi offload”
- Dr. Murakami (NICT), “R&D of technology for efficient frequency use through coordinated control and terminals compatible with heterogeneous radio systems”

## **6. Conclusions**

Technical Committee on Software Radio (TCSR) held five conferences, one international conference in 2012. TCSR makes a strong effort to international collaboration with the research organization of software defined radio and cognitive radio fields all over the world. In FY2013, we will plan five conferences as follows:

- May 2013: Hiroshima, Hiroshima Pref. (Panel Discussion of White Space, has been closed)
- July 2013: Hamamatsu, Shizuoka Pref. (Joint workshop)
- October 2013: Osaka Univ. (Technical Exhibition and International Workshop)
- January 2014: Tohoku Univ.
- March 2014: Waseda Univ. (Joint workshop)

TCSR welcomes contributions from newcomers. We are looking forward to meeting you at conferences.

### **More Information**

Website URL: <http://www.ieice.org/cs/sr/eng/>

Contact email: [sr\\_ac-sec@mail.ieice.org](mailto:sr_ac-sec@mail.ieice.org)

# In Pursuit of Business Agility at NTT Innovation Institute, Inc.

Kenji Takahashi  
NTT Innovation Institute, Inc.



## 1. Introduction

In April 2013, NTT Innovation Institute, Inc. (NTT I<sup>3</sup>) was established in Silicon Valley to accelerate the development of enterprise solutions driven by ever changing global markets. Our solutions are initially targeted to the North American market and subsequently plan to roll out the best practices globally.

Enterprises are now facing challenges of catching up with changes occurring at increasing speed in many fronts, including economic landscape, global competition, business models, threats, and technologies. We strive to enhance business agility of enterprise customers through a comprehensive set of IT solutions. Such solutions include cloud, mobility, analytics, and security offerings for the customers to predict, prepare for, and turn crucial business changes into growth opportunities, and materialize them. In this article, we will discuss our vision, projects, partnerships, and organization in pursuit of business agility.

## 2. Business Agility

Business agility is the ability of enterprises to continuously sense and respond to changes, and adapt themselves in a timely and competitive manner. Increasingly competitive markets and well informed customers drive faster innovation cycles, while the innovation fuels competition and empower customers. These two forces form the positive feedback loop, which accelerate changes in technology, business, and society at an even greater pace.

Under this ever-changing business environment, business agility is an essential asset of any going concerns to survive and grow. We help our enterprise customers successfully change how they react to changes through a holistic set of ICT solutions. The

ICT solutions encompass three dimensions: lifecycle phase, system layer, and industry. We streamline and automate all the phases of the ICT lifecycle, including advisory, application development, operation and management services. Also our ICT solutions are lined up to cover all layers, from networking through data centers, compute, and platform, to applications. Lastly the solutions are tailored to the specific vertical markets and industries, such as insurance and public sectors.

With focus on business agility, we strive to excel in the applied innovation of cloud, analytics, mobility, and security.

## 3. Innovation Pipeline for Business Agility

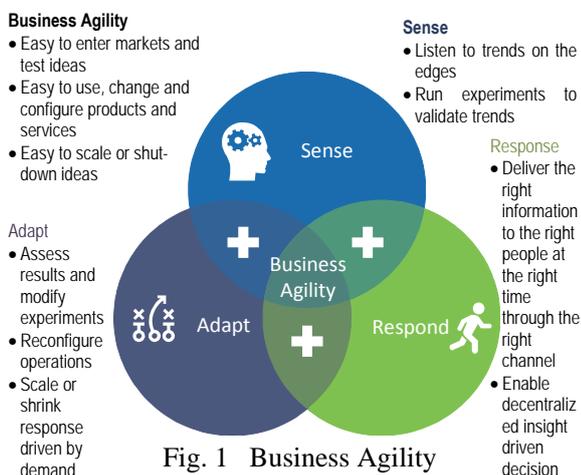
Public cloud services, in particular at infrastructure level, are becoming common as the first wave of adaption. As the next step, enterprises start planning of the migration of mission critical applications to cloud to fuel business agility. The target migration environment should be inherently hybrid – some portion is on public cloud and the other is on private cloud or legacy platform. We are working on technologies to streamline and automate the migration process. In addition, we are trying to add agility to security in order to mitigate the risks of ever evolving security attacks.

### Application Performance Monitoring of Hybrid Cloud

If an application is deployed in a hybrid cloud environment, monitoring must follow the same path to eliminate blind spots and achieve total performance visibility – across every silo, every tier and ever layer. We are working on solutions that allow organizations to correlate end-user experience with all relevant key performance indicators in a hybrid cloud in order to quickly find root causes, whether on-site or off-site, of any performance problem. Our predictive analytics can also help organizations to foresee an upcoming potential traffic spike and automate a temporary capacity expansion by scaling out to a public cloud.

### Cloud and VPN Integration Automation

One of the technological roadblocks for hybrid cloud is network. The virtualization of computing resources has become mature in the last decade. Adding and connecting new cloud resources in a data center to enterprise virtual private networks (VPNs) are still labor intensive tasks, which takes a few days for skilled network engineers to complete, and involves redesign and reassignment of IP addresses of network elements both in data centers and the VPN.



We have developed solutions for cloud and VPN integration by using OpenFlow based SDN technologies. More specifically we use OpenStack Quantum to orchestrate virtualized networking resources and OpenFlow to set up the connection between two autonomous IP networks (one for tenant resources in the datacenter and the other for VPN) by exchanging the routing information via BGP.

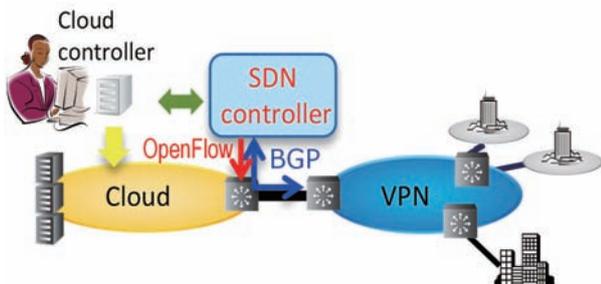


Fig. 2 Cloud-VPN integration automation

**Deep Security Analysis Platform**

Recently malware, malicious software designed to execute unauthorized and harmful actions in computer systems, rapidly proliferates in number and variation. For example, malware has caused the leak of critical confidential information. Existing security solutions, such as anti-virus software and firewalls, can not completely protect computer systems from attacks by malware because new types of malware are being developed and deployed every day and these solutions are designed to address known malware.

We are developing the Deep Security Analysis Platform (DSAP) to mitigate the threats of malware. For DSAP, we take an approach to analyze and acting with agility against the malware rather than try to completely shut out malware attacks, which we are afraid is nearly impossible in the foreseeable future. DSAP detects and analyzes malware behaviors, and quickly provides the information required to conduct incident responses, such as the information leakage and the scope of infected terminals.

**Global Security Intelligence (GTI) Platform**

Proactive security operation requires the information on vulnerabilities and threats gained through public monitoring. It, however, takes substantial efforts by security experts.

By using big data analysis, the GTI platform gathers and filters automatically the security related information from a variety of sources, and delivers the analysis results to security operation companies. Such information sources include security related organizations, vendors, conventional and social media. The GTI platform aims to create and expand the security information based businesses by not only efficiently processing the information but also providing the selected sets of security concerns, out of the vast generic security information, tailored to customer's devices and industry.

**4. Business Agility at Large**

We are working closely with Industrial forum, open

source communities, and academia to provide the best mix of solutions faster and better than we do alone. Also we believe that we need not only to develop solutions but also to establish a sustainable ecosystem of the solutions. Such ecosystem consists of ISVs, service providers, platform vendors, open source communities, users, solution providers, universities, and research institutes around the globe. They collaborate on open standards, open source projects, advocacy of emerging threats and prevention, and IP development. NTT IP is actively participating in and contributing to Open Networking Foundation, OpenStack, Forum of Incident Response and Security Teams (FIRST), and Cloud Security Alliance. We are also collaborating with prominent universities in the US, such as University of California Berkeley and Georgia Institute of Technology, on software engineering.

**5. Business Agility in House**

We aim to run our company on cloud - our own business processes are migrating onto cloud. We are using e-mail, calendaring, file storage, voice, video, and web conference and other office productivity tools on cloud to minimize operational costs and increase business agility.

