# *IEICE Communications Society* GLOBAL NEWSLETTER *Vol. 6*
# Contents

# International activities on the IEICE Communications Society

## COOPERATION AGREEMENT BETWEEN IEICE-CS AND THE MONGOLIAN COMMUNICATIONS UNION

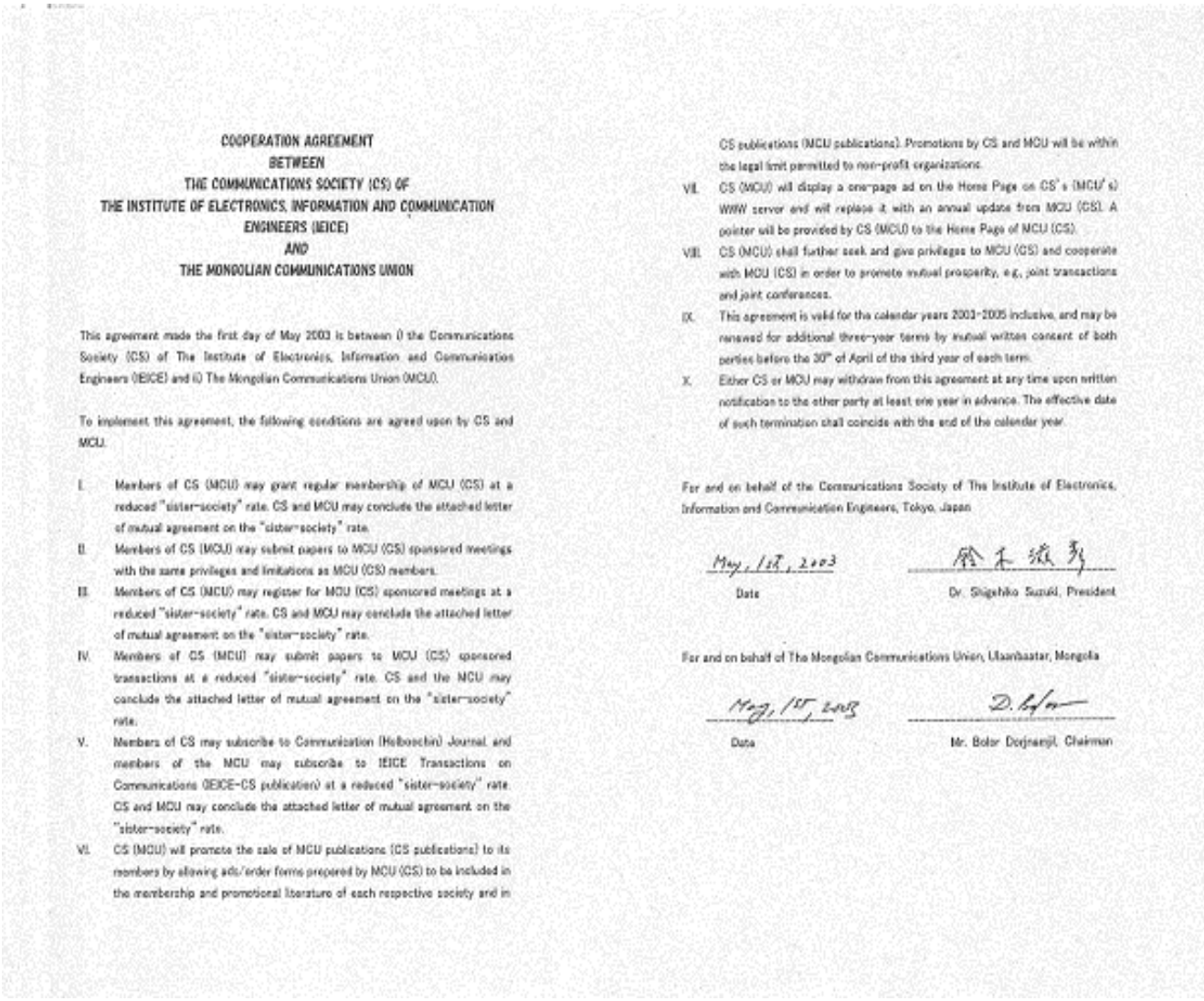
Takashige Hoshiai/NTT

Let us introduce international activities on the IEICE Communications Society (IEICE-CS). Since the IEICE-CS concluded the sister society agreements with IEEE Computer Society (IEEE-ComSoc) and Korean Institute of Communication Sciences (KICS) in 1999, we have exchanged opinions, information, and activity plans with each other through society summits, international conferences and web pages.

This time, we concluded a new sister society agreement between IEICE-CS and MCU (MONGOLIAN COMMUNICATIONS UNION) for the progress of Asian communications societies and establishment of good relationships.

This agreement, which was made on May 1, 2003, was signed by Dr.Shigehiko Suzuki, President of IEICE-CS and Mr.Bolor Dorjnamjil, Chairman of MCU as indicated in the following agreement.

This allows IEICE-CS members to get the same services as those of MCU, which means that the members can submit papers, participate in conferences, and get a dual membership, as specified in the agreement by CS and MCU.



COOPERATION AGREEMENT
BETWEEN
THE COMMUNICATIONS SOCIETY (CS) OF
THE INSTITUTE OF ELECTRONICS, INFORMATION AND COMMUNICATION ENGINEERS (IEICE)
AND
THE MONGOLIAN COMMUNICATIONS UNION

This agreement made the first day of May 2003 is between i) the Communications Society (CS) of The Institute of Electronics, Information and Communication Engineers (IEICE) and ii) The Mongolian Communications Union (MCU).

To implement this agreement, the following conditions are agreed upon by CS and MCU.

I. Members of CS (MCU) may grant regular membership of MCU (CS) at a reduced "sister-society" rate. CS and MCU may conclude the attached letter of mutual agreement on the "sister-society" rate.

