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Multiple Signal Reception

Yukitoshi Sanada
Keio University

1. Introduction

It is a very great honor for me to have been awarded the IEICE Fellow and have a chance to introduce some of my works. My research started in the area of multiple signal reception and I still work on similar topics though the target systems have changed.

2. Multiuser Detection for CDMA Systems

After I received B.Eng., I proceeded to a master course in a Canadian university. I first worked on the design of spreading sequences for a code division multiple access (CDMA) system to realize better orthogonality between user signals. Soon I realized that the achievable degrees of orthogonality among the signals are limited and multiuser detection at a receiver side is more effective. Thus, to improve the accuracy of replica signals for the scheme proposed in [1], I applied Viterbi decoding in multistage parallel interference cancelation [2,3]. The same concept was also presented almost at the same time in [4]. These seem to be the first research articles that combine iterative multiuser detection and error correction coding [5].

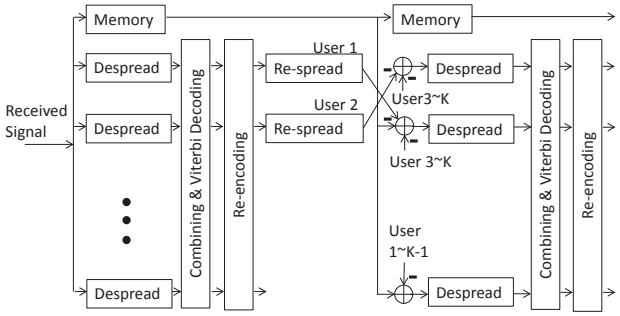

Fig. 1 Iterative parallel interference canceler with Viterbi decoding for a CDMA system

3. IQ Imbalance Compensation for Direct Conversion Receiver

After I started as a researcher, I worked on the signal processing aspect of software defined radio. Soon I understood that hardware issues are more critical for implementing software defined radio technology. Thus, I worked on IQ imbalance compensation schemes for a direct conversion receiver. The IQ imbalance in the direct conversion receiver causes interference between the I-phase and Q-phase signals and the compensation process is similar to the concept of multiuser detection. We worked on frequency offset and DC offset problems as well as IQ imbalance for a direct conversion receiver [6-8].

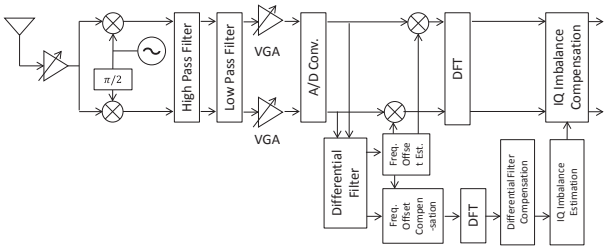

Fig. 2 IQ imbalance compensation in direct conversion receiver

4. Non-Orthogonal Access

After we worked on fractional sampling that is similar to a Faster-Than-Nyquist technique, we realized that the bandwidth of a signal has to be larger than the Nyquist bandwidth [9]. Thus, to accommodate the extended bandwidth of the signal, we have proposed a non-orthogonal access scheme [10]. In that scheme, the overlapped signals in a frequency domain are demultiplexed with successive interference cancelation. This is natural extension of multiuser detection in OFDM systems. Almost at the same time, non-orthogonal multiple access, which combines multiuser detection and user scheduling, was proposed and it has become one of major technology issues in the 5th generation mobile communication systems [11].

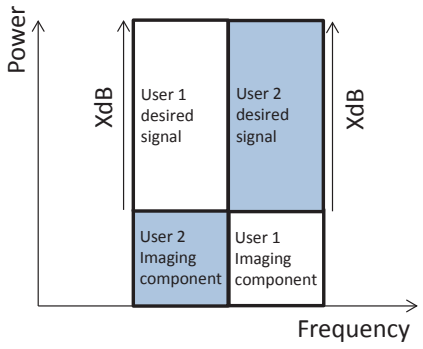

Fig. 3 Non-orthogonal access with iterative interference cancelation

5. Overloaded MIMO Technique

After attending an invited talk at a technical meeting, I thought that the number of antennas actually does not limit the throughput of a multiple-input multiple output (MIMO) system (while it limits the capacity). This is similar to multiuser detection in CDMA systems. The MIMO system with a larger number of transmit antennas is called overloaded MIMO [12]. I also found that overloaded MIMO had already proposed though its bit error rate performance was worse than that with

higher order modulation symbols [13,14]. Thus, we decided to combine overloaded MIMO and joint maximum likelihood decoding to suppress the performance degradation owing to signal multiplexing [15]. We have realized that the system can increase the total throughput as compared to that with higher order modulation symbols.

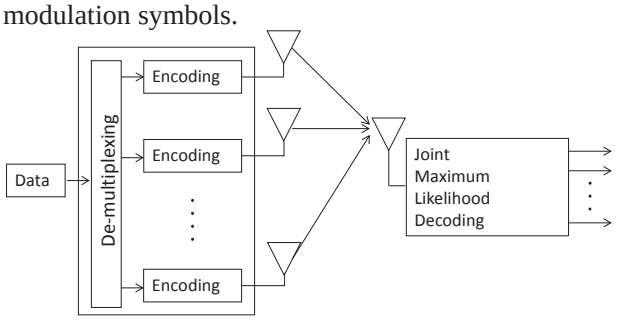

Fig. 4 Overloaded MIMO system with joint maximum likelihood decoding

6. Gibbs Sampling Based Multiple Signal Detection for Large Scale MIMO

Although joint maximum likelihood detection (joint MDL) achieves optimum signal reception performance, its computational complexity grows prohibitively as the number of received signal streams increases. For the case of uplink with massive MIMO, if it is applied to IoT applications, the number of signal streams may be quite large and efficient low complexity multiple signal detection is required. We are now working on the application of a Gibbs sampling algorithm to large scale MIMO systems [16]. It achieves the same BER performance with lower complexity than that of QR decomposition with M-algorithm (QRM)-MLD.

7. Conclusions

For over 25 years, I have been working on the research of multiple signal reception. This topic has long history and it is applicable to various systems. From many research results presented by many pioneers I have learned a lot and could continue to struggle with these research topics. I would like to express my respect to those pioneers in this research area.

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Middle and Upper Atmosphere (MU) Radar

–IEEE Milestone Dedicated–

Susumu Kato[1], Hiroyuki Hashiguchi[2], Toshitaka Tsuda[1, 2], and Mamoru Yamamoto[2]
1: Professor Emeritus of Kyoto University
2: Research Institute for Sustainable Humanosphere (RISH), Kyoto University

1. Introduction

The Middle and Upper atmosphere (MU) radar is a large-scale atmospheric radar for atmospheric observations located at Shigaraki in Shiga Prefecture, Japan. It has been recognized as an IEEE milestone for being the first large-scale atmospheric radar using an active phased array system. Its dedication ceremony was held at Kyoto University in May 13, 2015. In this article, we describe the background of the MU radar, from its development to its observation results.

2. Frontier of Atmospheric Science: Middle Atmosphere

The earth's atmosphere is divided into the troposphere (surface to 10 km altitude), the middle atmosphere (10-100 km), and the upper atmosphere (above 100 km) according to the temperature profile. The troposphere is the region in which various weather phenomena such as typhoons occur, and is directly linked to the livelihood of mankind. In the middle atmosphere, the ozone layer is formed and maintained by the irradiation of solar ultraviolet rays on oxygen molecules. The ozone layer has a maximum temperature at around 50 km altitude, and its upper and lower regions are called the mesosphere and stratosphere, respectively. The middle atmosphere is also the one in which there is a general circulation of air throughout the earth. In the upper atmosphere, which is called the ionosphere, a part of the atmosphere is ionized by solar radiation. The initial observation targets of the MU radar were the middle atmosphere and the upper atmosphere.

In the summer, because the solar radiation energy is efficiently received, the temperature increases in the troposphere. In the past, it was believed that the temperature of the middle atmosphere was higher in the summer hemisphere as well. However, in the 1970s, it was found that the latitude distribution of the temperature in the middle atmosphere is completely opposite to what was expected. To explain this, it was theoretically anticipated that in addition to solar radiation, there was a need for a mechanism (atmospheric wave) to transport energy from the surface to the middle atmosphere. To demonstrate this hypothesis, it was important to observe the height profiles of wind velocities in the middle atmosphere.

Regarding atmospheric observations, surface observations and balloon observations of various meteorological parameters have been conducted for a long time in the troposphere, and meteorological radars that observe the precipitation distribution have been in operation since the 1970s. For the upper atmosphere, satellite observations and ground-based radar observations using radio-wave scattering from the ionosphere have been carried out since the 1950s. However, the middle atmosphere was called the "unknown-sphere" because the observation techniques were limited to direct measurement by a rocket or balloon, which have poor temporal resolution. In the 1980s, the middle atmosphere became the "frontier of atmospheric science."

3. History of MU Radar Construction

First stage

The plan for MU radar construction had already started by the mid-1960s. At that time, the number of supersonic aircraft had increased, and according to meteorologists, the resulting emissions would destroy the ozone layer in the middle atmosphere and the number of harmful ultraviolet rays reaching the ground would increase, harming human health; therefore, interest in middle-atmosphere studies then rapidly increased. Atmospheric gravity waves are expected to be important in gaining an understanding of middle-atmosphere dynamics, and the development and construction of atmospheric radar site was considered the most suitable observation instrument for this purpose. In particular, in Japan, it attracted much attention by meteorologists as an "atmospheric dynamic coupling from below" problem owing to the gravity wave in the middle atmosphere.

Discovery of radio scattering in the middle atmosphere by Jicamarca radar

In the early 1960s, radio scattering from the mesosphere was discovered by the Jicamarca radar in Peru, and it was reported that the observation of the wind velocity was successful. The Jicamarca radar is a 50-MHz incoherent scatter (IS) radar with a passive array using a 300 m x 300 m coaxial-crossed collinear (Co-Co) antenna.

The scattering mechanism in the ionosphere is incoherent scattering owing to free electrons. The observations made by the Jicamarca radar successfully verified the scattering mechanism in the middle atmosphere, and it was found that coherent Bragg

scattering owing to fluctuations in the refractive index caused by density fluctuation due to atmospheric turbulence. From around 1975, it became clear that as this "fluctuation" varies with the atmospheric flow, it can enable us to remotely measure the atmospheric flow by detecting this as a Doppler shift of radar waves. It was then found that the stratosphere and troposphere can be observed using the same kind of radar, which means that we can measure three components of the wind velocity vector using turbulence scattering regardless of the weather.

Balloon measurements are conventional ways of obtaining meteorological observations. It was not easy for meteorologists to properly understand the turbulent scattering mechanism of the new observation system, called atmospheric radar. Actually, to date, this understanding is not perfect, and this observation theory has not been physically validated [1]. However, based on comparisons with balloon observations, it has been confirmed that radar observations are reliable in many cases. However, in research, there always remain unknown problems that need to be solved.

Dawn of atmospheric radar in Japan

Since the mid 1960s, Japanese scientists involved in the study of meteorology, the ionosphere, and radiowaves have had a strong interest in the importance of middle atmospheric research, and Kato, one of the authors, organized a large working group (WG) to focus on this area. The plan to construct the MU radar was carried out with strong support from this WG member. Furthermore, it was decided that the MU radar would be operated under an international collaborative research program.

In the early 1970s, Kato promoted theoretical research on "atmospheric vertical coupling," which treats both the upper and middle atmosphere. In 1976, he organized a research group consisting of meteorological and atmospheric researchers as well as experts in the fields of radar and antenna. At the time, the group members did not have prior experience with radar, and we created a small WG in this area to begin considering various radar systems. We first developed a small system called a meteor radar, and obtained training at foreign IS radar facilities. Since 1977, the WG members have visited the Jicamarca and Arecibo IS radar (430 MHz) sites in Puerto Rico. In the latter half of the 1970s, we devised concrete plans to construct a large-scale radar facility. Because it is impossible for passive array systems, such as Jicamarca radar, to detect rapid atmospheric variations, we proposed and designed an active phased array “MU radar.” Construction began in the mountains of Shigaraki in 1981.

International conference at Fairbanks, Alaska

In the summer of 1983 (one year before the MU radar was completed), the international meeting of MAP (Middle Atmosphere Program) was hosted by the National Science Foundation (NSF) in Fairbanks, Alaska. Participants were Lindzen, Holton, Geller, Fritts, Balsley, Strobel (USA), Vincent (Australia), White (NSF representative), Woodman (Peru), Chanin (France), Hirota, and Kato (Japan). They stayed in a mountain cabin for one week, and took part in daily debates about the radar observations of the middle atmosphere. “Is it possible to accurately measure the middle atmosphere?” was one of the questions that were debated. “The radar observation is a vertical observation at the fixed place, but it is not a global observation. Is it appropriate?” “Do radar echoes co-move with atmospheric motion like a balloon?” “Especially in the mesosphere, scattering targets are not neutral atmosphere, but electrons. Therefore, why do electrons and atmospheric turbulence always co-move?” At the time, there were no clear conclusions. However, there were improved personal friendships among the participants as a result of those sessions. This was the first step towards realizing the observation of the middle atmosphere by radar. The following year, in the autumn of 1984, the MU radar completion ceremony was held at the Shigaraki MU radar site. Prof. Gordon, who is the inventor of IS radar, attended this event, and cut the ribbon. Almost all of the participants of the Alaska meeting attended this ceremony as well as the international MAP symposium held in Kyoto from the next day.