ICT innovation requires agility in software development. We adopt agile methodologies in conjunctions with other modern software engineering techniques, such as test driven development, continuous integration, and DevOps. Also we are working on the migration of software development environment (SDE) to cloud by using commercial cloud services and open source software. Cloud SDE acts as a hub for software development teams collaborating across organizational and geographical borders spanned over different time zones, e.g., Japan, US and Europe.



Fig. 3 DevOps process on cloud

**6. Conclusion**

Business agility, the ability to quickly respond to changes, is a substantial asset of today's enterprises, which creates new values and better experiences for customers in a more timely and efficient manner. Business agility is enacted through three steps: sense, respond, and adapt. Each of these steps is assisted, automated, coordinated and/or enhanced by secure cloud solutions. Enterprises just start tapping the vast possibilities of cloud for further business agility. We strive to contribute to enterprise customers' success in pursuit of business agility through disruptive innovation.

# NEC Laboratories Europe in Heidelberg

Koichi Konishi

Central Research Laboratories, NEC Corporation



## 1. Introduction

The main portion<sup>1</sup> of NEC Laboratories Europe (NLE) is located in Heidelberg, Germany, which is in the center of Europe geographically. The city is located within a day-trip distance to major European and academic cities known for their excellence in ICT. Heidelberg itself is quiet, pleasant, and rich in historic monuments and nature (Fig. 1).



Fig. 1 Heidelberg Castle

This article gives an overview of NLE's activities, which are characterized not only by technical excellence but also by EU projects and standardization.

## 2. Organization

NLE consists of about 100 people divided into the Network Research Division, the Software and Services Division, and administration staff. The members exhibit a good diversity of nationalities from all over the world; while Germans are the largest group, Italians form the second, and Eastern Europe, the Middle East, Asia, and South America are all represented.

NLE's research activities are anchored to core technology targets; there are eight of them (Fig. 2).

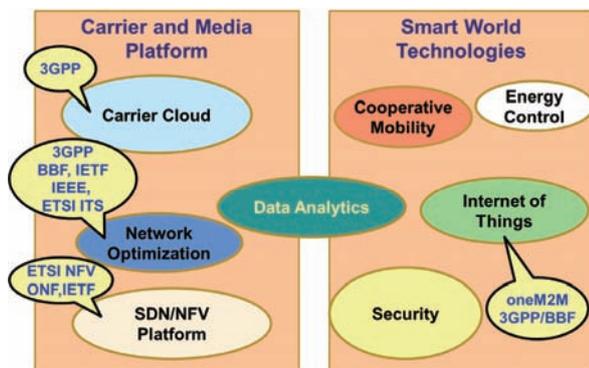


Fig. 2 Core Technology Targets

NLE targets the development of new core technologies enabling future networks and services. Prototype and proof-of-concept activities showcase the applicability of new technologies while standardization disseminates them into the industry.

## 3. Carrier and Media Platform

### SDN/NFV Platform

Software-Defined Networking (SDN) and Network Function Virtualization (NFV) research focuses on two main areas, fast user plane packet processing and network orchestration using SDN technologies. The user plane performance optimization of virtualization platforms targets the removal of bottlenecks arising when processing huge amounts of network packets inside virtualization network functions embedded in virtual machines. For this purpose, NLE works on high speed virtual switches and tiny fast virtual machines running on commodity servers. Research towards a network operating system enables SDN-based redesign of network infrastructure, control and data plane for dynamic programmability, re-configurability and high-performance of virtualized network function.

### Carrier Cloud

The carrier Cloud area brings together current carrier networks with Cloud technologies such as virtualization and SDN. Based on core technologies developed in this area, NLE is applying SDN and NFV to provide a more flexible, cost-efficient, and better performing network system. As proof-of-concept and combination of user and control plane research, NLE builds application prototypes such as an NFV-based BRAS system including a control framework and an information-centric networking prototype. A strong focus is placed on the evolution of the mobile core network within the research on virtual Evolved Packet Core.

### NW Optimization

Network Optimization targets significantly improving the performance of current and future networks, by implementing new concepts that facilitate network use, and time-to-market, and coping with bandwidth usage explosion. Transport Network Resource Optimization and Network Topology Optimization using genetic algorithms target the optimized use of wide area and access networks. QoE(Quality of Experience)-aware Congestion Management intends to solve user plane congestion using optimized protocols, novel queuing and scheduling mechanisms as well as enhanced policy control functionality.

### Data Analytics

The research activities in this area are focused on: i)

<sup>1</sup> A few of the members are based in London, UK.

the development of a distributed stream processing platform (called Blockmon) that can support the analysis of big amounts of data with high performance while maintaining flexibility and user friendliness; ii) scalable error-bounded real-time prediction algorithms for specific business sector applications such as Web, social media and sensor data analytics for content caching, mobile advertising, transportation and user mobility behavior analysis.

#### 4. Smart World Technologies

##### Security

This activity focuses on two areas, Cloud Correctness and Mobile Device Security. A new study on SDN security has just started. Cloud Correctness aims at making Cloud practical options not just for small and medium-sized enterprises, but also for large organizations with very high stakes at correct operation of their ICT systems. NLE combines dependability technology with applied cryptography to make Cloud operations verifiable. Mobile Device Security is about securing devices deployed in open public spaces such as surveillance video cameras in city streets. Their tamper-resistance is critically important for systems depending on them.

##### Internet of Things (IoT)

NLE's IoT research focus on systems connecting a large number of "Smart Things" – real-world objects instrumented with a device for computing, communication, and coordination – with Cloud-based systems. Issues investigated includes discovering devices distributed over geographical areas based on criteria such as geo-location and semantic relevance, elastically scaling resources to Big Data loads, and coordinating large sets of devices through novel scheduling and resource management algorithms.

One of its recent outcomes is the middleware product LeafEngine for sensor integration of various types of sensors and actuators. This is used with interactive digital signage to enable audience measurement, interactivity, as well as targeted advertisement.

##### Cooperative Mobility

Leveraging on its large success in vehicular communications in Europe and its strong domain knowledge, NLE has extended its Intelligent Transportation Systems (ITS) activities to focus on the coupling of cooperation and automation to optimize mobility. This includes techniques for cooperative driving like distributed speed and trajectory control, dynamic logistics fleet routing and multi-technology information dissemination. Developed closely with European auto makers, these technologies will help address real market needs in both ITS infrastructure and automotive on-board component businesses.

##### Smart Energy

Focusing on algorithms to predict and control energy usage, this activity tries to help create new solutions to building energy management systems as well as grid management in presence of renewable energy sources.

In both cases, community-wide management is the key; instead of managing energy in a single building or household, managing it across several buildings

sharing the same campus or across several households in the same apartment house will bring more room for control and better overall efficiency. The activity leverages several EU projects to run trials in realistic venues such as a university campus and a large stadium.

The group will place more attention in the future on interaction of systems across domains such as joint management of electricity and heat energy networks.

#### 5. Standardization

NLE is striving to drive the industry in standardization by delivering high quality input to global standards. "Lead, not follow" is its motto. Being in Europe, where a lot of global telecom operators are based, NLE is positioned very well to influence standardization in the networking area also by collaborating early with other organizations.

Standardization fora frequented by NLE members include:

- ETSI (NFV, M2M networking, ITS, fixed networks)
- 3GPP (mobile networks)
- Broadband Forum (SDN, M2M and home networking, mobile backhaul, policy control)
- oneM2M (machine-to-machine networking)
- Open Networking Foundation (SDN)
- IEEE (Wi-Fi and WiMAX)
- OASIS (security and identity & access management)

Beyond shaping and contributing to standards, NLE further holds multiple official positions in key standardization bodies.

#### 6. Active Roles in EU Projects

EU projects are venues for different players in Europe, to form a consortium to conduct R&D activities according to plans designed by the consortium itself. The European Commission makes calls for proposals, specifying areas and emphasis but with no details. Proposals are reviewed and given marks by experts commissioned by the EC. A typical acceptance rate is 10-20%. A small consortium includes five to eight partners; a large one has tens of them.