II. Members of CS (MCU) may submit papers to MCU (CS) sponsored meetings with the same privileges and limitations as MCU (CS) members.

III. Members of CS (MCU) may register for MCU (CS) sponsored meetings at a reduced "sister-society" rate. CS and MCU may conclude the attached letter of mutual agreement on the "sister-society" rate.

IV. Members of CS (MCU) may submit papers to MCU (CS) sponsored transactions at a reduced "sister-society" rate. CS and the MCU may conclude the attached letter of mutual agreement on the "sister-society" rate.

V. Members of CS may subscribe to Communication (Heiboshin) Journal, and members of the MCU may subscribe to IEICE Transactions on Communications (IEICE-CS publication) at a reduced "sister-society" rate. CS and MCU may conclude the attached letter of mutual agreement on the "sister-society" rate.

VI. CS (MCU) will promote the sale of MCU publications (CS publications) to its members by allowing ads/order forms prepared by MCU (CS) to be included in the membership and promotional literature of each respective society and in CS publications (MCU publications). Promotions by CS and MCU will be within the legal limit permitted to non-profit organizations.

VII. CS (MCU) will display a one-page ad on the Home Page on CS' s (MCU' s) WWW server and will replace it with an annual update from MCU (CS). A pointer will be provided by CS (MCU) to the Home Page of MCU (CS).

VIII. CS (MCU) shall further seek and give privileges to MCU (CS) and cooperate with MCU (CS) in order to promote mutual prosperity, e.g., joint transactions and joint conferences.

IX. This agreement is valid for the calendar years 2003-2005 inclusive, and may be renewed for additional three-year terms by mutual written consent of both parties before the 30th of April of the third year of each term.

X. Either CS or MCU may withdraw from this agreement at any time upon written notification to the other party at least one year in advance. The effective date of such termination shall coincide with the end of the calendar year.