4. World's First Active Phased Array Atmospheric Radar "MU Radar"

The MU radar construction plan received enthusiastic support from researchers who study both meteorology and the upper atmosphere, and it was required that it observes not only the middle atmosphere, but also the upper atmosphere. Therefore, a large-scale system with a peak transmission power of 1 MW and an antenna diameter of about 100 m with a frequency near 50 MHz were required. In order to detect rapidly changing atmospheric motions, it is essential to change the observation direction (antenna direction) at high speed. However, it was difficult for conventional large-scale radar systems such as Jicamarca radar to rapidly change the phase because it distributed the output of a large transmitter to each antenna. In the MU radar, the realization of a system capable of high-speed beam steering was set as a major design goal.

With respect to the new large atmospheric radar, it was required that it was able to change the beam direction at high speed and to control it freely using a computer. We referred to several domestic well-known radar manufacturers to embody our specifications, but received no positive reply from any of the manufacturers. At that time, there were no such atmospheric radar systems in existence anywhere in the world. One day, when discussing with engineers who manufacture wireless communication equipment at Mitsubishi Electric Corporation, the idea of the “active phased array” emerged. It was not a conventional system using a huge transmitter, but compact transmitters are connected to each antenna element, and

they simultaneously operate in phase. If it worked well, we would fulfill our request, but it required nearly 500 transmitters and receivers. It was very difficult to operate so many transceivers (transmitter and receiver modules) with all of the phases in a uniform manner.

We believed that we should publicize this new type of radar, and we therefore submitted a short paper that discussed the new design to Radio Science, which is published by the American Geophysical Union (AGU). The opinions of the two referees were different. One reviewer gave a good evaluation for novelty, but the other stated that it was simply a “pie in the sky” without any technical evidence. Fortunately, the editor also provided an evaluation, so with modifications to include additional theoretical data on antenna radiation characteristics, the manuscript was accepted [2].

Initially, we also did not fully recognize the feasibility of the active phased array method. Kyoto University and Mitsubishi Electric Cooperation continued to hold discussion meetings twice a month for more than two years, and the outcomes included detailed specifications of the proposed MU radar. Figs. 1-3 show the overview of the MU radar, Yagi antenna, and a picture of the TR module, respectively. The MU radar enabled automatic observation by computer control, and the beam direction can be changed every pulse transmission, that is, every 400 μs. The radar has enabled good flexibility when dealing with various observation objectives. Since then, it became possible to obtain various complicated observations that were subsequently devised using the MU radar for the first time [3-5].

After the emergence of this innovative observation technology, the lower to upper atmosphere became the subject of precise scientific observations. In recent years, related documents became public, and up to the early 1980s, only a few radars had reached this level in the 400-MHz or 3-GHz bands, and were developed by large US companies to provide the early warning of the former Soviet Union's ICBM (intercontinental ballistic missile). Except for these military radars, the MU radar is the first large two-dimensional (2D) active phased array radar developed with proprietary technology.

Fig. 1 Overview of the MU radar. The circle with a diameter of 103 m is the antenna array

Fig. 2 Three-element crossed Yagi antennas of the MU radar

Fig. 3 Transmitter-receiver module of the MU radar

5. Observations with the MU Radar

In standard observations made with the MU radar, the radar beams are steered in five directions (the zenith and north, south, east, west with a zenith angle of 10°), and we assume that the velocity field is uniform within the space / time that the radar beam scans. The wind vector is derived from the measured radial velocities. Atmospheric radar has superior advantages in that it can continuously observe the wind vector, including the vertical flow, regardless of the weather. The observation accuracy is roughly 0.1 m/s for the vertical flow, and 0.5–1.0 m/s for horizontal wind. Fig. 4 shows time-height variations of the horizontal winds. For the method involving measurements using a balloon with a sensor, the data as shown in red is intermittent every 6 h (or worse). However, the MU radar can obtain continuous data with an extremely high temporal resolution that is equivalent to launching balloons every minute. The figure shows a case where a typhoon passed near the MU radar before 9 o'clock, but it can be seen that the continuous wind changes that were due to the typhoon passage is captured.

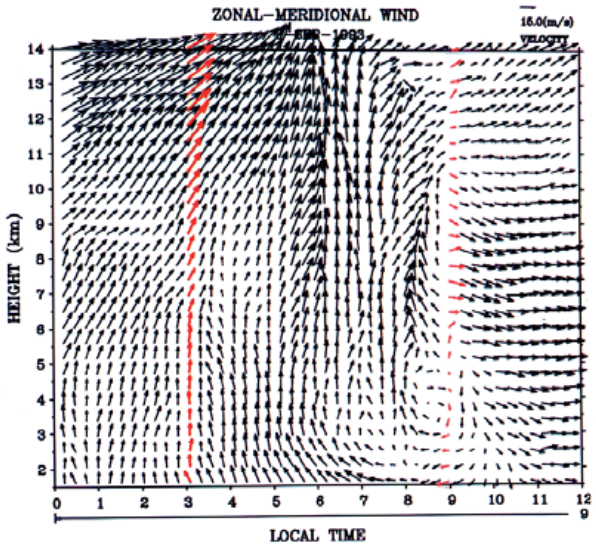

Fig. 4 Time-height variations of horizontal winds observed with the MU radar

Observation of atmospheric wave

The physical quantity observed with the MU radar is basically one dimensional in the vertical direction just above the radar. However, it is a remarkable feature that the one-dimensional (1D) data can be continuously obtained at intervals of about 1 min. In general, the behavior of the middle atmosphere can be understood as the overlapping of atmospheric waves with various temporal and spatial scales, so such continuous data in altitude and time is convenient for analyzing the wave motion. In particular, atmospheric gravity waves have a small scale, and because there were no suitable observation methods in the past, the atmospheric radar played a major role in clarifying the actual situation [6].

As atmospheric gravity waves that are generated mainly in the lower atmosphere are exponentially decreasing with the atmospheric density as they propagate upward, the amplitude of the wind speed (temperature) fluctuates exponentially. As a result, the horizontal wind shear (temperature gradient) in the height direction also increases, and the wave with increased amplitude becomes unstable at a given altitude and breaks. Turbulence is generated by the breaking wave, and contributes to the vertical transport of heat and the vertical mixing of atmospheric trace components. The momentum flux that the waves carry upwards is constant at steady-state elevations, but it shifts to a mean flow at breaking altitudes. It became clear that the atmospheric gravity wave plays an important role against the temperature inversion in the summer/winter hemisphere of the middle atmosphere first mentioned. We verified that the small-scale wave generated in the lower atmosphere propagates upward and controls global atmospheric circulation.

MU radar observations not only confirmed that atmospheric gravity waves exist universally in the middle atmosphere, but also clarified the parameters of the wave quantitatively. In addition, atmospheric gravity waves generated in the lower troposphere were captured by the jet stream, and using the MU radar, it was observed for the first time that the state where the waves were excited by the jet stream was sequentially captured by the critical layer while propagating upward [7]. Furthermore, it was clarified by MU radar observations that the atmospheric wave acts as an excitation source, causing a disturbance that is unique to the mid-latitude ionosphere [8].

Observation of meteorological systems and turbulence

Research is also being carried out on meteorological systems to take advantage of not only atmospheric waves but also wind vectors, including the vertical flow of the MU radar. Assuming that the spatial structure of the meteorological system does not change significantly within the observation time, it is generally interpreted that the time shift is a horizontal change by considering that the system moves from the west to the east, and the altitude-zonal cross-section can be estimated. By synthesizing sectional views at different north-south positions to accumulate observations of the same kind of phenomenon, it is possible to better understand the 3D structure of the phenomena [9].

The spatial resolution of the atmospheric radar observation is specified by the radar system, and the height resolution is 150 m in the case of a transmission pulse of 1 μs. This is insufficient for the observation of thin turbulent layers, etc., whose thicknesses range from several meters to several hundred meters. For this reason, radar imaging has been applied to the MU radar in order to develop advanced technology to improve height resolution [10]. This is to enable us to obtain a resolution that is finer than the pulse width using multiple frequencies and processing signals of respective frequencies with adaptive filters. This function was also added when the MU radar system was extensively upgraded in 2004, and it became possible to clearly observe the S-shaped waveform (billow) of Kelvin-Helmholtz (shear) instability. To date, much important knowledge has been gained regarding the transportation of substances and heat, such as the fact that the activity of billow changes markedly over time, and the altitude that occurs is localized [11].

6. Development of Atmospheric Radar Based on the MU Radar

Development of small portable radar

The Shigaraki MU Observatory, which has the MU radar as the core facility, has been developed as an atmospheric experiment site with related instruments that were acquired by research collaborators. We have also developed transportable radars (wind profilers) based on the MU radar at the Shigaraki MU Observatory.

In the early 1990s, we jointly developed a transportable boundary layer radar with an antenna diameter of 2 m and a peak output power of 1 kW using 1357.5 MHz. In 1999, we developed a wind profiler that had a rectangular 4 m × 4 m array with a

new antenna element and a peak output power of 2 kW. It was named "Lower Troposphere Radar (LTR)" because we can continuously observe the wind in the lower troposphere (up to a 5-km altitude) [12].

The Japan Meteorological Agency (JMA) has developed a wind profiler network, called “WInd profiler Network and Data Acquisition System: WINDAS,” which installs LTRs nationwide and intensively controls and monitors from a central monitoring station, and its operation was started in 2001. The quality of the observation data was determined at the central monitoring station, and is used as the initial value of the numerical weather forecasting model. Further, it contributes to the improvement of the prediction accuracy of phenomenon such as local severe rainfall.

Observations of equatorial atmosphere

From an early stage, Kato has looked forward to the possibility of obtaining atmospheric radar observations, and launched the "equatorial radar" project to construct a large atmospheric radar at the equator as early as the MU radar construction. In the equatorial region, which is the driving source of the global atmospheric circulation, a large-scale cumulus convection is generated and organized by strong solar radiation heating. In the equatorial region, there is no Coriolis effect, so various kinds of atmospheric waves can propagate vertically. These propagating waves interact with the background wind, and cause significant oscillations that are unique to the equatorial region. It is also strongly related to the behavior of the upper atmosphere.

After we conducted preliminary research based on balloons and small radar observations, we completed the construction of the Equatorial Atmosphere Radar (EAR) in West Sumatra in the Republic of Indonesia in 2001 [13]. The EAR has an antenna diameter of 110 m, which is slightly larger than the MU radar, but the output power is 100 kW, which is 1/10 times that of the MU radar, while the sensitivity is much more inferior. However, the EAR adopts the same active phased array system as the MU radar. As a result, the EAR can continuously observe altitude ranges from near the Earth’s surface to the lower stratosphere and ionospheric disturbance with a high temporal resolution and high precision.

The EAR is the first large-scale facility operated by Japanese universities overseas, and has been operated stably for about 15 years through joint operation with LAPAN (National Institute of Aeronautics and Space). The turbulence phenomenon in the tropopause region is important in clarifying the atmospheric exchange between the stratosphere and the troposphere. EAR observations have shown that the equatorial Kelvin wave near the tropopause causes atmospheric mixing between the stratosphere and the troposphere through the generation of turbulence. From the EAR observations, it is also evident that shear instability is constantly occurring along with a vertical shear with a strong wind near the tropopause.

Although many achievements have become possible using EAR, because the output power is 1/10 times that of the MU radar, mesospheric turbulence and ionospheric IS observations cannot be conducted. We are planning to drastically improve the observation function of the equatorial atmosphere by constructing the “Equatorial MU (EMU) radar,” which is based on the MU radar technology. The establishment of the EMU radar is important to parts of the research project “Study of coupling processes in the solar-terrestrial system,” which is one of high-priority projects in the Science Council of Japan’s Master Plan 2014 and 2017. We will continue to make the effort to be a world leader in the field of large atmospheric radar.

7. IEEE Milestone Dedication

Since its completion, the MU radar has been used to carry out collaborative research, and it has produced many results in a variety of research fields such as meteorology, atmospheric physics, astrophysics, electric and electronic engineering, and space engineering. It has therefore had a significant influence on atmospheric radar development. The MU radar was selected as an IEEE milestone, and its commemorative ceremony was held at Kyoto University on May 13, 2015. The Institute of Electrical and Electronics Engineers (IEEE) is the world's largest organization for electric, electronic, information, and communication, with over 400,000 members in more than 190 countries. The IEEE milestone honors significant technical achievements in all areas associated with IEEE, and recognizes the technological innovation and excellence identified in unique products, services, seminal papers and patents, which have been developed for the benefit of humanity. Previous milestones include the ENIAC computer, the Yagi-Uda antenna, and the Tokaido Shinkansen.

During the ceremony, the plaque was presented by IEEE President and CEO, Howard E. Michel, to Kyoto University President, Juichi Yamagiwa, and Mitsubishi Electric Corporation President and CEO, Masaki Sakuyama. After that, we moved to the Shigaraki MU Observatory, where we held the unveiling ceremony of the IEEE milestone plaque.

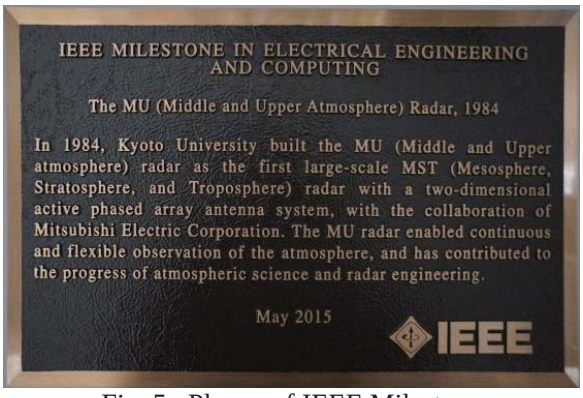

Fig. 5 Plaque of IEEE Milestone

8. Summary

The success of the MU radar was based on the outstanding technical pioneering work of the active phased array system. It has been utilized for collaborative research in various fields such as atmospheric science, upper atmosphere physics, electronic engineering, and radio science, and it has generated many research results. A new observation technology has been developed utilizing a multifunction radar system, and a part of it has been put to operational use in weather forecasting. The MU radar became the source of the atmospheric radar, and its technology has been successfully applied to many atmospheric radar systems that have since been developed worldwide. In order to further promote equatorial atmospheric research, which is the frontier of the present atmospheric science, we continue to make the effort to realize the EMU radar.