Our labs have been engaged in quite a few EU projects, and have collaborated with a diverse collection of partners from industry as well as academia. Despite fierce competition, NLE has a good track record of a high success rate in getting its proposals accepted and is being trusted by many partners, often receiving invitations for joining a new consortium.

#### 7. Concluding Remarks

In my view, many features of NLE show its inclination to promote coexistence of diverse parties. People from different countries mingle with one another, its passion for standardization shows its will to make possible interoperability of different systems, and its constant participation in EU projects keeps its activity open and connected to various partners throughout Europe. I think that is quite an European trait.

#### 8. Reference

- [1] [http://uk.nec.com/en\\_GB/emea/about/neclab\\_eu/](http://uk.nec.com/en_GB/emea/about/neclab_eu/).
- [2] Y. Suemura, "Global R&D Formation in NEC", IEICE GNL Vol. 36, No. 3

# My Life as a Researcher in Japan, the Land of Harmony

Cesar Carrizo  
Graduate School of Engineering, Nagoya University



## 1. Introduction

First of all, I would like to thank the editor of IEICE-CS GLOBAL NEWSLETTER, for giving me this opportunity to express my feelings and my views on this beautiful country that I can now call my second home.

My name is Cesar Carrizo from Panama. I joined Nagoya University Graduate School of Engineering in the year 2010 as a Master's student. I am currently pursuing my doctoral studies under the supervision of Professor Masaaki Katayama.

As a child I was always amazed by the way in which Japan blends tradition with advanced technology. The vague information available about Japan back in my country and my Japanese ancestry made me constantly wonder and become very interested in Japanese culture and lifestyle. I can just say that being able to live in Japan has been a blessing ever since the day I arrived. In Japan there is always something new to learn, although sometimes it may be a little difficult to adapt. Japan for me is like no other country in the world, very unique and special.

## 2. My arrival at Japan

The moment I arrived in April, 2009, I was initially surprised by how clean everything was and how kind people here were to me. I was warmly received by my senpai from Poland who immediately aided me and invited me to various events to make many new friends.

I was overwhelmed as each new day I would meet people from various countries. Some of them had just arrived as me, while others had been in Japan for several years. I was constantly showered by information on how to behave in Japan and I could not understand many of the procedures I had to carry out at the beginning, but as a new life and a new learning experience, I fully embraced and enjoyed it.

## 3. Life in the laboratory

I must say that when I first entered the Katayama Laboratory, I felt almost as a celebrity. There were various warm receptions, celebrations and greetings from the laboratory members. I was glad to see there were also a few annual laboratory trips meant to deepen the relationship between members and enjoy Japan's rich nature and traditions. However, little I knew about my functions in the laboratory and the well-structured and organized way in which Japanese people work. At the beginning I had some difficulties to understand my surroundings and communicate with my coworkers, but there was always some senior willing to guide me.

Little by little I came to understand how things should be done and I got to define my research topic and begin my investigation from there on.

## 4. My first great adventure

At the beginning of Golden Week in the year 2009 a group of friends from five different countries suddenly decided to go for a hike at Mount Ontake, between Gifu and Nagano prefectures. I had no prior climbing or camping experiences and I had really no idea about what awaited at the mountain. At first we took a train to a town in Nagano Prefecture, and from there we hitchhiked to the mountain. The mountain was almost completely covered in snow. It was my first time facing such a snowy and mountainous landscape so I was naturally very excited and nervous. We slowly began our hike and camped as it got dark. The following day we went all the way up to the top and started going down again. The landscape was surreal; meters of snow and ice, thick fog and plenty of deadly cliffs. Going down the mountain proved to be much more difficult than going up as deep snow and very slippery ice were abundant. The scariest part for me was getting lost and slipping on ice fearing a fall from any of the various cliffs. Later on we got lost in the forest below, but kept on supporting and encouraging each other. It took us almost eight hours to get out of this snowy and muddy maze, but when we did we ended up going to a very nice hot spring at the foot of the mountain. This turned out to be one of the most dangerous, yet rewarding experiences of my life. After this I was prepared to face snow with no fear and it also helped me realize how important cooperation and tolerance among people from different racial backgrounds are.



Fig. 1 Expedition to Mount Ontake

## 5. My first great challenge

By the end of my first year as a research student, I had to present my entrance examinations to enter

Nagoya University. This naturally made me feel very uneasy as I had been concentrating in adapting myself to a new language and a new world. From now on I would have to review many subjects I could barely recall in a relatively short time and almost completely on my own. This was one of the most critical moments for me since it would define if I could remain here as a researcher or not.

## 6. Research work

Initially, defining my research topic was a slight hassle for me, since I could not focus myself very well given my wide array of interests. I first thought of software defined radio related topics; however I was advised by my professor to focus my attention on the Smart Grid. My interest is not only focused on telecommunications, but also on clean energy sources for the future of power grids. Therefore, the Smart Grid represents a perfect example of a system that requires knowledge in both the field of telecommunications and the field of power generation and distribution. More specifically, my research topic currently points towards the control of machines through power lines in which the application of power line communications (PLC) is potentially necessary.

Throughout my master's studies I have published one journal paper which compares the performance of a system controlled through a channel with cyclostationary noise against a system controlled through a channel with stationary noise. I also participated in a few national conferences in Tokyo and Sapporo and am currently about to participate in my first international conference in Canada.

## 7. Other memorable experiences in Japan

Besides giving me a chance to develop myself in the academic aspect, Japan has also given me a chance to learn many new things about daily life and travel to many places I never imagined I would ever visit. Throughout my four years in Japan, I have been able to visit three of its four main islands and admire the breathtaking beauty of its four seasons.



Fig. 2 Winter trip to Nagano with Katayama Laboratory members (Jan. 2012)

In Japan I had the chance to experience snow and skiing for the first time. I come from a tropical country; however I truly enjoy winter sports and love snow. In

Japan I could ice-skate once again and I even began practicing a Brazilian martial art called capoeira. Japan being a very safe country allows for me to ride my bicycle almost until my last breath is gone, so this is another pastime I can fully enjoy. Riding the bicycle has led me to discover many places, save money and time as well as improve my physical condition.

Regarding the cultural experiences, in Japan I was able to experience buckwheat noodle making, to watch how Japanese swords are made, and even dress up as a samurai and a ninja several times. Being able to eat dishes not available in my homeland has also been quite a rewarding experience for me.



Fig. 3 Okehazama Festival, Toyooka City

Regarding human relations in Japan, I must say that making Japanese friends can sometimes be a challenge due to misunderstandings. My best advice to those trying to make Japanese friends is to do your best to learn the language, do not give up, and above everything else, be humble.

## 8. Final remarks

Being in Japan truly fulfills one of my childhood dreams. It is the clean and safe country I had been yearning for such a long time. However, life in Japan, like any other country is full of challenges. The values that I consider most important and which have allowed me to move forwards are perseverance, patience, tolerance and humility. Perseverance helped me endure and not give up when I found difficulties in my path. Language barriers and misunderstandings sometimes blocked my way, but trying again usually led me to good results. Patience allowed me to appreciate those results that take time to achieve. Careful planning instead of haste usually yield better results. Tolerance allowed me to accept and make friends with all sorts of people in Japan, even some who did not seem willing to be friends. Looking at good points in other people instead of focusing on their defects helped me achieve this. Finally, humility allowed me to listen to the more experienced ones around me and understand their advice without thinking my own opinion was more valuable. All these values have helped me lead a relatively smooth life in this wonderful country.

# Japan: A Gate Open to the World

Ngoc T. Dang  
Computer Communications Lab., The University of Aizu



## 1. Introduction

First of all, I would like to thank the editor for giving me a chance to express my experiences in research and life in Japan with readers of IEICE-CS GLOBAL NEWSLETTER. Regarding my brief introduction, I am Ngoc T. Dang from Vietnam. Thanks to the Monbukagakusho scholarship, I joined Computer Communication Lab. of the University of Aizu (UoA) in 2007 as a PhD. student. After graduation in 2010, I went back to my country to continue my job as a lecturer at Posts and Telecommunications Institute of Technology (PTIT), Vietnam. Currently, I am a visiting researcher at Computer Communications Lab., UoA.

I gained a lot of valuable experiences during my three-year study in Japan. It can be said, both literally and figuratively, that Japan is a gate open to the world for me. From Japan, I have travelled to many countries in the world. In addition, study in Japan helps me to approach to the world of advanced knowledge. I also have a lot of new friends from all over the world during my stay in Japan. Especially, I really admire the world of Japanese culture and people.