For and on behalf of the Communications Society of The Institute of Electronics, Information and Communication Engineers, Tokyo, Japan

May, 1st, 2003 — Date

Dr. Shigehiko Suzuki, President

For and on behalf of The Mongolian Communications Union, Ulaanbaatar, Mongolia

May, 1st, 2003 — Date

Mr. Bolor Dorjnamjil, Chairman

# Report on the 2003 IEICE Communications Society Conference

Masato Tanaka
CS Secretary, Technical Activities and Planning; CRL

The 2003 IEICE Communications Society (CS) Conference was held at Niigata University on September 23 – 26, 2003. More than one thousand technical presentations were given. The CS General Assembly was held during the conference, and the ceremonies of Society Contribution Award, the Young Engineer Award for English sessions, and IEICE Fellow presentation were held.

**1. Conference Statistics**

The number of sessions and presentations are summarized as follows.

- Special sessions: 2
- Panel sessions: 4
- Tutorial sessions: 5
- Technical sessions (normal): 19
- Technical sessions (symposium): 9
- Aural presentations (normal): 1137
- Aural presentations (symposium): 53

The technical symposium includes a couple of English sessions: “Multicarrier Signal Processing Techniques” and “Network Control, Operation, and Management”.

**2. CS General Assembly**

On September 24 during the Conference, the IEICE CS General Assembly was held.

The CS General Assembly was commenced by a keynote address of CS President Y. Suzuki and followed by presentation ceremonies of “Society Contributions Awards”, “The young English Award for English Sessions”, and “IEICE Fellow”.

The second half of the General Assembly was reserved for Special Session “New trial for university education”.

The General Assembly was closed by the address of Prof. Y. Akaike, the next President of CS.

Fig.1 Prof. Sakai, President of CS.

**2.1 Society Contributions Awards**

The IEICE CS presented commemorative “Plaques” to 30 individuals for their outstanding contributions to the Society.

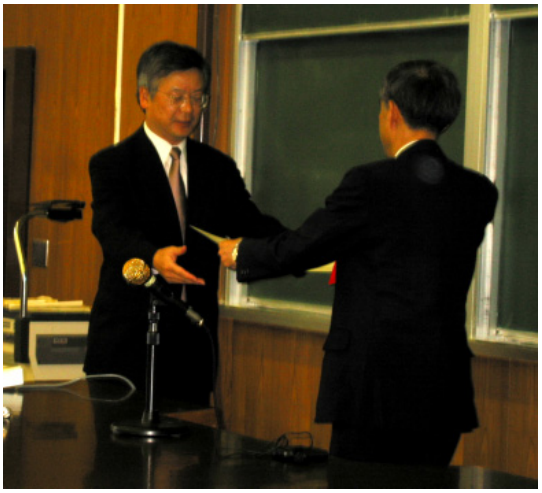


Fig. 2 The Society Contribution Awards Ceremony (Dr. Hasuike, a receptant).

### 2.2 The second Young Engineer Award for English Sessions

The second Young Engineer Award for English Sessions was presented to Dr. Shingo SUWA of NTT DoCoMo Wireless Laboratories for his paper "Performance of Low Rate Turbo Coding for Broadband MC/DS-CDMA in Reverse Link" which was presented at the 2002 IEICE CS Conference in September 2002. The award is designed for the best paper presentation in the English sessions of the IEICE Society Communications Conference each year.

Fig. 3 Dr. S. Suwa, the second Young Engineer Award for English Sessions.

### 2.3 IEICE Fellow Presentation

The IEICE presents each year "Fellow" grades to technical professionals for their outstanding contributions to the Societies, and their proficiency and accomplishments in their profession. This year 77 members became IEICE Fellows; 17 of those were with CS. The list of This Year's recipients of CS is shown in Table 1.