9. Acknowledgments

The MU radar was developed by industry-university collaboration between Mitsubishi Electric Corporation and Kyoto University, and the subsequent operation and maintenance of the system is possible by the ongoing cooperation. The MU radar is operated by the Research Institute for Sustainable Humanosphere, Kyoto University, and it is being used for international collaborative research programs.

Finally, Professor Emeritus Shoichiro Fukao, who passed away in May 2014, was the leader of development and research regarding the MU radar, LTR, and EAR. We sincerely believe that he would be pleased with the dedication of the IEEE milestone to the MU radar. We pray for the repose of his soul.

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Report on Communications Society Special Talk and Awarding Ceremony at 2017 IEICE Society Conference

Eiji Oki and Fusao Nuno
Director of General Affairs, IEICE Communications Society

1. Introduction

This article gives an overview of the Communications Society special talk and awarding ceremony at the 2017 IEICE Society Conference held at Tokyo City University, Tokyo, Japan, on September 13, 2017.

During the awarding ceremony, two awards were presented by Prof. Masahiro Morikura, President of the Communications Society; the Distinguished Contributions Award and the Outstanding Contributions Award.

A special talk for this year was "*Offstage of Grant-in-Aid for Scientific Research*," by Prof. Yasuo Okabe, Kyoto University.

Fig. 1 Participants in special talk and awarding ceremony at 2017 IEICE Society Conference

2. Awarding Ceremony

The Outstanding Contribution Award was presented for the chairing technical committees and chief editor services on the Editorial Board of Transactions on Communications and Communications Society Magazine. Eighteen members were awarded for their services prior to 2017. The Distinguished Contribution Award was presented for extraordinary planning activities and voluntary paper reviewing in the Communications Society. One hundred forty-three members were awarded for their contributions prior to 2017. On behalf of award recipients, Prof. Kohei Watabe, Nagaoka University of Technology, conveyed his gratitude for awards, and noted that IEICE is supported by many volunteers, and volunteering is one of most indispensable activities as researchers and engineers.

Fig. 2 Opening remarks by Prof. Masahiro Morikura, President of Communications Society

Fig. 3 Distinguished Contribution Award presented by President Masahiro Morikura

Fig. 4 Award Speech by Prof. Kohei Watabe, Nagaoka University of Technology, on behalf of award recipients

3. Special Talk

A technical lecture was arranged for the special talk. The title of the special talk was "*Offstage of Grant-in-Aid for Scientific Research*". Prof. Yasuo Okabe began his talk by introducing Grant-in-Aid for Scientific Research (KAKENHI), which is operated by Japan Society for the Promotion Service (JSPS). KAKENHI supports to significantly develop all scientific research

Fig. 5 Special talk by Prof. Yasuo Okabe, Kyoto University

based on the free ideas of the researcher in a bottom-up manner, from basic to applied research in all fields, ranging from the humanities and the social sciences to the natural sciences. The KAKENHI system is updated for the next-year application, in terms of the research categories, scientific areas, application formats, and review process. In the review process, two-stage reviews are conducted. He suggested that the applicants should clearly describe their significance of their research proposal, including its background, objective,

Fig. 6 Closing remarks by Prof. Shigeo Urushidani, President-Elect of Communications Society

and problem statements, methods, and impacts on society, in their proposal documents.

After that, he introduced Research Center for Science System, which selects the referees for KAKENHI applications and proposes the improvement of the KAKENHI system to JSPS. He described the organization of the center.

Prof. Okabe concluded this talk by encouraging to submit research proposals based on the free ideas of researchers, and use KAKENHI funds effectively to enhance their research activities.

4. Conclusions

This article gave an overview of the Communications Society special talk and awarding ceremony. The Communications Society supports members' activities in the field of communications by giving contribution awards.

The ceremony was concluded with closing remarks by Prof. Shigeo Urushidani, President-Elect of the Communications Society.

Report on ICM English Session at 2017 IEICE Society Conference

–BS-7, Network and Service Design, Control and Management–

Takashi Kurimoto
Session Organizer, National Institute of Informatics

1. Introduction

The 2017 IEICE Society Conference was held at Tokyo City University in Tokyo, on September 12-15, 2017, where three Societies of Engineering Sciences Society (ESS), Communications Society (CS), and Electronics Society (ES) joined.

In the Conference, the IEICE Technical Committee on Information Communication Management (ICM) [1] hosted a full English Session entitled "Network and Service Design, Control and Management" as one of 9 Symposium Sessions which focused on special topics of advanced technologies.

2. Background of ICM English Session

ICM has been hosting English session every year since 2004. The purpose of this English session is to contribute to the globalization of IEICE by offering the chance of the presentation and discussion in English to the foreign researchers/students living in Japan and the overseas researchers/students.

Figure 1 shows the change in the number of contribution papers since 2004. When the session began in 2004, only 15 papers were submitted. Since then, the number of papers has gradually increased and it reached 55 papers in 2013. Although it decreased in these years, it keeps around 40 after 2008.

The holding period of the session in the 2004 was one and half days, and that in this year was 3 days.

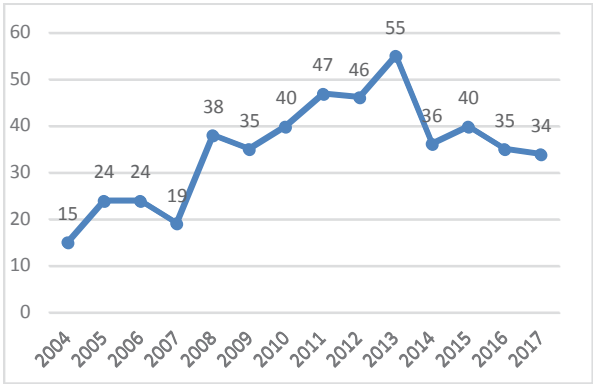

Fig. 1 The number of contribution papers since 2004

3. Presentations in ICM English Session

The contribution papers were classified into 10 sub-sessions according to the topics and set up three days during the Society Conference. Various topics are discussed in each sub-session.

Figure 2 shows the number of papers corresponding to their topics. 9 papers were especially concerning high layer, such as AI and applications. And 8 papers were about IoT (Internet of Things) including IoT network and IoT devices. These two topics collected the half of papers in this year. Wireless-related topics such as mobile networks, wireless LAN also had many papers. Also, content centric network (CCN) received much attention.

Fig. 2 The number of contribution papers corresponding to their topics

4. Authors

Figure 3 shows the number of papers corresponding to the categorization of the presenter's affiliations. 88% of the presenters belonged to the university. 6% belongs to research institutes, and remained 6% belongs to the industries. The situation in which the contribution from the university occupied the majority did not change. But, the number of submissions from industries and research has slightly increased compared with the last year.

Although most of presenters were international students studying in Japan, 4 presenters were Japanese students or researchers. In this symposium, ICM

expects the open contribution from not only the university but also enterprise, and expects the various presenters from not only the international students and the foreign researchers but also Japanese students and researchers, too.

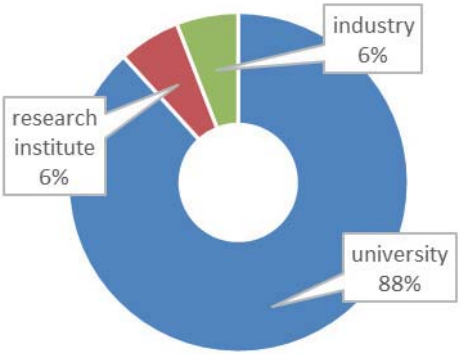

Fig. 3 The number of papers corresponding to the categorization of the presenter's affiliations

5. Award of ICM English Session

ICM will select the best papers and award a prize of the session in the near future to encourage their continuous activities. The best papers will be awarded in the upcoming ICM workshop in March 2018.

Table 1 shows the awarded papers presented in the 2016 IEICE Society Conference in March this year [2,3]. Its awarding ceremony took place in the last ICM workshop (Fig. 4).

6. Conclusions

ICM English session in 2017 successfully finished with a lot of excellent presentations and a very active discussion. The organizer believes that this session became fruitful for all people and was able to contribute to the globalization of IEICE. He wishes that more papers will be contributed to the session in the next year.

Table 1 English session Awardees of ICM Committee

Awardees	Title
Victor Torres da Costa (Tokyo Tech), Toyokazu Akiyama (Kyoto Sangyo Univ.), Katsuyoshi Iida (Tokyo Tech)	Resilient Controller Placement Mechanism in Split-Domain SDN
Bo Wei, Kenji Kanai, Jiro Katto (Waseda Univ.)	Performance evaluations of history-based throughput prediction with trend analysis for mobile network

Fig. 4 Winner of ICM English session award

7. Acknowledgement

The organizer would like to thank Prof. Yoshiaki Tanaka at Waseda University, who made a great contribution in soliciting papers, utilizing his nation-wide academic authority and human relations. He would also like to thank all the member of the ICM committee, the attendees and everyone who contributed to the discussions and supported the session.

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Activities of Steering Committee on Communication Behavior Engineering (CBE)

Sumaru Niida[†], Sho Tsugawa[‡] and Mutsumi Suganuma[§]
[†]KDDI Research, Inc., [‡]University of Tsukuba, [§]Waseda University

1. Introduction

The growth in Information Communication Technologies (ICT) have brought about a dynamically changing users' behavior. It causes unpredictable and unstable service environment. Stabilization of communication quality at low cost under such circumstances is an important and challenging task. In order to cope with this problem, the authors established the Technical Committee on Communication Behavior Engineering (CBE) in 2011 [1] and had been actively engaged for six years. This article outlines the activities of our committee and describes future activities.

2. Research Question of the Committee

Through the discussions in the committee over six years, we defined the "communication behavior" as the behavior which generate data traffic. It includes not only the usage behavior of communication devices, such as mobile phones and smart phones, but also all behaviors that generate data traffic. For example, with the spread of IoT devices in the future, it is assumed that many devices generate data traffic in cooperation with the user's behavior regardless of whether the users intend to generate traffic or do not. Data traffic that is unconsciously generated by users may be handled differently with the consciously generated data such as telephone calls and web services from the viewpoint of user experience. However, this type of behavior can be classified as the communication behavior. On the other hand, the behavior to collect lifelogs in a smartphone without generation of data traffic is not classified as the communication behavior, even if it utilizes a communication device.

In summary, the researches of the communication behavior engineering aims to the appropriate construction of ICT infrastructure through researches interested in understanding, controlling and/or utilizing the dynamics between stimulus and response via communication networks. Based on the discussion in the committee, we defined the main research question of the committee as "How do we construct a communication network system that includes users?". We aim to develop new research approaches that deal with the communication behavior from multidisciplinary perspectives and develop new technology based on information and communication engineering [2].

3. CBE Activities

Our committee held eleven technical conferences from 2011 to 2016. In most cases, the conferences were held in Tokyo or Osaka prefecture. Our committee also organized joint sessions with other committees in IEICE (IN, NetSci and CQ) at the society and the general conferences.

The 81 presentations related to the topics shown in Table 1 were delivered at the technical conferences. The researches presented at these symposiums were diverse. They have their background not only in communication engineering but also in neuroscience, psychology, anthropology, and so on. At each conference, a session called a "roundtable discussion" was set up, and we discuss both the presented researches and the future direction of the communication behavior engineering from interdisciplinary view points by all the participants.

From the research presented at the CBE conference, the approach to the research question of the CBE committee can be categorized from several viewpoints. A major classification is by purpose of the research, which are the "understanding of phenomenon" and the "engineering application."

The understanding of phenomenon is a research approach to analyze a psychology or behavior of users in communication behavior. The research subjects of this type of research include micro (individual characteristics), macros (group characteristics) and mezzo (taking into account an interaction among individuals in a group). They can also be classified by research method, such as a data acquisition method (questionnaire / interview / experiment / ethnography / data logging), an analysis method (qualitative / quantitative) and so on. For example, the qualitative evaluation of QoE by experiment, the emotion estimation during video viewing by experiment, an analysis of social network structure using Twitter logs, a methodology of ethnography for a communication behavior, etc. were presented.

The engineering application can be classified by processes in system development such as design, control and operation of a network system. In addition, the control of the network system can be divided into two methods: controlling the system according to characteristics of a users' behavior and adapting the behavior of users to the state of the system (behavior

Table 1 Research Topics

Research Area	Topics
Measurement and observation of communication behavior	behavior logging, brain activity measurement, biological information measurement, traffic measurement, behavior observation , questionnaire survey, sensor, measurement platform
Analysis and evaluation of communication behavior	cognitive process analysis, mental and physical basis for communication, social brain, neural information analysis, subconscious/subjective measurement, social network structure, complex system, service value
Adaptation and control of communication behavior	user behavior model, traffic model, mental model, user-oriented system design, network/traffic control, self-organization/autonomous distributed control, network science
User behavior support technology	sensation/perception interface, BMI/BCI application, realistic communication, context awareness, recommendation, community application, social support, authentication/ID management
User behavior engineering application	network application, next/new generation network service, sensor network, information appliance network, social network, communication and broadcasting convergence, robotics application, safety and security

modification). For example, BMI (brain-machine Interface) over network, system resource allocation based on QoE, users' behaviors under restrictions of time in a disaster congestion, etc. were presented.

4. Future Activities

After six years of activity, our committee finalized the activities as the technical committee and started activities as a steering committee under the Technical Committee on Communication Quality (CQ), from 2017. We will focus more on the engineering application by taking advantage of studies of the understanding of phenomenon. We think that one of the most effective ways for that is to model the users' communication behavior. The modeling can make the observed phenomena reproducible or manipulatable. The modeling of users' behavior helps us to develop the design and the technology for control. Modeling is important not only to gain a better understanding of communication behavior but also to facilitate efficient collaboration in multidisciplinary research.