## 2. To Other Countries in the World

I went to Japan in October of 2007. This is my first trip to a foreign country. From Japan, I have visited many other countries such as India, USA, Australia, Germany, Korea and China. My dream of traveling around the world comes true.



Fig. 1 Attending ATNAC 2009 in Australia thanks to travel grant supported by NEC C&C foundation

To be able to visit such a many countries, I did try my best to do research, write and submit papers to international conferences. In addition, the travel grants

supported by Japanese foundations for the promotion of science have helped me a lot. I would like to give special thanks to Aizu Area Foundation for the Promotion of Education and Science; Telecommunication Advancement Foundation [1]; NEC C&C Foundation [2]; and Research Foundation for the Electro-technology of Chubu [3] for awarding me travel grants to attend international conferences.

I have gained many things from attending international conferences. The most important thing is the improvement of my communication and presentation skills. Also, I know how to make a travel plan. I learned more about the people and the culture of different countries. Moreover, experience from traveling helps me to seamlessly adapt to any environment.



Fig. 2 The UoA 20<sup>th</sup> Anniversary logomark

## 3. To the World of Advanced Knowledge

Before going to Japan, there was lack of chances and good research conditions for me to do high quality research in my country. It was also difficult for me to approach to advanced knowledge in my field of study. Therefore, my research achievements were limited.

Everything has been changed since I went to Japan. Japan is a developed country and a world leader in many technological fields. Japan also has one of the best education systems. Here, I can find anything I need for doing research such as approaching to state-of-the-art technologies, doing research at modern laboratories, and studying under the guidance of outstanding professors.

After three-year study in UoA, Japan, I had achieved all goals to complete my research to the best of my standard. The results I got here are not only a Ph.D. degree but also experiences in doing high quality research. Especially, the experiences in doing high quality research are very helpful for my job as an University lecturer in my home country. Even after I came back to my country, I am still able to do research

at high level and publish my papers in international academic journals. Thus, Japan is really a gate open to the world of advanced knowledge for me. “**To Advance Knowledge for Humanity**” is also the slogan of my university, the University of Aizu (as seen Fig. 2).

#### 4. To the World of Friendship

There are a lot of people from all over the world living and studying in Japan. Moreover, my university has an international education and research environment with approximately 40% of the faculty being non-Japanese [4]. This helps me to have many new friends from other countries such as Korea, India, China, Sri Lanka, Bangladesh, Tunisia, Germany, Colombia, USA and, of course, Japan.



Fig. 3 The IVTA 1<sup>st</sup> Anniversary in 2010

I had such a great time with my friends in Japan. We did many activities together such as volleyball, ping-pong, skiing, climbing... Our volleyball club, named the International Volleyball Team of Aizu (IVTA, Fig. 3), has currently over one hundred members from about twenty countries all over the world. Although many of my friends, including myself, had left Japan, we still keep connection with each other and share information about our work and life.

#### 5. To the World of Japanese Culture and People

Japan besides being a world leading country in economics, science and technology also has a fascinating and multifaceted culture with the traditions dating back thousands of years. Many unique characteristics in Japanese culture that are well-known in the world include cherry blossoms, food, tea ceremony, ikebana, bonsai, and festivals. Aizu-wakamatsu city (Fukushima prefecture), where my university is located, was a castle town during the Edo period. Therefore, I had a chance to visit many historical buildings and sites, such as Tsuruga Castle (Fig. 5), Oyaku-en Garden, that belonged to the lord of Aizu, samurai houses, Mt. Iimori-yama (a symbol of the process in the formation of modern Japan), and Otsuka-yama-kofun, one of the oldest burial mounds in the Tohoku region [5]. I really enjoyed the culture and tradition of Japan.

About the Japanese people, I totally agree with the comment that the Japanese hold special personality characteristics of resilience, patience, industriousness

and helpfulness that assist in overcoming hardships. I admire the Japanese people for overcoming the difficulties after the earthquake, tsunami and nuclear problems that hit their country in 2011. I regret that I was not in Japan during that time to witness it. I am also impressed by the recovery at astonishing speed of Japan after three shocks, especially in Fukushima prefecture. I am very proud to talk with my friends in Vietnam that I have lived in Fukushima and I have many friends there. I came back Fukushima three times since 2012, and I hope to come back here again in the future.



Fig. 4 GETA (Japanese clogs), a gift from my Japanese friend



Fig. 5 Hanami 2008 at Tsuruga Castle, Aizu-wakamatsu city

#### 6. Conclusion

Japan was a gate open to the world for me in the past and now it is a gate open to the world for my students from Vietnam. One of my students has got master degree from UoA, and is now working in Japan. Two other ones are following the master program in UoA. I believe that they will succeed in the future with the advanced knowledge and priceless experience obtained during study in Japan.

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- [4] <http://www.u-aizu.ac.jp/e-index.html>.
- [5] <http://www.japan-guide.com/e/e7700.html>

# Impressions from One Year Living and Studying in Japan

Vuong V. Mai

Computer Communications Lab., The University of Aizu



## 1. Introduction

At first, I would like to extend my sincerest gratitude to the Institute of Electronics, Information and Communication Engineers Communications Society (IEICE-CS) GLOBAL NEWSLETTER for providing me an opportunity of sharing my one-year experience in Japan in this article.

My name is Vuong V. Mai, a foreign student from Vietnam. I received B.E. in electronics and Telecommunications, from Posts and Telecommunications Institute of Technology (PTIT), Vietnam, in 2012. After graduation, thanks to the Japanese government scholarship (MonbuKagaku-sho), I got a great chance to study in Japan. I am currently working toward a M.E degree in computer science and engineering from the University of Aizu (UoA), Japan.

## 2. First steps on the new land

So far, I am keeping in my mind that I am a lucky student. It can be explained by the excellent studying and living environment that I have been enjoying.

What initially caught my attention when arriving at UoA was the international environment. As UoA recruited faculty from throughout the world (approximately 40% of the faculty being non-Japanese), a student from overseas like me was getting a welcome from various classes given both in Japanese and English. In addition, one of the UoA's most distinctive features lies in the fact that it is the first university in Japan to specialize solely in computer education and research [1]. It is exactly what I expected before deciding to study abroad.

During the campus life, one year is an enough time for my experiences in full of outside activities with friends. As long as the landscape in Aizu city, where I am living, deeply depends on the season, we have different ways to enjoy every season. In the last spring, with other members in my laboratory, we gathered in Tsuruga Castle to view colorful cherry blossoms in the surrounding area, and simultaneously celebrate the coming of spring with drinking. When the summer came, we enjoyed the cooler time by sightseeing in the Inawashiro Lake and taking photos of its magnificent view. In autumn time, a phenomenon in that green leaves transform into many colors ranging from red to yellow provides the scenery for my unforgettable memories. Lastly, my most impressive moment may be in the winter. It is true when saying that the beauty of Aizu really shows up in its winter snow. It was my first time that I try snowboarding, taking a break in the

outdoor hot spring and watching the snow falling outside my window.



Fig. 1 Hanami at Tsuruga Castle, Aizu-wakamatsu city



Fig. 2 Skiing and snowboarding at Grand Sunpia Inawashiro Resort, Fukushima pref.

## 3. Research activities

The excellent studying and living environment have strongly motivated my passion for study and research. I have planned for early completion of the Master's Program (1.5 years instead of 2 years) and catch up the opportunity to extend my scholarship to the PhD program. In order to make the dream come true, I have tried my best since some first days.

I have started my research topic for almost one year. My research mainly focuses on Free-space Optical (FSO) and Visible Light Communications (VLC). In detail, I do the cross-layer design and analysis task for FSO and VLC. The results of these works give me the opportunity of attending several domestic and international conferences, including the IEICE general conference 2013, the 18<sup>th</sup> European Conference on Networks and Optical Communications (NOC 2013) [2], and the fifth International Conference on Ubiquitous and Future Networks (ICUFN 2013) [3]. Attending conferences might be the most wonderful time in my research work. I could discuss with other researchers and receive advices from them to strengthen knowledge and improve the communication skill. Fig. 3 is a photo taken at NOC 2013 in Graz, Austria, when I was with fellow students from other countries.