Table 1 The list of This Year's Fellow.

| |
|---|
| Ikuo ARAI |
| Kiyohiko ITO |
| Yuji OIE |
| Shingo OHMORI |
| Sadahiko KANOU |
| Ikutaro KOBAYASHI |
| Kenichi SATO |
| Masatoshi SARUWATARI |
| Taturo TAKAHASHI |
| Fumio TAKAHATA |
| Hiroshi TOKUNAGA |
| Syuichi NITTA |
| Takeshi HATTORI |
| Masao HOSHIKAWA |
| Yoshio HOSOYA |
| Tasuku MOROOKA |
| Kenichi YUKIMATSU |

Fig. 5 IEICE Fellow presentation ceremony (Prof. Ito, a new Fellow).

Fig. 6 Dr. Ohmori addresses as a new Fellow.

**2.4 Special Lecture by Prof. Makato YOSHIDA and Prof. Yoshikazu IKEDA**

The title of Special Lecture was "New Trial for university educations". First lecture entitled "Trial for university education – centered on the engineering department of University of Tokyo as an example" was given by Prof. Yoshida, Education System Project Office of the School of Engineering, University of Tokyo. Second lecture entitled "Trial for graduate school education – centered on the electrical engineering course of Tokyo Institute of Technology", was given by Prof. Ikeda, Tokyo Institute of Technology.

Fig. 7 Prof. Yoshida presented the first special lecture.

Fig. 8 Prof. Ikeda presented the second special lecture.

**3. Conference over IP**

The CS broadcasted two panel discussions by the Internet. The titles of the panel discussions were "The prospect on the new generation mobile communication system and Software radio technology" and "Breakthrough technologies for all-optical XC network".

The encoded video and audios together with

presentation material were relayed over the Internet not only to CS members but also to people all over the world. It was somewhat bi-directional and was actually allowed that a remote participant could ask a question by Web.

The record of the panel discussions is now available on your demand through CS homepage or directly from
http://www.ieice.org/cs/jpn/soc-conf/03/index.htm
You can enjoy the streaming record (video/audio/slides/all synchronized) on your own demand through either 56kbps (e.g. analogue modem) or 300kbps (e.g. ADSL).

Fig. 9 Panel discussion on the prospect on the new generation mobile communication system and Software radio technology.

Fig. 10 Panel discussion on breakthrough technologies for all-optical XC network.

Acknowledgement

The success of the conference owed to a large number of contributors including officers and staff of Niigata University, the Steering Committee of Technical Groups, and IEICE secretaries. Special thanks are to Mr. H. Nagafuchi, NEC, for his great efforts devoted to the Conference over IP project.

# Where are heroes?


## OCS Symposium "Innovation of Future by Optical Communication"

Joji Maeda
Tokyo University of Science

## OCS symposium on June.

For several years, Technical Group of Optical Communication Systems (OCS) had promoted symposiums on 40Gbps optical transmission technologies once or twice per year. The symposiums had been highly appreciated for they have greatly stimulated technological development on ultra-high speed optical and baseband signal processing, latter of which was believed almost impossible ten years ago.


Fig. 1: Dr. Minoru Shikada, Chair of OCS Technical Group, giving opening remarks.

Although the 40 Gbps technologies have matured, they find difficulties in their applications. The OCS technical committee decided to suspend the 40Gbps symposium; instead, they decided to hold another application-minded symposium.

This is a report on the novel symposium held on June 13, 2003, at Kokuyo hall in Shinagawa, Tokyo, where more than 60 attendees gathered.

## Lectures and discussion

Major problem that high-speed optical transmission systems face lies in lack of needs for products. Even 10Gbps backbone systems, available since ten years ago, have found difficulties in their applications other than some limited examples. Now terabit transmission systems are at hand, but for what? The major concern is naturally focused on how to enlarge overall traffic in the world.

Prof. Ikutaro Kobayashi of the University of Tokyo talked from historical viewpoint that current broadband services are based on infrastructures built ten years ago. To support further services in the next ten years, we need current investment to new communication infrastructures. His proposal for enlargement of total traffic is to distribute intelligent sensors or memories all over the society, as if they can be regarded as environmental resources. Although each element transmits only a small amount of data, total data from tremendous number of the elements will be summed up to an enormous traffic.