5. Conclusion

In this article, we outlined the past activities and the future direction of CBE committee. The cutting edge of ICT technology frees users from the restrictions of time and place. It also generates new problems related to the development of communication networks. The activity of our committee will create new strategies and technologies for future network systems. Our committee welcomes contributions from anyone who is interested.

Fig. 1 Participants in the conference

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Report on the 4th Asian Workshop on Antennas and Propagation (AWAP2017)

Minseok Kim
Niigata University

1. Introduction

This article reports on the fourth Asian Workshop on Antennas and Propagation (AWAP2017) that was held at Hokkaido University in Sapporo, Hokkaido, Japan, during June 28-30, 2017. Hokkaido University is one of Japan's oldest and most prestigious universities of which historical buildings, and elm (a kind of gingko) trees draw a lot of tourists.

This workshop was jointly organized by the technical committee on antennas and propagation of the Institute of Electronics, Information and Communication Engineers (IEICE), Japan, the technical group on antennas and propagation of the Korean Institute of Electromagnetic Engineering and Science (KIEES), Korea, and the electromagnetic group of the Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology Association (ECTI), Thailand.

2. Brief History of AWAP

The AWAP originated from Korea-Japan Joint Conference (KJJC). In 2012, AP groups started to have a separate meeting as Korea-Japan workshop on Antennas and Propagation (KJAP). In 2013, KJAP was held at Gwangju Institute of Science and Technology (GIST), Korea, during January 9-10, 2013. In 2014, Korea-Japan workshop grew to Asian Workshop to welcome participants from all over the world.

AWAP2014, the first AWAP, was held in Kanazawa Theatre in Kanazawa, Japan, during May 14-16, 2014 [1]. Then, in 2015, the second AWAP, AWAP2015 was held at Swissotel Le Concorde in Bangkok, Thailand, during June 17-18, 2015 [2]. The third AWAP, AWAP2016, was held in Busan, Korea, during January 27-29 [3]. In the fourth AWAP, AWAP2017, Prof. Qiang Chen (Tohoku Univ., Japan), Prof. Ikmo Park (Ajou Univ., Korea), and Prof. Prayoot Akkaraekthalin (KMUTNB, Thailand) served as general co-chairs [4].

AWAP is intended to provide an international forum for the exchange of information on the progress of research and development in antennas, propagation, and the related fields. A matter of the greatest importance of this workshop is to promote friendship among the participants. In this regard, AWAP2017 specially organized a dinner event (student version welcome party) for culture exchange as well as active technical discussion within students' participants from Japan, Korea and Thailand. The students enjoyed dinner and free discussion with poster presentation about his/her university, lab, supervisors/members and research. See [5] for more detail report.

3. Technical Sessions

The technical program of AWAP2017 consisted of 2 poster sessions and 5 invited sessions where 55 papers in poster sessions and 18 papers including 1 plenary talk in the invited sessions were presented. Total number of registered participants reached 109, including 77 from Japan, 27 from Korea, 5 from Thailand.

The presented papers covered a wide range of unique and novel technical topics on antennas and propagation. On the first day of the workshop, two poster sessions were held in series where most of the papers were presented by students and young researchers (Fig. 1). In the invited sessions in the second day, a variety of interesting topics and recent results were presented from 18 prominent professors and researchers, where there was very active discussion (Fig. 2).

Fig. 1 Poster session

Fig. 2 Invited session

4. Ceremony

On the second day, the opening ceremony was conducted by general co-chairs, Prof. Qiang Chen and

Prof. Ikmo Park, with their welcome addresses (Fig. 3). After the opening ceremony, Prof. Monai Krairiksh (KMITL, Thailand) gave a plenary talk on "Dual-band Beam-Scanning Reflectometer." After his talk, Electromagnetics award was delivered to him for his leadership and contribution to Asian AP society (Fig. 4). Then, it was followed by five invited sessions.

After the invited sessions, the award ceremony was performed by Prof. Kunio Sakakibara (Nagoya Inst. Tech., Japan), award chair, where Young scientist awards were granted to 6 students selected among 55 poster presenters in the poster sessions which were held in the first day afternoon. Congratulation! The winners are as following (Fig. 5).

- ✓ Tomohiro Komatsu (Iwate Univ., Japan)
- ✓ Naoki Akiyama (NDA, Japan)
- ✓ Tatsuya Nagayama (Tokyo Tech., Japan)
- ✓ Toshinori Kudo (Tohoku Univ., Japan)
- ✓ Tae Heung Lim (Hongik Univ., Korea)
- ✓ Woo Cheol Choi (Yonsei Univ., Korea)

Then, finally the workshop was closed by vice chair, Prof. Hisato Iwai (Doshisha Univ.) with his closing remarks.

Fig. 3 Opening ceremony
(left: Prof. Qiang Chen, right: Prof. Ikmo Park)

Fig. 4 Prof. Monai received Electromagnetics award

Fig. 5 Young scientist award winners

In this workshop, the certificates of appreciation were awarded to Prof. Seong-Ook Park (KAIST, Korea) and Prof. Titipong Lertwiriyaprapa (KMUTNB, Thailand), the former general co-chairs of AWAP2016, and Prof. Minseok Kim (Niigata Univ., Japan), Prof. Jae-Young Chung (Seoul Tech., Korea), and Prof. Akkarat Boonpoonga (KMUTNB, Thailand), the secretaries of AWAP2017.

5. Social Events

At the first night, the welcome reception was held at "Sapporo Beer Garden" which is a very popular "Jingisukan" restaurant located at Susukino area. The party started with Prof. Jaehoon Choi (Hanyang Univ., Korea)'s proposing a toast. The participants enjoyed the delicious Sapporo traditional cuisine and beverage in a very much convivial atmosphere (Fig. 6). After the welcome reception, some of participants might go to the second party and enjoy Sapporo's night individually. On the other hand, the student exchange dinner event was held in the cafeteria in the campus for student participants. This event was open only for the student participants, thus they could really enjoy the event in very relaxed atmosphere [5].

At the second night, all participants enjoyed the banquet at "Koropokkuru" which is also a very popular Japanese style restaurant in Sapporo (Fig. 7) where a lot of delicious Hokkaido's seafood including famous king crab were served. In the beginning of the banquet, Prof. Jiro Hirokawa (Tokyo Tech., Japan) gave his welcome address as a chairman of the technical committee on antennas and propagation, IEICE, Japan, and the party started with Prof. Toshikazu Hori's toast.

Fig. 6 Welcome party with "Jingisukan" at Sapporo Beer Garden

Fig. 7 Banquet at a popular restaurant at Susukino

In the middle of the party, a few senior members of Asian AP society including Prof. Seong-Ook Park, Prof. Young-Ki Cho (Kyungbook Natl. Univ., Korea), Prof. Toru Uno (Tokyo Univ. Agri. Tech., Japan), and Prof. Prayoot Akkaraekthalin delivered consecutive brief speeches about the future events emphasizing friendship and cooperation within Asian AP society members. In the banquet, all participants spent their last night in Sapporo enjoying various Hokkaido's cuisine with lots of popular Japanese Sake's.

In the final stage of the party, Prof. Takashi Hikage (Hokkaido Univ., Japan) who was in charge of local arrangement and management, gave some words of thank and the participants expressed their gratitude for his efforts with loud applause. Then, the party was closed with some words briefing the history of AWAP and emphasizing our continuous friendship from Prof. Hiroyuki Arai (Yokohama Natl. Univ., Japan).

In the banquet, all participants really had a very nice time to promote friendship further as well as make new friends. The party heated up by young members and students enjoying delicious Sake's. After the banquet, most participants also missed parting and went to enjoy the last night in Sapporo in small individual groups (Fig. 8).

6. Closing Remarks

As reported above, AWAP2017 was finished with a great success (see more information and photographs at [4]). In the AWAP steering committee meeting held in the lunch break of the second day, it was decided that the fifth AWAP, AWAP2018 will be held at the Bangkok region, Thailand in the end of July 2018 and will also be organized by more than current three countries (Japan, Korea, and Thailand). See you all in Thailand!

Fig. 8 Young members. Forever our friendship!

Finally this article is ended with a group photograph as shown in Fig. 9 that was taken after all of the technical sessions for our memory.

7. References

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[5] "Report on the Student Exchange Dinner Event in AWAP2017," IEICE Communications Society Global Newsletter Vol. 41, No. 4.

Fig. 9 Group photo of all participants

Report on the Student Exchange Dinner Event in AWAP2017

Ryotaro Taniguchi[†], Toshinori Kudo[‡], Tohko Nishiyama[††], Takuto Kurose[†], Yuki Ito[‡‡], and Jumpei Motohashi[†††]

†Graduate School of Science and Technology, Niigata University
‡Graduate School of Engineering, Tohoku University
††Graduate School of Science and Technology, Kumamoto University
‡‡Graduate School of Science and Engineering, Doshisha University
†††Graduate School of Information Science and Technology, Hokkaido University

1. Introduction

This article reports on the Student Exchange Dinner Event in fourth Asian Workshop on Antennas and Propagation (AWAP2017) that was held at Hokkaido University in Sapporo, Hokkaido, Japan, on June 28, 2017. Hokkaido University is the national university with the largest campus in Japan, and there is a bust of William Smith Clark who is known for shouting “Boys, be ambitious.”

AWAP2017 was jointly conducted by the technical committee on antennas and propagation of IEICE (the Institute of Electronics, Information and Communication Engineers) in Japan, the technical group on antennas and propagation of KIEES (the Korean Institute of Electromagnetic Engineering and Science) in Korea and the electromagnetic group of ECTI (the Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology Association) in Thailand. This dinner event was held at the first night of the workshop where only student participants were allowed to attend.

In the student exchange dinner event, 37 Japanese students and 11 Korean students joined. At the beginning, Professor Kim from Niigata University of Japan explained the aim of this event, and, after then it was held by only students. It has poster session, dinner and exchange, and closing speech in this order.

2. Poster Session

The participants were divided into four small groups and each group enjoyed the poster presentation and discussion (Fig. 1). The number of participating laboratories were 15 from Japan and 7 from Korea. Each poster was written about the research of the laboratory that the participant belonged, the life in the laboratory, and so on.

Unfortunately the time for the poster session was limited to 15 minutes because this event is planned to finish within 2 hours. In this session, we verily explained the contents of the research, the situation of university life and the atmosphere of the laboratory. We all became familiar, and continue to talk about even more specific issues.

Fig. 1 Poster session

3. Dinner

After the poster session, we enjoyed dinner and conversation. It was a standing style for about an hour and a half. Students from different countries and different laboratories made various exchanges among the groups with eating and drinking such as salads, fried foods and beer (Fig. 2).

There were many contacts among students from different countries. We had conversation in English, and talked about various topics such as the university circumstances, sightseeing spots, food culture, famous sweets and fashion in each other countries. In addition, we had exhaustive discussion about contents which was not explained in the poster session (Fig. 3). Some Korean master’s students were married then Japanese student were surprised by the difference in culture between Japan and Korea.

Furthermore, we actively interacted among Japanese students. Students in the same country mainly talked about research and career paths. Students who are considering their future were listening with interest to someone who decided to go on to the doctor course.

Also, we exchanged contact information, and we promised that after AWAP2017, we will keep in touch and meet again in any future academic conferences (Fig. 4).

Finally, we gathered and took group photos together, and promoted friendship further (Fig. 5).

Fig. 2 Students exchange

Fig. 3 Poster session at dinner

Fig. 4 Exchange contacts

Fig. 5 Group photo

4. Closing Remark

Mr. Sekiguchi who is a student of Hokkaido University gave the closing remark. This party is closed in a harmonious atmosphere with his wonderful speech.

After that, we exchanged contacts each other and wished all the best and success in the future. We had to leave the hall immediately. However, it took a few more minutes after closing remark that everyone came out of the hall.

5. Second Party

After the event, some of the participants gathered together and went to another place to continue the party. Sapporo which is the venue for AWAP 2017 is very famous for Miso Ramen and it was hard to select the shop.

Because we, student group leaders, couldn't talk to one other in the dinner event, we were enjoyed the second party talking about various issues not only about the laboratory but also private topics. At that time, we understood that some people working for the same company from next year, so they became much familiar with each other.

6. Conclusion

As reported above, the student exchange dinner event in AWAP 2017 was finished with great success (see more information and photographs at [1]).

This event gave us good stimulus for the future. Based on this experience, we hope that participating students will be able to live a fulfilling research life. "Boys, be ambitious."

7. References

[1] Website of AWAP2017, IEICE Technical Committee on Antennas and Propagation, https://www.ieice.org/cs/ap/jpn/index.php?awap/awap2017.

Report on the 7th International Symposium on Network Virtualization

Takeshi Kinoshita*, Norio Sakaida*,
and Dai Suzuki**

*NTT Network Innovation Laboratories
**Fujitsu Laboratories Ltd.



1. Introduction

The Seventh International Symposium on Network Virtualization was held on August 4, 2017, at the University of Tokyo (U-Tokyo), Japan. The symposium has been held annually since 2011 to promote research and development of network virtualization through international collaboration of researchers, aiming at realizing new communications infrastructure using the technology.

2. Overview

The theme of this year's symposium was "Network Softwarization for Diverse 5G/IoT Services." Like in the last year, latest research activities and technological issues on network softwarization were discussed with the focus on 5G mobile networking and Internet of Things (IoT).

The symposium was co-hosted by IEICE Technical Committee on Network Virtualization; JSPS ITRC Network Virtualization Working Group; Graduate School of Interdisciplinary Information Studies, Graduate Program for Social ICT Global Creative Leaders (GCL), U-Tokyo; U-Tokyo Interfaculty Initiative in Information Studies; and NICT. Dr. Teruyuki Hasegawa of KDDI Corporation led the Program Committee.