Fig. 3 NOC 2013 at TU Graz, Graz city, Austria

#### 4. Keeping balance in life and research

On the way to achieve those results, I have faced with many challenges. The key point what I tend to point out is that how to balance in life and research. It is a common question of all researchers. In the rest of this article, I would like to share some personal experiences, which I have applied to deal effectively with that issue.

**Break a big goal into smaller goals:** I often divide my work into smaller parts. This method has given me the opportunity to take the pressure off by trying to finish the final task gradually. As a result, I can focus on finishing one small task at a time and it is not really a big deal. After that I feel totally relax and ready to finish the next task until completing the whole work.

**Reward yourself after completing each task:** Between two tasks, there is a break time. I try to reward myself at that time. For example, after done weekly task, I spend my weekend time to play some sports, e.g., volleyball and running. I am a member of an international volleyball club. In the club, although there are differences in nationality, gender and age among its members, everyone shares a common interest in

volleyball. After a semester, the traditional activity of my laboratory is winter/summer camp program. In the last winter, we went to Grand Sunpia Inawashiro Resort Hotel. In that event, besides some activities like skiing (Fig. 2), onsen and having dinner together, we had a seminar when each individual presents about his/her research process. It is the good chance to relax and prepare for further steps.

**Invest your time in other things besides research:** Social activities are my preferences. I am an active member of a team supported by the Center for Strategy of International Programs (CSIP) of UoA. With CSIP team, I often visit local elementary schools to attend international exchange programs. Photo in Fig. 4 was taken at the Matsunaga elementary school in Aizu-wakamatsu city when I was introducing to the lovely kids about Vietnam and its environmental problems. In addition, another remarkable activity was an international exchange program with students from other universities in Japan in the last winter. We enjoyed a 3-day trip to discover the phenomenal beauty of Ura-Bandai in Fukushima prefecture.



Fig. 4 My class at Matsunaga elementary school. Aizu-wakamatsu city

#### 5. Conclusions

One year living and studying in Japan is not a long time; I however have gained valuable experience and knowledge, as well as improved my confidence. I know my plan is a long-term relationship commitment with Japan, and I believe in my decision thanks to wonderful things I have been experiencing in this country. Moreover, I hope that my experience shared in this article would be helpful for those who not only are planning to go to Japan, but also are now studying in Japan.

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# Studying in Prof. Adachi Laboratory: My New Life in Japan

Guan GUI

Department of Communications Engineering,  
Graduate School of Engineering, Tohoku University



## 1. Introduction

First of all, I would like to thank the editor of IEICE-CS GLOBAL NEWSLETTER for giving me this opportunity to share my studying life in Japan.

My name is Guan Gui, a Japan Society Promote Science (JSPS) postdoctoral research fellow in Prof. Adachi laboratory [1] at Tohoku University [2]. To tell the truth, I was born in a poor countryside in China. When I was a child, I couldn't even dream of entering university or studying abroad. Thanks to my parents who have not even entered elementary school, but always encouraged me to be optimistic with the virtue of politeness, patience and positiveness. These values helped me overcome many unexpected challenges on my studying road. Until now, the most challenging event was joining Prof. Adachi's laboratory as a joint doctor course training with University of Electronics Science and Technology of China (UESTC) [2] which is located in Chengdu, China. Indeed, I was really scared before arriving to Japan due to the culture difference. Surprisingly, Japanese people are very polite and friendly. Under the supervision of Prof. Adachi and the help of my Japanese friends, I was really enjoying the four years studying life in Japan. In the past four years, I have experienced many critical events which helped me earn fruitful experience in many aspects, such as research and new family.

This article will give a brief outline of my studying life and personal experience in Japan in the last four years. It hope my experience is helpful to all those who may plan to study in Japan.



Fig. 1 Members in Prof. Adachi laboratory.

## 2. Enjoying new daily life

Coming to Japan was my first time to visit abroad. I was surprised by the beautiful sky, the fresh air and the clean environment. Besides these natural environments,

Japanese people are very polite and kind. In addition, the transportation system is very good and it makes people feel safe. Since then, my new studying life started in Sendai. Prof. Adachi's laboratory looks like an international family even though members are changing every semester. The latest members in this laboratory are shown in Fig. 1. I am really enjoying the research time with them. I have many beautiful memories in this laboratory to share but unfortunately not possible due to the limitation of space.

## 3. Enjoying high-efficient research life

In the field of mobile communication systems, high spectrum efficiency and energy efficiency are considered as important metrics to reduce costs and save energy [4]. We can also extend the wireless communication theory to human networks. In these four years, there were many such high efficiency communication stories between Prof. Adachi and me. Due to the limitation of space, let's only focus on one story as an example. About two years ago, my professor had a business travel to Europe. In that time, I did not use to ask Prof. Adachi where he was and I had three draft papers which required his comments and suggestions. After sending the three papers to Prof. Adachi, he replied quickly. To keep the originality of the story, I bring the reply emails without any change as follows:

*Dear Guan Gui,*

*Thank you for your draft papers. I will read them on my flight back to Japan.*

*Best regards,*

*Fumiyuki Adachi*

After Prof. Adachi just arrived at Narita airport, he sent the revised papers to me as follows:

*Dear Guan Gui,*

*As I promised, I have gone through your three draft papers on my return flight. I am attaching three papers annotated with my comments. Please revise them carefully by taking into account of my comments.*

*P.S. I just arrived at Narita/Tokyo airport.*

*Best regards,*

*Fumiyuki Adachi*

He had checked three manuscripts on his long flight and sent them back to me at Narita airport. Thanks to my professor for his many valuable comments and suggestions. I really can't imagine that he checked the three papers on his flight. According to his comments and suggestions, the three papers were improved a lot and submitted to conferences and journals. To

appreciate his time for checking my papers, I wrote him a thank you email and Prof. Adachi replied again on the train as follows:

*Dear Guan Gui,*

*I am now on the train from Narita airport to Tokyo. I will transfer to Shinkansen to Sendai. I am very happy if you do very good research and contribute the outcomes to many journals.*

*Best regards,*

*Fumiyuki Adachi*

According to the story, probably you can understand now why I have always enjoyed the studying life in Prof. Adachi's laboratory. Prof. Adachi not only teaches me research but also gives me a good example of a high-efficient person.



Fig. 2 APCC2012@Jeju island, Korea (From left to right: Mr. Amnart, Mr. Kimura, Prof. Adachi and me).



Fig. 3 WCNC2013@Shanghai, China.

#### 4. Enjoying attending conferences

Under guidance and encouragement of Prof. Adachi, I have attended many conferences, such as APCC2012 (see Fig. 2), WCNC2013 (see Fig. 3), IWCMC2013 (see Fig. 4) and RCS-April 2013 (see Fig. 5). To tell the truth, I hadn't realized the importance of attending conferences at the first year in Prof. Adachi laboratory.

After four years training in Prof. Adachi laboratory, I really earned a lot of knowledge from attending conferences and improved my oral presentation skills to a great extent. Attending conferences has three obvious merits to the best of my understanding. First, we can present our new research result and receive comments and suggestions for improving our work. Second, conferences are good locations to make friends



Fig. 4 IWCMC2013@Cagliari, Italy (from left to right: me, Prof. Adachi and Prof. Wang).

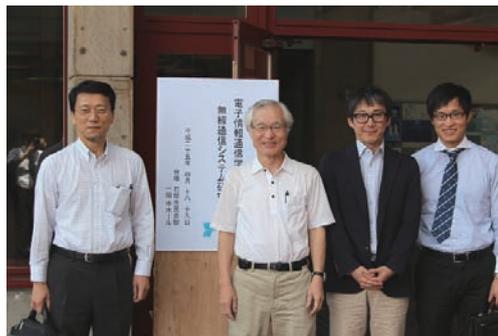


Fig. 5 RCS2013@Ishigaki, Japan (from left to right: Prof. Yamao, Prof. Adachi, Prof. Higuchi and me.)

and communicate with the experts directly. In fact, talking with experts can improve not only our research abilities but also gives us inspiration for thinking for our future. Thirdly, attending conferences is a good chance to travel and visit new places. Thanks to Prof. Adachi, he supported me attending many conferences for improving my presentation skills. Generally speaking, I have really enjoyed attending conferences which enriches my human networking, improves my communication skills and research ability.