Fig. 2: Prof. Ikutaro Kobayashi of the University of Tokyo.

I wonder in what area such local data would be circulated. Information on local environment as well as status information of elderly sick people would matter within a small community, raising no more than local traffics.

A stimulating talk was given by Prof. Yoshio Nishimura of Osaka University. As an experienced scientific journalist, he has a unique view of effect of network innovation on current Japanese communities. He considers it as a motif to individualization: the Internet breaks large companies and encourages independency of individuals.

His discussion was quite impressive to me, in particular, importance of variety that activates communities. I suspect the same discussion can be applied to current status of optical communication technologies: longer and faster transmission has been the unique goal. The recent recession was a result of enthusiastic, almost fanatic investment to such technologies. Now that DWDM systems achieve terabits transmission per fiber with little need for them, other targets should be seriously looked for.


Fig. 3: Prof. Yoshio Nishimura of Osaka University.

For realizing traffic explosion, killer applications that mercilessly consume transmission resources are eagerly anticipated. One of the candidates is an application that requires huge amount of data. Another is an application that many people will participate. In this symposium, two

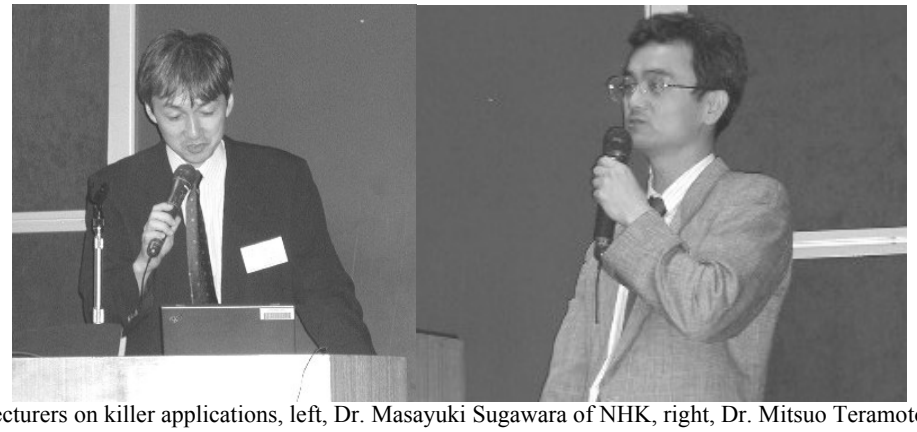


Fig. 4: Lecturers on killer applications, left, Dr. Masayuki Sugawara of NHK, right, Dr. Mitsuo Teramoto of NTT.

Fig. 5: A scene at a break. Dr. Kazuo Hagimoto, former chair of OCS Technical Group (center), discussing with lecturers future of communication systems (?)

lecturers are invited to introduce recent development of bandwidth-consuming applications. Dr. Masayuki Sugawara from NHK talked about current status of ultra-high quality video technology. Dr. Mitsuo Teramoto from NTT presented a review of current peer-to-peer technologies.

Prof. Nishimura presided at a panel discussion after a short break. It seemed that every attendee hoped channel capacity as large as possible. On the other hand, everyone could not help being skeptical whether current networks would *really* provide fast and reliable data transmission. Ubiquitous networking promoted by Japanese government is based on an ethical doctrine that man's born nature is good. But ubiquitous information means ubiquitous possibility of cracking, both technical and ethical. How could we protect ourselves from such cracking? I'm afraid of enormous cost required by a trivial convenience.

## Anticipating heroes?

Although able to forecast from titles of the talks, it was a small pity that the symposium merely confirmed potential demands for optical communication systems. It seems that the discussion could not leave an old fashioned one that huge traffic is indispensable for investment of backbone networks. This is true, but it only anticipates heroes who consume current network resources. Isn't it possible to expect another technological approach that requires challenging efforts?