Fig. 1 Audience in the symposium

Nearly 100 researchers and engineers from both industry and academia joined the conference. As in the past, there were many student attendees as well. A social gathering was held after the symposium to facilitate the international interaction.

3. Session Program

The symposium started with the greeting by Dr. Hasegawa, chair of this year's symposium, followed by three opening speeches by Dr. Naoto Kadowaki of NICT, Dr. Kiyohide Nakauchi of ITRC, and Prof. Toshiyuki Nakata of GCL.

Fig. 2 Greeting by Dr. Teruyuki Hasegawa (Chair)

In the following talk sessions, each of five invited speakers made a presentation for a 40-minute time slot. The first speaker was Dr. Glenn Ricart of US Ignite. His talk was about "Virtualization for Edge Computing." In his talk, he presented use cases of city or community edge computing as the future of cloud computing and the Internet, citing emerging technological drivers for the move, especially ones concerning IoT. He also explained how network virtualization should be applied to meet wide-spectrum of IoT requirements in such a way as to take services as the main abstraction target.

The next speaker was Dr. Fumio Watanabe, Chairman of KDDI Research. His talk, titled "End-to-End network virtualization and future vision of RAN," covered issues on 5G mobile networks and discussed them from the viewpoint that how virtualization would be related. He emphasized the importance of operations for end-to-end network slices, which would include virtualized radio access networks (vRANs). He said the future operations should be able to deal with problems peculiar to virtualized networks and also to explore capabilities using automation.

The third speaker, Mr. Motoyoshi Sekiya of Fujitsu Laboratories, talked about "Network Virtualization: Catalyst for Digital Transformation." Technologies have been developing so as to enable computing and storage resources as well as networks to be virtualized and shared. In the coming age of digital transformation, data would become the key resource that would provide added values, he said. He discussed technological challenges in network virtualization, relating it to the concept of virtual private digital exchange (VPX), in which data would be shared securely using Blockchain.

Following the lunch break, Dr. Hiroshi Mano of EverySense made a presentation with the title "End-to-end IoT platform for data exchange." Data collected from various kinds of IoT devices should have higher value as information when they are combined properly. To that end, he introduced a platform that would provide interoperability among different kinds of devices and a mechanism to share data from devices deployed by different entities. He then explained how the platform would work while retaining 'fair information practice principles' that he also introduced.

The final speaker was Dr. Abhimanyu Gosain of Northeastern University, who is Technical Program Director of PAWR Project Office. He explained the activities of Platforms for Advanced Wireless Research (PAWR), a joint project by National Science Foundation (NSF) and an industry consortium on wireless technologies. The project, with its research area including virtualization and network slicing among others, would bridge the 'valley of death,' he said.

Following the talk session, there was a 20-minute special lecture by Mr. Chip Elliott of Raytheon BBN Technologies, who has been a regular participant in this annual symposium. His talks in the past meetings always included future visions that appealed to the listeners' curiosity, and so did this year's talk. With the lecture title "A Vision for Advanced Wireless Testbeds," he presented a picture in which everything, including telecom equipment, would be managed in layers of cloud datacenters. In there, the wireless part would become the 'cloud's skin' that would provide ubiquitous accesses.

Fig. 3 Presentation by Mr. Chip Elliott

The lecture was part a two-hour panel session, which was chaired by Prof. Akihiro Nakao of U-Tokyo. With the above six speakers as the panelists, the panel discussed challenges towards efficient and speedy launch of diverse 5G/IoT services, which would make use of network softwarization as a key enabler. The panelists exchanged opinions about the questions like 'What are the critical impediments for 5G/IoT successful launch and social acceptance?', 'Do we need an international/global information/data sharing in 5G/IoT era?', and so on. The discussion was very lively and identified a number of interesting issues as homework for the next year.

In the same building, six exhibition booths were placed. During the breaks between the sessions, researchers from industry and academia showed their newest activities using demonstrations and posters.

Additional information about the program is available at the symposium website [1].

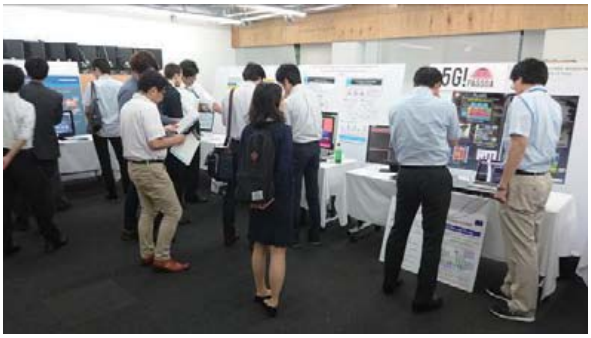

Fig. 4 Exhibition booths

4. Conclusion

Network softwarization technologies are paving the way towards realizing new infrastructures and services in the coming 5G/IoT era. This year's symposium showed the latest moves of both industry and academia, which are making ever more concrete progresses in laboratories, field trials, or projects.

5. Reference

[1] http://www.ieice.org/~nv/english/symposium1

Activities of Technical Committee on Optical Fiber Technologies (OFT)


Ikutaro Ogushi* Katsuki Suematsu**
NTT*, Furukawa Electric co., Ltd.**
Web page: http://www.ieice.org/cs/oft/jpn

1. Introduction

The Optical Fiber Technologies (OFT) committee, which was established in April 1998, is one of the technical committees of the Communications Society of the IEICE. One of the most important aims of our committee is to contribute to technological innovation in relation to optical fiber technologies for the development of industrial applications. We do this by focusing on the technologies from cross-sector viewpoints with reference to communication engineering, measurement technologies, optical devices, and materials.

2. Covered Research Fields

OFT is concerned with a wide variety of research related to optical fibers and optical systems (Table 1). Our topics of interest mainly include optical fiber sensing, optical fiber devices, optical fiber systems, optical fiber wiring/installation, maintenance/operation, and the design of optical fiber/cables. We discuss optical devices that are applied to actual communication equipment. OFT covers research areas ranging from basic optical technology to actual maintenance.

However, our topics are not limited to the above. We would like to engage in discussions with industry and academia unrelated to communication. We are interested in discussing the topics underlined in red in Table 1. The use of optical fiber in various industries has actually been increasing. We also organized a symposium in cooperation with optical fiber systems for the medical field and structural health monitoring field at past IEICE Society and General Conferences.

3. OFT Activities in FY 2016

3.1 Technical Meetings

We hold one- or two-day technical meetings six times a year. Many researchers participate in the meetings, and they report their latest results. The schedule in FY 2016, which consists of six regular technical meetings, is shown in Table 2. Several of the meetings are co-organized with other committees. Fifty-one papers were presented at our regular meetings in FY 2016 and there were 438 participants.

3.2 OFT Encouragement Award in 2016 (calendar year)

Since the program was launched in 2011, OFT has encouraged the research activities of younger researchers. This program has two awards for younger researchers and students.

The winner of the Young Researcher Award was Atsushi Nakamura (NTT) who presented papers [1].

The winners of the Young Researcher Award for Students were Ryo Yokota (UEC), Kazushige Sugawara (Kitami Inst. of Tech.), Ken Takahashi (Soka Univ.) and Toshiaki Hara (Soka Univ.) who also presented papers [2-5].

Figure 1 shows a photograph taken at the award ceremony.

Table 1 Topics

Major Topic Areas	Topics
Optical fiber sensing	Optical fiber probe, Optical fiber gyroscope, Optical fiber sensor device, Distributed optical sensing, Remote optical sensing, Optical fiber measurement, Optical reflectometry
Optical fiber devices	Optical signal information processing, Optical fiber interferometer, Optical fiber amplifier, Optical fiber laser, Optical fiber coupler/splitter, Optical filter
Optical fiber systems	Image/Illumination/Display, Material processing system, Medical system, Biological system, High-power system, Environmental system, Communication system
Optical fiber wiring/ installation, maintenance/ operation	Optical line testing system, Optical line management, Optical line reliability, Optical line design, Optical line construction technique, Optical connector/interconnection, Optical line components
Optical fiber/cable design	Optical fiber characterization, Optical fiber reliability, Optical propagation analysis, Analysis of optical fiber characteristics, Optical fiber cable/Optical fiber cord, Optical fiber for various uses

Red underlined parts include both communication and non-communication areas

Table 2 Technical meetings schedule for FY 2016

Date	Venue	Joint committee
2016/5/26-27	Okayama International Center (Okayama City)	
2016/8/25-26	Chitose-alcadia plaza (Hokkaido)	OCS, LSJ
2016/10/13-14	MALIOS (Morioka City)	
2016/11/10-11	Nagasaki Shoko Kaigi Sho (Nagasaki City)	IEE-CMN, ITE-BCT, OCS
2017/1/20	Kikai-Shinko-Kaikan (Tokyo)	
2017/2/16-17	Osaka Prefecture Univ. (Osaka)	OPE, OCS

Fig. 1 Winners of OFT Young Researchers Award in 2016: L-R, A. Nakamura, R. Yokota, K. Sugawara, K. Takahashi, and T. Hara

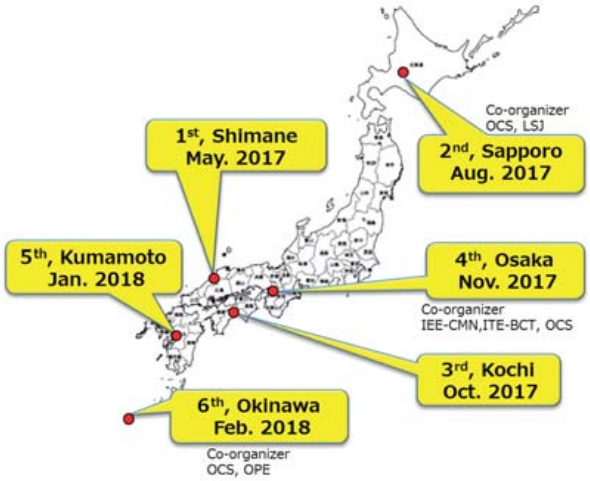

Fig. 2 Regular technical meetings in FY 2017

3.3 Activities of IEICE Society and General Conferences

Sixty papers were presented at the IEICE Society and General Conferences in FY 2016. We organized the symposium "Biomedical applications of optical fibers" on 22nd September 2016, at the IEICE Society Conference 2016 (September 20th-23rd, 2016, Hokkaido Univ., Sapporo). Six outstanding speakers were invited, and they gave talks on topics including biomedical applications of optical fibers. Another symposium, "Future trend of optical fiber cable", was co-organized by the EXAT and OCS committees on 22nd March 2017, at the IEICE General Conference 2017 (March 22nd-25th 2017, Meijo Univ., Nagoya). There were nine invited talks and the directionality of optical cable in the future was discussed.

4. Technical Meetings in FY 2017

We plan to hold six successive technical meetings as shown in Fig. 2. We would welcome your submissions to and/or participation in our conferences (http://www.ieice.org/cs/oft/jpn).

5. Conclusion

This report has summarized the activities of the Technical Committee on Optical Fiber Technologies. We will focus on the area of optical fiber systems for non-communication use. To conclude, we would like to thank all the speakers and participants for their contributions.

6. References

[1] Atsushi Nakamura, et al, "Mode field diameter of LP11 mode for estimating coupling efficiencies at a splice and its measurement technique," IEICE Tech. Rep., vol. 116, no. 198, OFT2016-12, pp. 5-10, Aug. 2016.

[2] Ryo Yokota, et al, "Distortion compensating optical variable delay line using cross phase modulation assisted optical Fourier transformation," IEICE Tech. Rep., vol. 116, no. 295, OFT2016-34, pp. 51-56, Nov. 2016.

[3] Kazushige Sugawara, et al, "Fluctuation of void intervals in fiber fuse near the splice point between different fibers," IEICE Tech. Rep., vol. 116, no. 244, OFT2016-24, pp. 35-39, Oct. 2016.

[4] Ken Takahashi, et al, "Durability evaluation of hydrogen sensor based on hetero-core optical fiber with Au/Ta_2O_5/Pd alloy," IEICE Tech. Rep., vol. 116, no. 295, OFT2016-28, pp. 9-12, Nov. 2016.

[5] Toshiaki Hara, et al, "Swallowing measurement using hetero-core optical fiber sensor for medical examination in home environment," IEICE Tech. Rep., vol. 116, no. 295, OFT2016-27, pp. 5-8, Nov. 2016.

Special ECOC 2017 Symposium

Toshio Morioka
Technical University of Denmark

1. Introduction

The Special ECOC 2017 Symposium was held at the Technical University of Denmark (DTU) Lyngby campus in Copenhagen, Denmark over the period of 14th-15th, 2017. The symposium is intended to address major ECOC-related research efforts worldwide, including 1) large EU-overseas research strategies, 2) large national research investments in research centres and institutes, as well as 3) advanced spatial multiplexing technologies for extremely high capacity data transmission. The third track for advanced spatial multiplexing technologies is technically co-sponsored by Technical Committee on Extremely Advanced Optical Transmission Technologies (EXAT), IEICE Communications Society [1], working for 3-M (multi-core, multi-mode. multi-level) technology promotion. The symposium consisted of four plenary talks and 42 invited talks by eminent speakers in the three main tracks described above and gathered more than 100 participants from across the world, in which there were 25 participants from Japan. The organizers are Prof. Leif Katsuo Oxenløwe, Prof. Lars Dittmann, and Prof. Toshio Morioka of DTU Fotonik, Department of Photonics Engineering, Technical University of Denmark [2].
http://www.conferencemanager.dk/ecoc2017symposiumDTU/special-ecoc-2017-symposium.html

2. General Description of the Symposium

The symposium had four plenary talks, namely, “50 years of optical fibre communications - a personal perspective” by Prof. Klaus Petermann, Technische Universität Berlin, Germany “EU Research Funding Opportunities in relation to Optical Communications in the 5G Framework under H2020” by Dr. Pertti Jauhiainen, European Commission, “Photonics 21 visions and opportunities” by Dr. Sebastian Bigo, Nokia Bell Labs, France and “The ERC: Achievements and Opportunities” by Prof. Fabio Zwirner, Universily and INFN, Padova, Italy. In Track I: EU-overseas research strategies, there were 14 invited talks. In Track II: large national research investments in research centres and institutes, there were 15 invited talks. In Track III, there were 2 keynote talks and 11 invited talks. On Day1 after the technical sessions, there was a bus guided tour around Central Copenhagen followed by a reception at Copenhagen City Hall and a dinner at Copenhagen Street Food. On Day2, there were another reception and a lab tour at a newly built DTU Fotonik Building 340.