#### 5. Concluding remarks

As Prof. Adachi always says, patience is needed for efforts to bear fruit [5]. Thanks to his much patience for my research, four years studying life in Prof. Adachi's laboratory was really fast and enjoyable since I have earned fruitful experience in research and life. Beyond research, as for a Chinese studying in Japan, I try to do my best to enhance understanding and improve friendship between Japan and China. At last, I hope that my personal experience and suggestions give you confidence to realize your dreams, especially with regards to studying in Japan.

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## Special Section Calendar of IEICE Transactions on Communications

| Issue     | Special Section   | Note   |
|-----------|---|--|
| Oct. 2014 | Recent Progress in Measurement and Design Techniques on Antennas, Propagation and Wireless Systems                                  | Submission due:<br>3 February 2014                       |
| Sep. 2014 | Ambient Intelligence and Sensor Networks  | Submission due:<br>6 January 2014<br><b>See page 45</b>  |
| Aug. 2014 | EU's FP7 ICT R&D Project Activities on Future Broadband Access Technologies in Conjunction with Main Topics of 2013 IEICE ICT Forum | Submission due:<br>31 October 2013<br><b>See page 44</b> |
| Jul. 2014 | Opto-electronics and Communications for Future Optical Network  | Submission due:<br>13 October 2013<br><b>See page 43</b> |
| Jun. 2014 | No special section  | /  |
| May 2014  | No special section  | /  |
| Apr. 2014 | No special section  | /  |
| Mar. 2014 | Information and Communication Technology for Medical and Healthcare Applications in Conjunction with Main Topics of ISMICT2013      | Vol. E97-B, No. 3  |
| Feb. 2014 | Technologies for Effective Utilization of Spectrum White Space  | Vol. E97-B, No. 2  |
| Jan. 2014 | Management for Flexible ICT Systems and Services  | Vol. E97-B, No. 1  |
| Dec. 2013 | Network and System Technologies for Sustainable Society   | Vol. E96-B, No. 12                                       |
| Nov. 2013 | Progress in Information Network Science   | Vol. E96-B, No. 11                                       |
| Oct. 2013 | Recent Progress in Antennas and Propagation in Conjunction with Main Topics of ISAP2012   | Vol. E96-B, No. 10                                       |
| Sep. 2013 | No special section  | /  |
| Aug. 2013 | No special section  | /  |
| Jul. 2013 | Internet Architectures, Protocols, and Management Methods that Enable Sustainable Development                                       | Vol. E96-B, No. 7  |
| Jun. 2013 | Heterogeneous Networks for Future Cellular Systems  | Vol. E96-B, No. 6  |

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## Call for Papers

### --- Joint Special Section on Opto-electronics and Communications for Future Optical Network ---

The IEICE Transactions on Communications and the IEICE Transactions on Electronics announce that it will publish a joint special section entitled "Opto-electronics and Communications for Future Optical Network" in **July 2014**.

This Special Section will be published in conjunction with the 18th Optoelectronics and Communications Conference (OECC 2013), which will be held in Kyoto, Japan on June 30 – July 4, 2013, cosponsored by IEICE Communications Society and IEICE Electronics Society and co-organized with Conference on Laser and Electro-Optics Pacific Rim (CLEO-PR) and Photonics in Switching (PS).

The purpose of this Special Section is to present a collection of original papers that give an overview of current progress of research, development, and applications of optical communication systems and optoelectronics.

Submission of the paper presented at OECC 2013 is strongly encouraged. However, presentation of the paper at OECC 2013 is not mandatory for its inclusion in this Special Section. Presentation at the Conference does not ensure the acceptance of the paper. Note that the regular reviewing process will be performed for this Special Section.

#### 1. Scope

The major topics of interest include:

- Access Network (Category OP1)
- Core Network (Category OP2)
- Transmission Systems and Their Subsystems (Category OP3)
- Optical Fibers, Cables and Fiber Devices (Category OP4)
- Optical Switching Systems and Related Technologies (Category OP5)
- Semiconductor Active Optical Devices (Category J1)
- Optical Passive Devices and Modules (Category J2)
- Silicon Photonics Platform (Category J3)
- Optical Signal Processing, Display, Storage (Category J4)

Papers in categories OP1 to 5 should be submitted to the IEICE Transactions on Communications, and papers in categories J1 to 4 to the IEICE Transactions on Electronics.

#### 2. Submission Instructions

The standard number of pages is 8. The page charges are considerably higher for extra pages. Manuscripts should be prepared according to the guideline in the "Information for Authors". The latest version is available at the web site, [http://www.ieice.org/eng/shiori/mokuji\\_cs.html](http://www.ieice.org/eng/shiori/mokuji_cs.html) (IEICE Transactions on Communications), [http://www.ieice.org/eng/shiori/mokuji\\_es.html](http://www.ieice.org/eng/shiori/mokuji_es.html) (IEICE Transactions on Electronics). The term for revising the manuscript after acknowledgement of conditional acceptance for this special section could be shorter than that for regular issues (60 days) because of the tight review schedule.

This special section will accept papers only by electronic submission. Prospective authors are requested to follow carefully the submission process described below.

1. Submit a manuscript and electronic source files (TeX/Word files, figures, authors' photos and biographies) via the IEICE Web site [https://review.ieice.org/regist/regist\\_baseinfo\\_e.aspx](https://review.ieice.org/regist/regist_baseinfo_e.aspx) **by October 31, 2013 (Japan Time)**. Considering the technical field of the paper, authors should choose the [Special-OB](Transactions on Communications) or [Special-OC](Transactions on Electronics) Opto-electronics and Communications for Future Optical Network as a "Journal/Section" on the online screen. Do not choose [Regular-EB] or [Regular-EC].
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Yasuhiko Aoki

Network systems labs, Fujitsu Laboratories Limited,

Address: 4-1-1 Kamikodanaka, Nakahara-ku, Kawasaki, Kanagawa,  
211-8588 Japan.

Tel: +81 44 754 2641, Fax: +81 44 754 2640,

Email: eb-oecc2013@ml.labs.fujitsu.com

##### Special EC(IEICE Transactions on Electronics)

Kiichi Hamamoto

Interdisciplinary Graduate School of Engineering Sciences, Kyushu  
University

Address: D-321, 6-1 Kasuga-kouen Kasuga, Fukuoka, 816-8580 JAPAN

Tel: +81-92-583-7604, Fax: +81-092-583-7898

E-mail: hamamoto@asem.kyushu-u.ac.jp

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\* At least one of the authors must be an IEICE member when the manuscript is submitted for review. Invited papers are an exception. We recommend that authors unaffiliated with IEICE apply for membership. For membership applications, please visit <http://www.ieice.org/eng/member/OM-appli.html>

## **Special Section on EU's FP7 ICT R&D Project Activities on Future Broadband Access Technologies in Conjunction with Main Topics of 2013 IEICE ICT Forum**

The IEICE Transactions on Communications announces that it will publish a special section entitled "EU's FP7 ICT R&D Project Activities on Future Broadband Access Technologies in Conjunction with Main Topics of 2013 IEICE ICT Forum" in **August 2014**. The special section is organized by IEICE Europe Section.

As the growth of wireless services continues, improved and new transmission technologies, system and network architectures and their socio-economic implications are being investigated in order to accommodate the increasing user demand for ease of scalability and reliable broadband service. On this background, since 2007, European Commission (EC) has launched 7<sup>th</sup> European Union's (EU's) Framework Programme (FP7) for ICT R&D projects, and in 2013, the final year of FP7, IEICE Europe Section will held IEICE ICT Forum 2013 in Sarajevo, Bosnia and Herzegovina. The special section seeks for submission particularly from, but not limited to, the authors of the IEICE ICT Forum, and will focus on both theoretical and practical aspects of new algorithms, network/system design and architectures, performance analysis, and experimental studies, related to the technical fields of EU's FP7 ICT R&D project.