State-of-the-art technologies have been first applied to high-end products, pulling-up overall technical levels. Through certain efforts towards cost reduction, they are delivered to fabrication of mid- and lower-range products. The same history can be found in optical communication systems, symbolically found in drastic cost drop of optical interfaces of gigabit Ethernet.

Now that speed of local area networks has been rapidly increased, we have been acknowledging what can be done through fast networks. Such experience will encourage people to hope for seamless connections between remote places without any stresses. If backbone networks have enough room for further traffic, what is the bottleneck that prevents such remote connections? Is there any smart optical solution for this? Now is the time for serious consideration, it seems.


Fig. 6: Debate at panel session by lecturers.

# Tokuda Laboratory at Keio University


Hideyuki Tokuda[1,2] Kazunori Takashio[1]
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[1]Graduate School of Media and Governance,
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The Tokuda Laboratory at Shonan Fujisawa Campus, Keio University is a research group in the Graduate School of Media and Governance and in the Faculty of Environmental Information. We study systems issues ranging from operating systems, network protocols, middleware, user-interface to application software for ubiquitous computing systems, mobile systems, distributed systems, p2p systems and smart appliance systems. Our mission is to develop basic computing and communication technology to transform the current Internet-based society to the ubiquitous network-based society.

## From Vision to Mission

We have a vision that our society will be transformed from the current Internet-based society to the Ubiquitous Networked society where everything is connected to ubiquitous networks seamlessly. Not only PCs, PDAs, cellular phones, consumer electronics, but also everyday objects will be connected to ubiquitous networks to support our daily life. Our research mission is to develop computing and communication technology for realizing such a ubiquitous networked society. To accomplish such missions, we have five research groups: ECN, KMSF, ACE, Move!, and HORN in our Laboratory.

## People

The number of people in our laboratory is about 50 students and 20 visiting researchers. The members are as follows.

Faculty Members
Prof. Hideyuki Tokuda
Prof. Kazunori Takashio
Dr. Jin Nakazawa (Post Doctoral Fellow)
Graduate Students
9 Ph.D. Students
20 Master Students
Undergraduate Students
20 Bachelor Students
Visiting Research Associate
~20 Visiting Researchers
Secretary
Ms. Michiko Nitta

Among Ph.D. students, Mr. Okoshi is now studying at Carnegie Mellon University and Ms. Yuu Ohkita is currently studying at Stanford University. The bachelor program at KEIO-SFC is unique in the sense that even a freshman can join our laboratory by singing it up. So, some of our graduate students often spend several years in our laboratory.

## Style in Tokuda Laboratory

Our campus, KEIO-SFC was opened back in 1990 as the newest campus in Keio University which was established in 1858. Our idea of what university education ought to be was to produce students who can discover what the problem is and to solve that problem. In our laboratory, each student must present a thesis proposal for their thesis. To discover the thesis topic is one of the challenging tasks for many undergraduate students. Although we often willing to assist this finding process, we try to let them decide their thesis topic. In this way, they will be very responsible to attack the proposed problems and issues in their thesis.

Since we have many graduate and undergraduate students who have various educational background, we often tell them to remind “four mind”, namely engineering mind, scientific mind, artistic mind, and business mind. Students who just enjoy writing a program often miss scientific skills, while students who enjoy analyzing the system often miss engineering skill and mind. Students who could produce a system should understand the beauty of the system, its potential business chance and intellectual property rights.

Our favorite tradition is that new comers must visit Akihabara and buy necessary parts for their desktop PCs. They must build a PC from the various parts and install favorite UNIX and Windows for their daily use. They enjoy using their very personalized PC with their favorite operating system during their work.

Figure 1: KEIO-SFC Delta Building and Tokuda Lab.