3. Track III: Advanced spatial multiplexing technologies for extremely high capacity data transmission

The track III is intended to discuss recent developments of space-division multiplexing (SDM) technologies and the future research directions with a subtitle “Next steps towards 10 Pbit/s and beyond”. This track is technically sponsored by Technical Committee on Extremely Advanced Optical Transmission Technologies (EXAT), IEICE Communications Society and 6 speakers were invited from the EXAT Technical Committee: Dr. Yoshinari Awaji, NICT, Prof. Kunimasa Saitoh, Hokkaido University, Dr. Kazuhide Nakajima, NTT Access Network Service Systems Laboratories, Prof. Yasuo Kokubun, Yokohama National University, Prof. Masato Yoshida, Tohoku University, and Dr. Takayuki Mizuno, NTT Network Innovation Laboratories.

The program of track III is shown in Fig.2. There were two keynote talks: Nonlinear interactions in SDM fibers” by Prof. Antonio Mecozzi of University of L’Aquila, Italy and “Mode division multiplexing in optical fiber transmission - Review of mode theory, analysis and multi/demultiplexing -” by Prof. Yasuo Kokubun, Yokohama National University. In addition, there were four technical sessions on SDM studies in the world (Japan, US, Europe), SDM fibers, SDM components, and transmission systems.

Fig. 1 Opening of Track III: Advanced spatial multiplexing technologies for extremely high capacity data transmission

Time	Session	Name, Paper Title	Affiliation
Sep. 14 11:00-12:00	**Keynote**	Antonio Mecozzi, "Nonlinear interactions in SDM fibers"	University of L'Aquila, Italy
13:00-14:30	SDM studies in the world	**Yoshinari Awaji**, "Overview of EXAT initiative"	NICT, Japan
		Roland Ryf, "SDM research in the US"	Nokia Bell Labs., USA
		Poul Kristensen, "SDM research in Europe"	OFS Denmark, Denmark
15:00-16:30	SDM fibers	**Kunimasa Saitoh**, "Recent progress in multi-core fibers and multi-mode fibers for space division multiplexing"	Hokkaido University, Japan
		René-Jean Essiambre, "Coupled-core MCF transmission"	Nokia Bell Labs., USA
		Kazuhide Nakajima, "Multi-core fibre technology: toward real application and standard"	NTT Access Network Service Systems Labs, Japan
Sep. 15 11:00-12:00	**Keynote**	**Yasuo Kokubun**, "Mode division multiplexing in optical fiber transmission - Review of mode theory, analysis and multi/demultiplexing -"	Yokohama National University, Japan
13:00-14:30	SDM components	Shaif-ul Alam, "Multi-core fiber amplifier for dense space division multiplexed transmission systems"	University of Southampton, UK
		Jean-François Morizur, "Spatial multiplexer based on Multiplane Light Conversion : state-of-the-art performances and applications in SDM"	CAILabs, France
15:00-16:30	Transmission systems	Magnus Karlsson, "Prospects for high-spectral-efficiency modulation"	Chalmers University of Technology, Sweden
		Masato Yoshida, "Recent progress in multi-level modulation"	Tohoku University, Japan
		Takayuki Mizuno, "Dense SDM Long-haul Transmission Over Single-Mode MCF"	NTT Network Innovation Laboratories,Japan

Fig. 2 Program of Track III

In the "SDM studies in the world" session, Dr Awaji of NICT gave an overview of the Japanese EXAT activities for the last nine years since 2008 while Dr. Roland Ryf of Nokia Bell Labs., USA gave an overview of research activities in the US, especially at Bell Labs. and Dr. Poul Kristensen of OFS Denmark gave the one in Europe, focusing on OAM (Orbital Angular Momentum) fibers. In the "SDM fiber" session, Prof. Saitoh of Hokkaido University presented recent research developments on multi-core and multi-mode fibers and Dr. René-Jean Essiambre of Nokia Bell Labs., USA presented "Coupled-core MCF transmission" for long distance transmission systems. Dr. Nakajima of NTT Access Network Service Systems Laboratories, on the other hand, presented "Multi-core fibre technology: toward real application and standard" discussing some of the requirements for their future commercialization and standardization. In the "SDM components" session, Dr. Shaif-ul Alam of University of Southampton, UK presented multi-core fiber amplifiers having more than 30 cores [3] and Dr. Jean-François Morizur of CAILabs, France presented their recent technical developments of spatial multiplexer based on multiplane light conversion. In the final "Transmission systems" session, Prof. Magnus Karlsson of Chalmers University of Technology, Sweden discussed prospects for high-spectral-efficiency modulation and Prof. Yoshida of Tohoku University reported the recent developments of multi-level modulation applied to short pulse transmission. Finally, Dr. Mizuno of NTT Network Innovation Laboratories presented dense SDM long-haul transmission using single-mode high-count multi-core fibers (MCFs) with more than 30 cores [3].

4. Conclusion

The symposium received positive responses from the participants both in the program and organization. The IEICE Technical Committee on Extremely Advanced Optical Transmission Technologies (EXAT) intends to continue to organize workshops and symposia to exchange ideas and most recent technical developments with researchers from across the world.

5. References

[1] IEICE Technical Committee on Extremely Advanced Optical Transmission Technologies (EXAT). http://www.ieice.org/~exat/index2.php
[2] DTU Fotonik http://www.fotonik.dtu.dk/english
[3] EU-Japan SAFARI project http://www.ict-safari.eu/

Report on the 23rd IEEE International Symposium on Local and Metropolitan Area Networks (LANMAN 2017)

Arata Koike†, Toru Hasegawa‡
Tokyo Kasei University†, Osaka University‡

1. Introduction

The 23rd edition of the IEEE International Symposium on Local and Metropolitan Network (LANMAN 2017) [1] visited Osaka, Japan and it welcomed international participants at Osaka University Nakanoshima Center during June 12 to 14. LANMAN has an established tradition as a forum for presenting and discussing the latest technical advances in many areas of networking researching expanding from local and metropolitan area networking. It is the first time to have this symposium in Japan since the epoch. The Institute of Electronics, Information and Communication Engineers Communication Society (IEICE-CS) and the Information Processing Society of Japan (IPSJ) were co-technical sponsors of this symposium, which contributed the number of submissions and participations from Japan.

2. Brief Overview of the Symposium

LANMAN 2017's central theme was "Connecting Smart Cities through Software-Defined Infrastructure." Under this theme with intimate single-track session format, there were eight presentation sessions and two demo/poster sessions. These sessions covered various network architecture areas including Software Defined Networks (SDN), Internet of Things (IoT), and Mobile Edge Computing (MEC) and each session had a lot of discussion and two Keynote speakers presented their views on the future scenarios of networks with their deep insights.

There were 81 participants including 42 participants from abroad.

There were 25 papers presented at the technical session. The TPC chairs reported that the acceptance ratio of these paper was 34.2%.

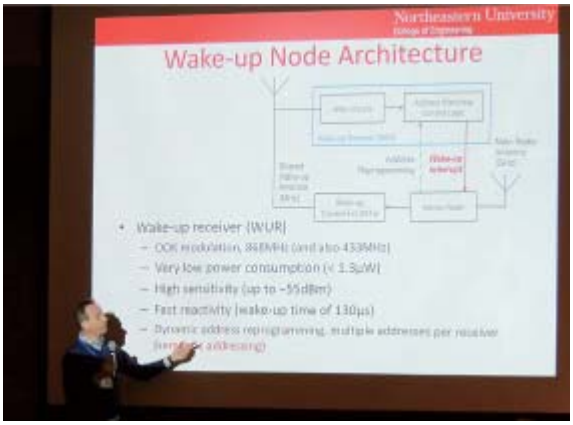

Fig. 1 Keynote Speaker: Prof. Basagni

3. Keynote Presentations

Following the opening session, Prof. Stefano Basagni (Northeastern University, USA) (Fig. 1) made his keynote address entitled "Smart Usage of Wake-up Radio and Energy Harvesting for Long Lasting IoT Systems." He presented about their wake-up radio technology with semantic addressing capabilities and reported its usage to obtain very short packet delivery delays and up to five orders of magnitude energy savings, resulting in lifetimes that are decades longer than those obtained with standard energy-conserving methods.

Fig. 2 Keynote Speaker: Dr. Teranishi

Dr. Yuuichi Teranishi (National Institute of Information and Communications Technology (NICT), Japan) presented his keynote on the 3rd day (Fig. 2). He first gave a detailed introduction of NICT's SDN/SDI-based open distributed cloud testbed called JOSE. The testbed is an edge computing environment that consists of distributed cloud data centers and provides a service platform that can host multiple IoT services. In his talk, he explored their concepts, base technologies and then introduced research projects and field trial projects using JOSE for IoT/Smart Cities. He then concluded his talk by giving his view on the future directions of IoT networking.

Both keynotes presentations called many discussions and the symposium participants could earn new vista and in-depth understandings on future networking directions.

4. Symposium Award

At the opening session, the TPC chairs announced that they awarded the Best Paper Award to Takeshi Matsumura et al. for their paper entitled "Compact IEEE 802.22-based Radio Equipment Enabling Easy Installation for Regional Area Network System using TV White-spaces" (Fig. 3). Their paper describes an innovative prototype that they have developed for using TV white space spectrum. The paper addresses that the authors have done some very substantial work validating their novel approach. The symposium participants had an opportunity to vote for Best Demo Award during Demo Session. During banquet, the Demo Co-chairs reported the result and Naoki Higo., et al. wined the award for their demo "COG: Overlay network functions assisting COnnected next Generation society systems."

Fig. 3 Presenting Best Paper Award

5. Technical Sessions

There were 25 accepted full papers and 4 invited papers presented at the eight technical sessions from various countries: including five presentations from Asian countries other than from Japan. Session titles were as follows: Mobile and Edge Computing, Next Generation Cellular Networks, Datacenter Networks, Software Defined Networks, Wireless and Sensor Networks, Internet of Things and Mobility, Scheduling, Topology, and Routing, Energy Efficient Networks. All presentations had intimate but in-depth discussions (Fig. 4).

Fig. 4 In-depth discussion during technical sessions

6. Demo/Poster Sessions

There were 22 accepted short papers and five accepted demo papers. The authors gave their pitches during the lightning talk sessions. Following to the sessions, participants could visit various posters and demos (Fig. 5). It is worth noting that these demos and posters gave many students or young researchers opportunities for presenting their ideas and research results among international experts with valuable discussions.

Fig. 5 Demo/Poster session

7. Excursion

Following the tradition of the LANMAN, we had a half-day excursion around the heart of Osaka downtown. Starting with a walking tour around Dotonbori-Nihonbashi area by feeling the deep atmosphere of the city and then boarded on a boat to understanding the long history of Water City as the west capital of commerce in Japan and relaxed on the boat with beautiful city view (Fig. 6). Then participants enjoyed beautiful Japanese garden at Taikoen.

Fig. 6 Excursion – All aboard!

8. Conclusion

At the end of the LANMAN 2017 sessions, the next General Co-chairs Prof. T. Wood (The George Washington University, USA) and Prof. T. Melodia (Northeastern University, USA) announced that they would have the LANMAN 2018 at Washington DC, USA on the end of June 2018. The announcement shall appear on [2].

9. Acknowledgements

We have greatly acknowledged National Institute of Information and Communications Technology (NICT), Kayamori Foundation of Informational Science Advancement, and Support Center for Advanced Telecommunications Technology Research, Foundation (SCAT) for their support to the LANMAN 2017 Symposium. We also appreciate the organization committee members of the LANMAN 2017 for their contributions and hospitality for participants.

10. References

[1] http://lanman2017.ieee-lanman.org/.
[2] The IEEE LANMAN Symposium official web site, http://www.ieee-lanman.org/.

Report on 19th Asia-Pacific Network Operations and Management Symposium (APNOMS 2017)


Yuncheng Zhu* and Kiyohito Yoshihara**
* Secretary of APNOMS 2017 and Hitachi, Ltd.
** Vice Co-Chair of APNOMS 2017 and KDDI Research

1. Overview

The 19th Asia-Pacific Network Operations and Management Symposium (APNOMS 2017) was held from September 27th to 29th in Seoul, Korea. It is organized by the committee on Korean Network Operations and Management, the Korean Information and Communications Society (KICS KNOM) and Technical Committee on Information and Communication Management, the Institute of Electronics, Information and Communication Engineers (IEICE ICM), and is technically co-sponsored by IEEE Communications Society.

APNOMS 2017, with its theme being "Managing a World of Things," consists of 5 keynote speeches, a distinguished expert panel, 2 special sessions, 4 tutorial sessions, 9 technical sessions, 2 poster sessions, 2 innovation sessions and 4 exhibition booths. About 180 people from 9 countries participated in the conference.