### **1. Scope**

Topics of the special section include research results from EU's FP7 ICT R&D project activities or related ones for, but are not limited to, the following areas:

- Information and communication theory and algorithms,
- 4G and beyond wireless cellular networks/wireless cooperative networks/wireless cognitive and reconfigurable networks, and related technologies,
- Socio-economic implications of new technologies, law/regulatory impacts of new network technologies, social networking, The Internet of Things and machine type communications,
- Next-generation wireline access technologies and networks (integration of optical and wireless access as a last mile, converged optical-wireless networks, power communication technologies, future broadband digital subscriber line (DSL) access, distributed monitoring and management techniques, channel modeling/measurement,)
- Performance measurements, experimental platforms and testbeds concerning to the above mentioned topics.

### **2. Submission Instructions<sup>1</sup>**

The standard number of pages is 8; the page charges are considerably higher for extra pages. Manuscripts should be prepared according to the guidelines given in the "Information for Authors." The latest version is available at the web site, [http://www.ieice.org/eng/shiori/mokuji\\_cs.html](http://www.ieice.org/eng/shiori/mokuji_cs.html). Note that The IEICE Transactions on Communications has discontinued LETTERS due to the new online journal for letters, "IEICE Communications Express." The term for revising the manuscript after acknowledgement of conditional acceptance for this special section could be shorter than that for the regular section (60 days) because of the tight review schedule.

This special section will accept papers by only electronic submission. Prospective authors are requested to follow carefully the submission process described below.

1. Submit a manuscript and electronic source files (TeX/Word files, figures, authors' photos and biography) for publishing using the IEICE Web site [https://review.ieice.org/regist/regist\\_baseinfo\\_e.aspx](https://review.ieice.org/regist/regist_baseinfo_e.aspx) by **October 31, 2013(Japan Standard Time)**. Authors should choose the [Special-EB] EU's FP7 ICT R&D Project Activities on Future Broadband Technologies in Conjunction with Main Topics of 2013 IEICE ICT Forum as the "Type of Issue (Section)/Category of Transactions" on the online screen. Do not choose [Regular-EB].

2. Send the "Copyright Transfer and Page Charge Agreement" and "Confirmation Sheet of Manuscript Registration" forms by E-mail or FAX to the following address (guest editor of the special section) by the above due date. We may withdraw the submission if these documents do not arrived by the due date, even if the manuscript has been received by electric submission. For additional guidelines on manuscript submission, please visit: [http://www.ieice.org/eng/shiori/mokuji\\_cs.html](http://www.ieice.org/eng/shiori/mokuji_cs.html).

### **Send the above documents to:**

Prof. Makoto Taromaru  
Faculty of Engineering, Fukuoka University  
Phone: +81-92-871-6631 ex 6383, Fax: +81-92-865-6031, E-mail: taromaru@fukuoka-u.ac.jp

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- Please note that if accepted for publication, all authors, including authors of invited papers, should pay for the page charges covering partial cost of publication. Authors will receive 50 copies of the reprint.

- At least one of the authors must be an IEICE member when the manuscript is submitted for review. For membership applications, please visit the web-page: <http://www.ieice.org/eng/member/OM-apple.html>

## Call for Papers

### ----- Special Section on Ambient Intelligence and Sensor Networks -----

The IEICE Transactions on Communications announces that it will publish a special section entitled "Special Section on Ambient Intelligence and Sensor Networks" in September 2014.

Sensor networks enable connections among peoples, products, and sensing devices for real space. Sensing data should be processed, analyzed, and applied for enhancement or assistance for human activities, which is called "Ambient Intelligence". It is expected that gentle social environments such as efficient electric power usage in smart grids and effective transportation systems will be established through the systems with ambient intelligence based on sensor networks. Not only developments of technologies supporting the ambient intelligence such as sensor networks but also to look ahead to industry applications are important for ambient-intelligence contributions to social-infrastructure progressions. From above points of view, the special section is planned (scheduled to appear in the September 2014 issue) to publish papers on the related fields.

#### 1. Scope

The scope of this special section includes not only information communication research fields but also its multidisciplinary research with agriculture, forestry and fisheries industry fields, industry fields including incineration and power-generator plants, and service fields such as health-care, medical-care, and circulations because they are important and major applications for the ASN. Possible topics include, but are not limited to:

- a. Ubiquitous sensing and actuation technologies  
Space sensing, ambient interface, embedded software, sensing and control theory, etc
- b. Ad-hoc, mesh, and sensor networks  
MAC/routing protocols, multi-hop and cooperative communication, security, green wireless, communication and network theory, etc
- c. Ambient Intelligence  
Sensor database, location-information technology, stream processing, privacy and security, big data, learning signal processing, etc
- d. System infrastructure  
Large scale widening, dependability, IoT, M2M, cyber physical, operation administrative, autonomous distributed control, etc.
- e. System applications  
Agriculture, forestry and fishery support systems, medical and health systems, industrial support system, social infrastructure system, smart grid, etc.

#### 2. Submission Instructions

The standard number of pages is 8. The page charges are considerably higher for extra pages. Manuscripts should be prepared according to the guideline in the "Information for Authors". The latest version is available at the web site, [http://www.ieice.org/eng/shiori/mokuji\\_cs.html](http://www.ieice.org/eng/shiori/mokuji_cs.html). The term for revising the manuscript after acknowledgement of conditional acceptance for this special section could be shorter than that for regular issues (60 days) because of the tight review schedule.

This special section will accept papers only by electronic submission. Prospective authors are requested to follow carefully the submission process described below.

1. Submit a manuscript and electronic source files (TeX/Word files, figures, authors' photos and biographies) via the IEICE Web site [https://review.ieice.org/regist/regist\\_baseinfo\\_e.aspx](https://review.ieice.org/regist/regist_baseinfo_e.aspx) **by January 6, 2014 (Japan Time)**. Authors should choose the Ambient Intelligence and Sensor Networks as a "Journal/Section" on the online screen. Do not choose [Regular-EB].
2. Send "Copyright Transfer and Page Charge Agreement" and "Confirmation Sheet of Manuscript Registration" by E-mail or FAX to the following address (guest editor of the special section) by the above due date. We may withdraw the submission if these documents have not been received by the due date, even if the manuscript has been received by electronic submission. For additional guidelines on manuscript preparation, please visit: [http://www.ieice.org/eng/shiori/mokuji\\_cs.html](http://www.ieice.org/eng/shiori/mokuji_cs.html)

**Send the above documents to:**

**Hiroo Sekiya**

**Graduate School of Advanced Integration Science, Chiba University**

**Tel: +81-3-5750-3088, Fax: +81-3-5750-3088, Email: [asn-ss-sec@mail.ieice.org](mailto:asn-ss-sec@mail.ieice.org)**

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\* Please note that if the submitted paper is accepted, all authors, including authors of invited papers, are requested to pay for the page charges covering partial cost of publications. Authors will receive 50 reprints.

\* At least one of the authors must be an IEICE member when the manuscript is submitted for review. Invited papers are an exception. We recommend that authors unaffiliated with IEICE apply for membership. For membership applications, please visit <http://www.ieice.org/eng/member/OM-appli.html>