## Life in KEIO-SFC

Since our campus accepts freshmen in every April and September, we have commencement twice a year. In the beginning of the semester, we have a special

seminar and welcome party for incoming undergraduate students. Near the end of the semester, every undergraduate must present their term project to all of our members. In addition to this event, we have defense for their bachelor and master thesis. Indeed, it is a bit busy schedule throughout a year.

In every August, we have a special summer workshop with Real-Time and Multimedia Systems Laboratory, Carnegie Mellon University. We call it as a summer training camp for our laboratory. In Fall, we also present our research results and demonstrations at Open Research Forum at SFC. In every year, many students spend many sleepless nights to debug their demos. In December, we have a special Christmas party for all of our members and alumni in a restaurant. In March, we take a Ski camp.

## Sponsored/Joint Research Projects

- *Micro Smart Hot Spot Networking* (Ministry of Public Management)
- *.HOME* (Information-technology Promotion Agency, Univ. of Tokyo, Waseda Univ.)
- *Ubiquitous Computing* (NTT DoCoMo)
- *Development of Ubiquitous Information Technology by Cross-section Approach* (Japan Society for the Promotion of Science)
- *Anzen* (Ministry of Education, Culture, Sports, Science and Technology)
- *Distributed Real-Time Network Technology for Human Support* (Japan Society for the Promotion of Science)
- *Ubiquitous Network Technology* (21Century COE Program , Ministry of Education, Culture, Sports, Science and Technology)
- *Smart Space* (HRC Program , Ministry of Education, Culture, Sports, Science and Technology)
- *Next-generation Information Infrastructure* (Development of Meta-Level Knowledge Base Systems for Integrating Cultural, Social, and Natural Sciences)

## SSLab. Project

The Smart Space Laboratory (SSLab) Project aims to accomplish next generation computing based on interactions between users and Smart Space. At the *Post PC Era*, not only the users' conventional note PC or PDAs but also numerous kind of small-sized and light-weighted devices around users, such as home appliances, A/V equipment, or intelligent sensors and devices embedded into space, are getting intelligent with computational power, and are getting connected to the network. In such an environment, computational intelligence can be regarded as being embedded into the users' *surrounding space* rather than into specific devices, such as their note PCs. Interaction between users and this kind of intelligent space, what we call "*Smart Space*", would achieve the next generation computing.

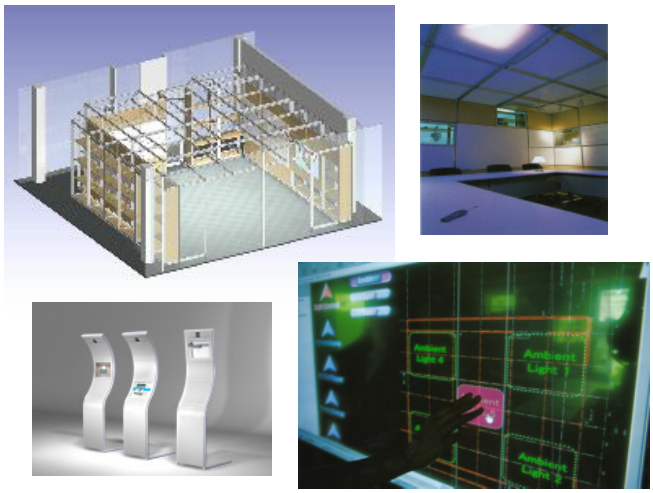

Figure 2: Smart Space Lab.

## ECN (Engineering Approach to Computer Networks) Research Group

A principal goal or the ECN group is research in new generation computer networks. We are building an application platform in the coming wireless ubiquitous networking environments to provide spontaneous network connectivity and scalable network usability. Specifically, we are developing a QoS routing protocol, naming service, and simple limited broadcast scheme for heterogeneous MANETs. We are also working on auto-configuration issues for Bluetooth personal area networks, data similarity issues for sensor networks, and group mobility managements. In addition, we are now investigating application level ad hoc routing, secure overlay networks, network supported games, and high speed TCP.