2. Highlights

Five executives delivered keynote speeches. Three of them are about 5G, including "SKT's Vision and Plan for Next-Gen OSS in 5G Era" by Mr. Jin-Hyo Park from SK Telecom, "Softwarization of 5G Core Networks" by Prof. Jyh-Cheng Chen from NCTU, and "The First 5G System PoC in Conjunction with the PyeongChang Winter Olympics" by Dr. Hyung Kyu Chung from ETRI. Besides, Mr. Tsunemasa Hayashi from BOSCO gave a speech on "IT Management for IoT Era" and Dr. Sławomir Kukliński from Orange Polska introduced "Network Slicing – Open Issues."

In the distinguished expert panel session, 4 panelists including Mr. Satoru Matsushima from Softbank Corp. and Mr. Katsuhito Asano from Fujitsu Labs, discussed various emerging topics about network operations and management with chair and audiences.

The 2 special sessions cover the topics of "Network intelligence in the age of IoT with SDN and NFV" and "Mobile Edge Computing and V2X for Autonomous Driving," respectively.

A total of 100 papers, including 13 papers from Japan, were submitted to APNOMS 2017, among which 36 papers (5 from Japan) were accepted to be presented in the technical sessions. Besides, 51 papers (4 from Japan) were accepted to be presented in poster style in poster sessions. These papers are to be included in IEICE I-Scover and IEEE Xplore.

Fig. 1 Welcome address by General Chair, Dr. Taesang Choi

Fig. 2 Announcement of the next APNOMS by Vice Co-Chair, Dr. Kiyohito Yoshihara

The technical program committee and organizing committee selected the top 4 papers with the highest overall scores from technical sessions as "Best Paper Award." One of the awardee is "Design of Optical Aggregation Network with Carrier Edge Functions Virtualization," presented by Dr. Takashi Miyamura from NTT.

3. Summary

APNOMS 2017 was closed with great success. On behalf of all organizing committee members, we would like to express our appreciation to all parties involved in this conference.

Because IEEE/IFIP NOMS 2018 will be held in Taipei, Taiwan, the next APNOMS, celebrating its 20th anniversary, will be held in Japan in 2019.

IEICE-CS Related Conferences Calendar

Date	Conference Name	Location	Note
28 Jul. – 2 Aug. 2019	IEEE International Geoscience and Remote Sensing Symposium 2019 (**IGARSS 2019**)	Yokohama, Japan	TBD
3 Jun. – 6 Jun. 2019	2019 Joint International Symposium on Electromagnetic Compatibility and Asia-Pacific International Symposium on Electromagnetic Compatibility, Sappolo (**EMC Sapporo & APEMC 2019**)	Sapporo, Japan	TBD
29 Aug. – 31 Aug. 2018	2018 IEEE International Workshop on Electromagnetics: Applications and Student Innovation Competition (**iWEM2018**)	Nagoya, Japan	Submission due: 10 May 2018 **See page 40**
20 May 2018	The 11th International Workshop on Evolutional Technologies & Ecosystems for 5G Phase II (**WDN-5G ICC2018**)	Kansas City, USA	Submission due: 3 Jan. 2018 **See page 41**
18 Dec. – 20 Dec. 2017	Japan-Africa Conference on Electronics, Communications and Computers 2017 (**JAC-ECC 2017**)	Alexandria, Egypt	To be held **soon**
11 Dec. – 13 Dec. 2017	The 23rd Asia-Pacific Conference on Communications (**APCC2017**)	Perth, Australia	To be held **soon**
4 Dec. – 6 Dec. 2017	2017 IEEE International Conference on Antenna Measurements & Applications (**2017 IEEE CAMA**)	Tsukuba, Japan	To be held **soon**
26 Nov. – 30 Nov. 2017	13th Int. Conference on Network and Service Management (**CNSM2017**)	Tokyo, Japan	Done
14 Nov. – 16 Nov. 2017	The fifth ENRI International Workshop on ATM/CNS (**EIWAC2017**)	Tokyo, Japan	Done
5 Nov. – 8 Nov. 2017	International Conference on Renewable Energy Research and Applications (**ICRERA2017**)	San Diego, USA	Done
30 Oct. – 2 Nov. 2017	2017 International Symposium on Antennas and Propagation (**ISAP2017**)	Phuket, Thailand	Done
18 Oct. – 20 Oct. 2017	International Conference on Information and Communication Technology Convergence 2017 (**ICTC2017**)	Jeju Island, Korea	Done
27 Sep. – 29 Sep. 2017	Asia-Pacific Network Operations and Management Symposium (**APNOMS2017**)	Seoul, Korea	**Reported** on this issue
22 Sep. 2017	IEEE 5G Summit Tokyo (**5G Summit**)	Tokyo, Japan	Done
14 Sep. – 15 Sep. 2017	Special European Conference on Optical Communications 2017 Symposium (**Special ECOC 2017 Symposium**)	Copenhagen, Denmark	**Reported** on this issue
21 Aug. – 25 Aug. 2017	The 24th Congress of the International Commission for Optics (**ICO-24**)	Tokyo, Japan	Done
4 Jul. – 6 Jul. 2017	2017 IEICE information and Communication Technology Forum (**IEICE ICTF2017**)	Poznań, Poland	Done
12 Jun. – 14 Jun. 2017	The 23rd IEEE International Symposium on Local and Metropolitan Area Networks (**LANMAN2017**)	Osaka, Japan	**Reported** on this issue

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

Special Section Calendar of IEICE Transactions on Communications

Issue	Special Section	Note
May 2019	European ICT R&D Project Activities on Broadband Access Technologies in Conjunction with Main Topics of 2016/2017 IEICE ICT Forum	Submission due**:** 7 June 2018 **See page 35**
Apr. 2019	Sensing, Wireless Networking, Data Collection, Analysis and Processing Technologies for Ambient Intelligence with Internet of Things	Submission due**:** 11 May 2018 **See page 34**
Mar. 2019	Network Virtualization and Network Softwarization for Diverse 5G Services	Submission due**:** 12 April 2018 **See page 33**
Feb. 2019	Recent Progress in Antennas and Propagation in Conjunction with Main Topics of ISAP2017	Submission due**:** 15 February 2018 **See page 32**
Oct. 2018	Wireless Distributed Networks for IoT Era	To be issued
Sep. 2017	No special section this issue	
Aug. 2018	Autonomous Decentralized Systems Technologies and Approaches Innovation through Structure Change of Society and Life	To be issued
Jul. 2018	Communication Quality in Wireless Networks	To be issued
Jun. 2018	No special section this issue	
May 2018	No special section this issue	
Apr. 2018	Optical Access System for Social Life	To be issued
Mar. 2018	Network Resource Control and Management for IoT Services and Applications	To be issued **soon**
Feb. 2018	Recent Progress in Antennas and Propagation in Conjunction with Main Topics of ISAP2016	To be issued **soon**
Jan. 2018	Internet Technologies to Accelerate Smart Society	To be issued **soon**
Dec. 2017	No special section this issue	
Nov. 2017	Network Virtualization, Network Softwarization and Fusion Platform of Computing and Networking	Vol. E100-B, No. 11
Oct. 2017	Opto-electronics and Communications for Future Optical Network	Vol. E100-B, No. 10

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http://www.ieice.org/event/ronbun-e.php?society=cs

Call for Papers

------- Special Section on Recent Progress in Antennas and Propagation in Conjunction with Main Topics of ISAP2017 -------

The IEICE Transactions on Communications announces "Special Section on Recent Progress in Antennas and Propagation in Conjunction with Main Topics of ISAP2017" in **February 2019**. The objective of this special section is to publish recent research results on antenna and propagation technologies related to the topics in ISAP2017 (2017 International Symposium on Antennas and Propagation). The ISAP2017 will be held in Phuket, Thailand during October 30 – November 2, 2017, which provides an international forum for exchanging recent information on progress of the researches. The special section has been planned to publish papers on progressed discussion in ISAP2017. Submissions are available particularly from, but not limited to, the authors in the symposium.

1. Scope

This special section aims at timely dissemination of progressing research fields in ISAP2017. Possible topics include antennas and propagation technologies such as antenna design techniques, 5G mobile communication systems, MIMO, millimeter-wave/THz/optical applications, and wireless power transmission. The topics also include electromagnetic wave theory and computational methods for various electromagnetic topics including metamaterial, nano-electromagnetics, image sensing and their applications. However, the field of papers submitted to this special section is not limited to the above topics.

2. Submission Instructions

The standard number of pages is 8. The page charges are considerably higher for extra pages. Submissions of “letters” are not accepted. 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. The period 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 only papers by electronic submission. Submit a manuscript and electronic source files (LaTeX/Word files, figures, authors’ photos and biography) via the IEICE Web site https://review.ieice.org/regist/regist_baseinfo_e.aspx **by February 15th, 2018 (JST)**. Authors should choose the Recent Progress in Antennas and Propagation in Conjunction with Main Topics of ISAP2017 as a "Journal/Section" on the online screen. Do not choose [Regular-EB].

Contact Person: Yuichi Kimura
Graduate School of Science and Engineering, Saitama University
Email: ap_ac-isap2017ss@mail.ieice.org

3. Special Section Editorial Committee

Guest Editor-in-Chief: Monai Krairiksh（KMITL）
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* The accepted papers will be published online soon after notification of acceptance on the web site of Transactions Online. For detailed information, please visit http://www.ieice.org/eng/shiori/page2_cs.html#8

Call for Papers

------- Special Section on Network Virtualization and Network Softwarization for Diverse 5G Services -------

The IEICE Transactions on Communications announces that it will publish a special section entitled "Special Section on Network Virtualization and Network Softwarization for Diverse 5G Services" in **March 2019**.

ICT (Information and Communication Technologies) have become an indispensable social infrastructure for our everyday life and industry activities by making ICT systems be flexible, scalable, efficient and sustainable. Recently, extensive efforts are being made towards 5G mobile services, including research projects, proof-of-concept demonstrations, field trials, standardization and consortium activities, and so forth. Such industry efforts, with complemented by academic insights, have materialized the necessity of network virtualization and softwarization as key concepts and guiding principles.

Advanced technologies for network virtualization and softwarization are expected to provide flexibility to satisfy a wide variety of customer demands, scalability to expand in accordance with the increase of demands, efficiency in resource usage even under scarce and heterogeneous environment, and sustainability to involve new functionalities and technologies in an incremental manner for service continuity. They imperatively require such techniques to construct virtual networks providing diverse services on a substrate infrastructure consisting of network resources, computational resources and storage resources. In addition, focusing on end-to-end service offering, it is essential to study and develop such techniques to virtualize wireless access networks with their integration to other virtualization techniques.

We thus call for publications (scheduled to appear in the March 2019 issue) for promoting discussion and development of network virtualization and softwarization for diverse 5G services, especially on architectural examination, resource management and control approaches, wireless access virtualization, SDN/NFV applications, and so forth.

1. Scope

This special section aims at timely dissemination of research in these areas. Possible topics include, but are not limited to:

- Network virtualization for diverse 5G services
- Network softwarization and open-source software
- Network management and control in network virtualization
- Wireless access virtualization and its related wireless communication technologies
- Edge computing for 5G services
- Application of Software defined networking and Network function virtualization
- Innovative applications based on network virtualization
- Security for network virtualization and secure services
- Testbeds for above technologies and experimental results

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. The period 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 only papers by electronic submission. Submit a manuscript and electronic source files (LaTeX/Word files, figures, authors' photos and biography) via the IEICE Web site https://review.ieice.org/regist/regist_baseinfo_e.aspx by **April 12th, 2018 (JST)**. Authors should choose the Network Virtualization and Network Softwarization for Diverse 5G Services as a "Journal/Section" on the online screen. Do not choose [Regular-EB].

Contact point:
Takaya Miyazawa
Network Science and Convergence Device Technology Laboratory, Network System Research Institute, National Institute of Information and Communications Technology (NICT).
Tel: +81-42-327-7274, Email: nv+eb2019@mail.ieice.org

3. Special Section Editorial Committee

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Call for Papers

--- Special Section on Sensing, Wireless Networking, Data Collection, Analysis and Processing Technologies for Ambient Intelligence with Internet of Things ---

The IEICE Transactions on Communications announces that it will publish a special section entitled "Special Section on Sensing, Wireless Networking, Data Collection, Analysis and Processing Technologies for Ambient Intelligence with Internet of Things" in the April 2019 issue.

In the Internet of Things (IoT) era, sensor networks gather ambient information from peoples, products, and sensing devices for real space. The sensed data is processed, analyzed, and applied for enhancement or assistance for human activities, which is called ambient intelligence. Sophisticated social environments such as efficient electric power usage in smart grids, effective transportation systems, smart agriculture and big data analytics based on sensed data will be established through the ambient intelligence. Ambient intelligence can offer the convenience that before does not have and a radical cost cut by fusing the technologies of various fields. Fundamental researches have been promoted in the field of technologies supporting the ambient intelligence. Toward future generation, it is important to develop such sensing, wireless networking, data collection, analysis and progressing technologies for ambient intelligence. From the above points of view, the special section is planned (scheduled to appear in the April 2019 issue) to publish papers on the related fields.

1. Scope

The scope of this special section includes not only sensing, wireless networking, data collection, analysis and processing technologies but also their multidisciplinary researches for ambient intelligence. Possible topics include, but are not limited to:

- Space sensing, vital sensing, mobile sensing, participatory sensing, cloud sensing ambient interface, device and appliance technologies, embedded software, sensing and control theory, long distance communication, 5G, millimeter wave communication, near field radio communication
- MAC/routing protocols, multi-hop, full-duplex and cooperative communication, QoS control, cross layer design, energy harvesting, green wireless, communication and network theory
- Sensor database, context extraction, mining, location-information technology, stream processing, privacy and security, big data, learning signal processing
- Large scale widening, dependability, IoT, M2M, D2D, cyber physical, operation management, autonomous distributed control

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. 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. Submit a manuscript and electronic source files (LaTeX/Word files, figures, authors' photos and biographies) via the IEICE Web site https://review.ieice.org/regist/regist_baseinfo_e.aspx by May 11, 2018 (JST). Authors should choose the Special Section on Sensing, Wireless Networking, Data Collection, Analysis and Processing Technologies for Ambient Intelligence with Internet of Things as a "Journal/Section" on the online screen. Do not choose [Regular EB].