## IEICE-CS Related Conferences Calendar

| Date                      | Conference Name   | Location                         | Note                                    |
|---------------------------|---|----------------------------------|---|
| 13 May -<br>16 May 2014   | 2014 International Symposium on Electromagnetic Compatibility ( <b>EMC'14/Tokyo</b> )   | Tokyo Japan                      | Submission<br>deadline:<br>15 Sep. 2013 |
| 10 Feb. –<br>12 Feb. 2014 | The 28 <sup>th</sup> International Conference on Information Networking ( <b>ICOIN2014</b> )  | Phuket, Thailand                 | Submission<br>deadline:<br>15 Sep. 2013 |
| 12 Dec. -<br>15 Dec. 2013 | 2013 IEEE Electrical Design of Advanced Packaging & Systems ( <b>EDAPS2013</b> )  | Nara, Japan                      | Submission<br>deadline:<br>Closed       |
| 23 Oct. -<br>25 Oct. 2013 | 2013 International Symposium on Antennas and Propagation ( <b>ISAP2013</b> )  | Nanjing, China                   | To be held <b>soon</b>                  |
| 14 Oct. -<br>17 Oct. 2013 | 17th International Conference on Intelligence in Next Generation Networks ( <b>ICIN2013</b> )   | Venice, Italy                    | To be held <b>soon</b>                  |
| 14 Oct. -<br>16 Oct. 2013 | International Conference on Information and Communication technology Convergence 2013 ( <b>ICTC2013</b> )   | Jeju Island, Korea               | To be held <b>soon</b>                  |
| 30 Sep. 2013              | TeleManagement Forum Tokyo Spotlight 2013 ( <b>TM Forum Tokyo Spotlight 2013</b> )  | Tokyo, Japan                     | To be held <b>soon</b>                  |
| 25 Sep. -<br>27 Sep. 2013 | Asia-Pacific Network Operations and Management Symposium 2013 ( <b>APNOMS 2013</b> )  | Hiroshima, Japan                 | To be held <b>soon</b>                  |
| 8 Sep. 2013               | The 6 <sup>th</sup> International WDN Workshop on Cooperative and Heterogeneous Cellular Networks ( <b>WDN-CN2013</b> )                               | London, UK                       | To be held <b>soon</b>                  |
| 29 Aug. -<br>31 Aug. 2013 | The 19 <sup>th</sup> Asia-Pacific Conference on Communication ( <b>APCC2013</b> )   | Bali Island, Indonesia           | Done                                    |
| 08 Jul. -<br>10 Jul. 2013 | IEEE Photonics Society 2013 SUMMER TOPICALS Meeting Series Space-Division Multiplexing for Optical Communication ( <b>IEEE Summer Topicals 2013</b> ) | Hawaii, USA                      | <b>Reported</b><br>on this issue        |
| 01 Jul. -<br>05 Jul. 2013 | 18 <sup>th</sup> OptoElectronics and Communications Conference / International Conference on Photonics in Switching 2013 ( <b>OECC/PS2013</b> )       | Kyoto, Japan                     | <b>Reported</b><br>on this issue        |
| 30 Jun. -<br>05 Jul. 2013 | The Pacific Rim Conference on Lasers and Electro-Optics 2013 ( <b>CLEO Pacific Rim 2013</b> )   | Kyoto, Japan                     | <b>Reported</b><br>on this issue        |
| 29 May -<br>31 May 2013   | 2013 IEICE Information and Communication Technology Forum ( <b>2013 IEICE ICTF</b> )  | Sarajevo, Bosnia and Herzegovina | <b>Reported</b><br>on this issue        |
| 20 May -<br>23 May 2013   | URSI Commission B 2013 International Symposium on Electromagnetic Theory ( <b>EMTS2013</b> )  | Hiroshima, Japan                 | <b>Reported</b><br>on this issue        |

Please confirm with the following IEICE-CS web site for the latest information.  
<http://www.ieice.org/cs/conf/calendar.html>

## **Sister Society Agreement between VDE/ITG and IEICE-CS Has Been Renewed**

The sister society (SS) agreement between the Informationstechnische Gesellschaft within the Verband Der Elektrotechnik Elektronik Informationstechnik (VDE/ITG) of Germany and the IEICE Communications Society (IEICE-CS) has been renewed. The SS agreement has been maintained since September 2005. With this renewal, the term of the agreement has been extended to the end of 2017. Various benefits are provided to members of VDE/ITG and IEICE-CS including paper submission, meeting participation, and transactions/journal subscription as well as the discount rates of membership annual fee. For more information on the VDE/ITG, visit the VDE web site [1].

### **IEICE-CS's activities with sister societies**

Currently, IEICE-CS has five sister society agreements concluded with IEEE ComSoc(US), KICS and KIEES(Korea), VDE/ITG(Germany) and CIC(China), respectively. Each sister society agreement includes mutual privileges of conference registration and paper submissions fee, promotion of their publications, and further cooperation with each other. In addition to such main agreements, side agreements which introduce the discount rates of membership annual fee are concluded with ComSoc, KICS, and VDE/ITG so far. As a part of international activities, IEICE-CS will continue to construct a close and mutually beneficial relationship between all sister societies in the future. At the same time, the IEICE-CS hopes that many overseas members of "Sister Societies" will join in the IEICE-CS as a member and also participate in the IEICE-CS related international conferences/meetings.

### **References**

[1] <http://www.vde.com/en/Pages/Homepage.aspx>

## From Editor's Desk

### ● Hot and Humid Summer

At the time I am writing this note, we are in the middle of the hot and humid summer. I participated in a summer festival that my neighbor community holds every year. Although it was not an extremely hot day, cooling down is absolute necessary to avoid heatstroke. I wonder how people in the past manage to cool down without air conditioning and chilled drink? I imagine that the heat might not be as severe as we experience today since there must be more woods instead of concrete and asphalt and no heat dissipation to outside from air conditioned buildings.

When readers see this note, it should be no more hot and humid summer. Good season for various activities comes. One of activities you should consider is to attend IEICE Society Conference, which will be held on 17th-20th September at Fukuoka Institute Technology, Fukuoka, Japan. It is an academic festival.



Omikoshi (conveyance of god).

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No special order is observed



**Michiharu NAKAMURA**

Fujitsu Laboratories, Ltd.

Network Systems Laboratories

*Director, Planning and Member Activities, IEICE Communications Society*



**Fumio FUTAMI**

Tamagawa University

Quantum ICT Research Institute

*Director, Planning and Member Activities, IEICE Communications Society*

# The International Conference on Information Networking 2014 (ICOIN 2014) February 10 (Mon) – 12 (Wed), 2014, Phuket, Thailand



## CALL FOR PAPERS

### GENERAL INFORMATION

This is the 28<sup>th</sup> edition of the International Conference on Information Networking (ICOIN), which was originally started under the name of Joint Workshop on Computer Communication in 1986. ICOIN 2014 will take place in Phuket, Thailand, under the organization of Korea Institute of Information Scientists and Engineers (KIISE). ICOIN 2014 looks for your valuable contributions to the computer communications, wireless/mobile networks, and converged networks in the theoretical and practical aspects.

### TOPICS

Authors are invited to submit original unpublished manuscripts that demonstrate recent advances in computer communications, wireless/mobile networks, and converged networks. Areas of interest include, but are not limited to:

- Ad-hoc and sensor networks
- 5G/B4G cellular systems and heterogeneous networks
- Cloud computing and networks
- Cognitive radio, cooperative communication and networking
- Content distribution network (CDN)
- Content/information centric networking (CCN/ICN)
- Cross-layer design and optimization
- Cyber-physical system (CPS)
- Delay/disruption tolerant network (DTN)
- Device-to-device communications
- Distributed database and data mining
- Energy-efficient protocols, green networks, and smart grid
- Future internet and future networks
- Internet and web-based database systems and applications
- Internet of things and machine-to-machine communications
- Multimedia/database systems and applications
- Networked computing systems and devices
- Network convergence technology
- Network performance analysis/measurement and evaluation
- Network security, trust and privacy
- Network simulation and modeling
- Network survivability and reliability
- Network science
- Network traffic management
- Optical networks
- Operating systems and middleware support for networking
- Peer-to-peer (P2P)/overlay networks
- Pricing and billing
- QoS and resource management
- Routing, switching, and addressing
- Social computing and networks
- Software defined networking (SDN) and network virtualization
- Ubiquitous home and office networking
- Vehicular and underwater networks
- Wireless/mobile networks (WBAN/WPAN/WLAN/WMAN/WWAN)
- Wireless mesh/multihop networks

### INSTRUCTIONS FOR AUTHORS

Authors are invited to submit full paper(s) electronically as PDF files through EasyChair, <http://www.easychair.org>. The direct link for paper submission is <http://www.easychair.org/account/signin.cgi?conf=icoin2014>. Details about the submission process including formatting instructions will be available at the conference website, <http://www.icoin.org>. All submitted papers are subject to peer reviews by Technical Program Committee members. Accepted papers for presentation in the conference will appear in the proceedings which will be available to participants during the conference. More details will be made available in subsequent announcements and on our website. There will be Best Paper Awards for outstanding contributed papers. All accepted papers will be published in the Proceedings of ICOIN 2014.

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### IMPORTANT DATES

- Paper Submission Deadline: **September 15, 2013**
- Acceptance Notification: **December 10, 2013**
- Camera-ready Papers: **January 10, 2014**

Please send any inquiry on ICOIN 2014 to TPC Chair:  
Prof. Sanghoon Lee  
(Yonsei University, Korea, [slee@yonsei.ac.kr](mailto:slee@yonsei.ac.kr))