Contact point:
Masaki Bandai
Dept. of Information and Communication Sciences, Sophia University
Email: asn-ss-sec@mail.ieice.org

3. Special Section Editorial Committee

Guest Editor-in-Chief: Hiraku Okada (Nagoya Univ.)
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Call for Papers

------- Special Section on European ICT R&D Project Activities on Broadband Access Technologies in Conjunction with Main Topics of 2016/2017 IEICE ICT Forum -------

The IEICE Transactions on Communications announces that it will publish a special section entitled "Special Section on European ICT R&D Project Activities on Broadband Access Technologies in Conjunction with Main Topics of 2016/2017 IEICE ICT Forum" in the 2019 issue (**May 2019**).

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. 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 European ICT R&D Projects.

1. Scope

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

- Information and communication theory and algorithms,
- 5G 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 Access (NGA) technologies and networks: Integration of optical and wireless access as a last mile,
- Converged optical-wireless networks,
- Power line 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

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. 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. Submit a manuscript and electronic source files (LaTeX/Word files, figures, authors' photos and biographies) via the IEICE Web site https://review.ieice.org/regist/regist_baseinfo_e.aspx by June 7th, 2018 (JST). Authors should choose the European ICT R&D Project Activities as a "Journal/Section" on the online screen. Do not choose [Regular EB].

Contact point:
Osamu Muta, Kyushu University
Daisuke Umehara, Kyoto Institute of Technology
Phone: +81- 92-802-6912, E-mail: eb-eu2019@mail.ieice.org

3. Special Section Editorial Committee

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● IEICE Societies and Publications

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A (Fundamentals of Electronics, Communications and Computer Sciences)	EA (English) A (Japanese)	Engineering Acoustics, Noise and Vibration, Speech and Hearing, Ultrasonics, Digital Signal Processing, Analog Signal Processing, Systems and Control, Nonlinear Problems, Circuit Theory, VLSI Design Technology and CAD, Numerical Analysis and Optimization, Algorithms and Data Structures, Graphs and Networks, Reliability, Maintainability and Safety Analysis, Cryptography and Information Security, Information Theory, Coding Theory, Communication Theory and Signals, Spread Spectrum Technologies and Applications, Mobile Information Network and Personal Communications, Intelligent Transport System, Image, Vision, Computer Graphics, Language, Thought, Knowledge and Intelligence, Human Communications, Neural Networks and Bioengineering, Multimedia Environment Technology, Communication Environment and Ethics, Concurrent Systems, Measurement Technology, General Fundamentals and Boundaries
B (Communications)	EB (English) B (Japanese)	Fundamental Theories for Communications, Devices/Circuits for Communications, Transmission Systems and Transmission Equipment for Communications, Optical Fiber for Communications, Fiber-Optic Transmission for Communications, Switching for Communications, Switching for Mobile Communications, Network, Network Management/Operation, Internet, Wireless Communication Technologies, Terrestrial Radio Communications, Satellite Communications, Optical Wireless Communications, Antennas and Propagation, Electromagnetic Compatibility (EMC), Sensing, Navigation, Guidance and Control Systems, Energy in Electronics Communications, Terminals for Communications, Multimedia Systems for Communications, Broadcast Systems, Integrated Systems for Communications, Space Utilization Systems for Communications
C (Electronics)	EC (English) C (Japanese)	Electromagnetic Theory, Lasers, Quantum Electronics, Optoelectronics, Microwaves, Millimeter-Waves, Ultrasonic Electronics, Electronic Circuits, Electronic Materials, Organic Molecular Electronics, Electronic Components, Electromechanical Devices and Components, Semiconductor Materials and Devices, Integrated Electronics, Electron Tubes, Vacuum and Beam Technology, Electronic Displays, Superconducting Electronics, Storage Technology, Electronic Instrumentation and Control
D (Information and Systems)	ED (English) D (Japanese)	Computation and Computational Models, Automata and Formal Language Theory, Algorithm Theory, Complexity Theory, Computer Components, VLSI Systems, Computer Systems, Fundamentals of Software and Theory of Programs, System Programs, Software Engineering, Database, Contents Technology and Web Information Systems, Data Mining, Networks, Dependable Computing, Application Information Security, Distributed Cooperation and Agents, Artificial Intelligence and Cognitive Science, Human-computer Interaction, Office Information Systems, e-Business Modeling, Educational Technology, Rehabilitation Engineering and Assistive Technology, Pattern Recognition, Speech and Hearing, Image Processing and Video Processing, Image Recognition, Computer Vision, Computer Graphics, Multimedia Pattern Processing, Natural Language Processing, Biocybernetics, Neurocomputing, Biological Engineering, Music Information Processing, Kansei Information Processing, Affective Information Processing
Journal of IEICE (written in Japanese only)		

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Please contact the IEICE Membership Section: E-mail:member@ieice.org FAX: +81 3 3433 6659 ***Please fill out the application form printed on the next page.***

IEICE Overseas Membership Application Form

URL http://www.ieice.org/eng/member/OM-appli.html **E-mail** member@ieice.org **FAX** +81-3-3433-6659

◆ **Please type or print in English. The deadline for submitting application form is the 1st day of every month.**

Personal Information

Full name: _____ ***Nationality:*** _____ ☐Male ☐Female
First name Middle name Last name

☐Prof. ☐Dr. ☐Mr. ☐Ms. ***Place of birth:*** _____ ***Date of birth:*** _____
Day Month Year

Mailing Address ☐Home ☐Office

Name of Company/School/College Department/Section

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Academic Background The highest academic degree: ☐Ph.D. ☐Masters ☐Bachelors ☐Others: _____

University/college/school of the highest academic degree Month & year of graduation

(For Student Member) Academic degree which will be conferred on you Month & year when the degree will be conferred on you

Application Information

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I recommend this applicant for IEICE membership.

Endorser's name Membership number Endorser's signature Date

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A 10% - 20% discount* of the annual fees will be granted to the sister society members to become the IEICE-CS overseas members. The discounted fees will be applied for the individual members when the new membership is starting or the current membership is renewing.

* The discount does not apply to the optional items and services i.e. “Additional Society”, “Additional Transactions of paper version” and “Rapid Mailing Service”.

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Sister Society: ☐IEEE ComSoc ☐KICS ☐VDE-ITG

Membership number (Member):_____

Copy of Membership certificate or Membership card:

(Attached here)

From Editor's Desk

● Season's greetings

In June of this year, I became the Director of Planning and Member Activities of IEICE-CS, and started editing the IEICE-CS GLOBAL NEWSLETTER (GNL). While editing GNL, I sent many emails to GNL authors and read all the articles. It was hard but enjoyable work.

By the way, the IEICE General Conference 2018 will be held at Tokyo Denki University, Tokyo, 20th-23rd March 2018. The campus is located in downtown Tokyo. There are many famous sightseeing spots near the campus. For example, Ueno, Asakusa, Akihabara, and the tallest structure in Japan "Tokyo Skytree". You can enjoy sightseeing before and after the conference. Please check out the latest conference information on the IEICE web site at:
http://www.toyoag.co.jp/ieice/E_G_top/e_g_top.html

We published GNL four times in 2017. Many thanks to all GNL authors and readers. We hope you have a wonderful holiday and a Happy New Year !

IEICE-CS GLOBAL NEWSLETTER Editorial Staff

Editorial Staff of this issue

No special order is observed.

Manabu KAI
Fujitsu Laboratories, Ltd.
IoT Systems Laboratory
Director, Planning and Member Activities, IEICE Communications Society

Yoshitaka ENOMOTO
Nippon Telegraph and Telephone Corporation
Access Network Service Systems Laboratories
Director, Planning and Member Activities, IEICE Communications Society

Moriya NAKAMURA
Meiji University
Department of Electronics and Bioinformatics, School of Science and Technology
Director, International Publication, IEICE Communications Society

Call for Papers

2018 IEEE International Workshop on Electromagnetics: Applications and Student Innovation Competition

August 29-31, 2018, Nagoya, Japan

Organizing Committee

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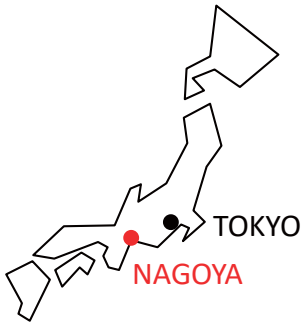
iWEM started in Taipei in 2010 for the first time as “International Conference on Applications of Electromagnetism and Student Innovation Awards” (2010 ICAE/SIA), and it then continued but renamed in Taipei in 2011 as “IEEE International Workshop on Electromagnetics: Applications and Student Innovation Competition” (2011 IEEE iWEM). Supported by IEEE, this workshop series will be held in rotation in Taiwan, China, Hong Kong, and Japan. Different from other recognized conferences and/or workshops, this workshop series focuses more on student innovation competition and runs in a single session format. It provides not only an international platform for scientists and engineers to exchange their ideas, but also a good venue for young scholars and students to demonstrate their innovative results (which may lead to awards).

IEEE iWEM2018 is organized by the IEEE AP-S Nagoya Chapter, and technically co-sponsored by IEEE AP-S Tokyo/Fukuoka/Kansai Chapters, IEEE Nagoya Section, and IEICE Communications Society. The venue of the workshop is Nagoya Institute of Technology, Nagoya, Japan. Nagoya is one of the most historical and industrial cities in Japan. All accepted papers will be included in IEEE Xplore.



The topics of interest include but are not limited to the following:

- *Electromagnetic Theory*
- *Instrumentation and Measurement*
- *Millimeter Wave, THz Technologies*
- *Microwave Circuits and Systems*
- *Advanced Materials in RF and THz*
- *Wireless Power Transmission and Harvesting*
- *Antennas and Propagation*
- *Wireless Systems*
- *Array Antenna and MIMO System*
- *MMIC, RFIC*
- *EMC/EMI*
- *Other EM Topics*

Important Dates

- Deadline of paper submission: **May 10, 2018**
- Notification of Acceptance: June 27, 2018
- Early-bird Registration: July 10, 2018

Paper Submission Guidelines

Authors MUST submit camera-ready papers up to two A4 pages including figures by the submission deadline via the workshop website. The paper format and submission guideline will be found at the workshop web page.

Contact person:
Dr. Kazunari Kihira (iWEM2018@lab-ml.web.nitech.ac.jp)



The 11th International Workshop on Evolutional Technologies & Ecosystems for 5G Phase II (WDN-5G ICC2018)

Scope

The main objective of the workshop is to offer an opportunity for academic and industrial researchers to discuss on evolutional technologies and killer ecosystems for the realization of 5G Phase II, taking into account the combination of mmWave and MEC, under the support of MEC/SDN technologies.

Topics of Interest include (but not limited to):

- Architecture for 5G heterogeneous networks & beyond
- Millimeter wave communications and 5G-NR
- 5G ecosystems for Phase II
- Hardware implementation and demonstration of 5G systems
- MEC architecture for 5G networks
- Resource management/MANO in HetNet
- Micro-operator network management
- Self-organizing networks (SON) and reinforcement learning
- 3GPP, WiFi, and WiGig interworking
- MU-MIMO and massive MIMO at mmWave bands
- Smart antenna systems and dynamic cell structuring
- Enhanced channel models for 5G Phase II
- Backhaul (wired, wireless, millimeter wave, etc.) and networking
- Fronthaul and functional splitting
- Context information management for HetNet
- Network load balancing and smart information storage for C-RAN
- SDN/NFV based cognitive, cooperative, and reconfigurable networks
- Regulation and standardization for cooperative HetNet
- Storage and computation caching capability of small cells
- mmWave for A2X and V2X

Submission Guideline: see http://icc2018.ieee-icc.org/authors/call-workshop-papers

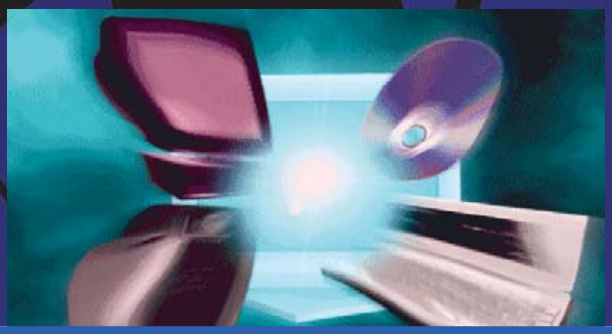
Submission link: http://edas.info/N24152

Deadlines:

Paper Submission Deadline: 3 January 2018
Acceptance Notification: February 21, 2018
Final Paper submission: March 5, 2018
Date of the workshop: May 20, 2018

To Probe Further and Keep Up-to-date with Communication Technologies

IEICE Communications Society



IEICE General Conference 2018

20-23 March 2018

Tokyo Denki University Tokyo-senju Campus, Tokyo

Every spring, each Society organizes a General Conference to provide a forum where members can present their study results and exchange views. At present, four of the Societies -- the Engineering Sciences Society, the NOLTA Society, the Communications Society, and the Electronics Society -- hold their Society Conferences as a joint event. The Communications Society Conference includes English-language sessions in addition to the Japanese-language sessions.

Please check out the latest information on the IEICE web site at:

http://www.toyoag.co.jp/ieice/E_G_top/e_g_top.html

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Web: http://www.ieice.org TEL: +81-3-3433-6691 FAX: +81-3-3433-6659
IEICE Communications Society: cs-secretariat@ieice.org