***Research Topics:***

- Mobile Ad Hoc Networks
- Wireless Packet Scheduling
- Wireless Personal Area Networks
- Group Mobility Management
- Secure Overlay Networks
- Network Supported Games
- Heterogeneous Wireless Networks
- Ubiquitous Spontaneous Networks

Figure 3: Target Devices (ECN)

## KMSF (Keio Media Space Family) Research Group

We envision homes and offices in the near future to become Smart Spaces, which we define as a room equipped with networked devices and sensors. A broader goal of our research group is to develop middleware technologies which support connection of various Smart Spaces infrastractures and their applications. To support communication between devices and sensors without centralized home server, we are designing an event delivery mechanism using P2P network. We are also proposing a coordination mechanism for home appliances which provides intuitive user interface with 3D GUI to instruct devices' action when events are delivered. And, we are trying to construct a programming language to define federation of appliances. These technologies enhance experiences of nomadic users of Smart Spaces.

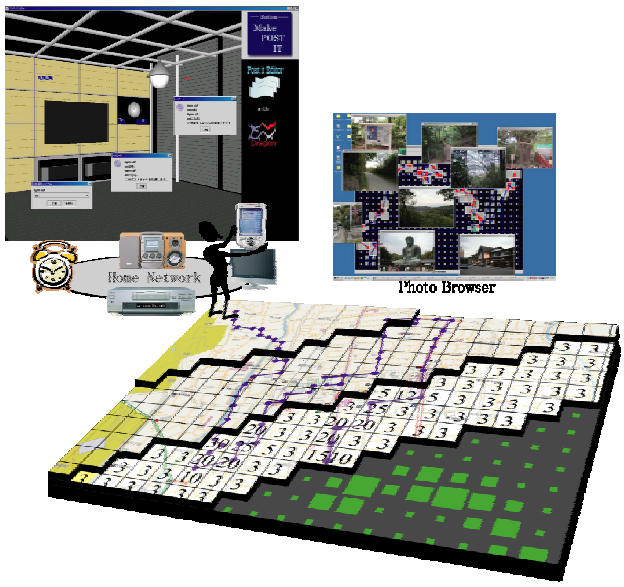


Figure 4: KMSF Application Images

***Research Topics:***

- Virtual Networked Appliances (VNA)
- System software for heterogeneous network
- Context-aware applications
- Service discovery framework based on user preference
- Event binding and delivery mechanism
- Media and service translation system
- Networked apppliance operating applications
- Network security

## ACE (Active Computing Environment) Research Group

The technologies for making ubiquitous computing environments are increasing. These technologies enable us to interact with the environment using software and hardware architecture. Up to now, researchers on ubiquitous computing mainly focus on constructing software and hardware which aim to develop faster/smaller/cheaper and interoperability between heterogeneous devices. With utilizing this environment, our group will focus on realization of human-centric life environment with the cooperation of ubiquitous devices and software. In this environment, software has the functionalities of information retrieval, information judging based on policies, operation of devices and so on. The software autonomously should be active. By making autonomous software, environment becomes autonomous and intelligent, and can reduce users' input. Therefore users are free from real operation, task processing in an explicit manner.

***Research Topics:***

- Proactive Computing
- Autonomous System
- Smart Environment
- Agent System


Figure 5: ACE Software Architecture

## Move! (Mobile and Adaptive System) Research Group

A broader goal of Move! is to construct an adaptation architecture for mobile entities. The mobile entities include users, devices and services. The adaptation architecture keeps mobile entities in best condition, supports seamless continuity of user's task, and on time service completion. The following four systems are our current contributions. *ASAMA* is a directory service for service management and event notification. *MoCa* enables device coordination, and switching of devices under operation. *Commutext* is an user task based flexible continuity support mechanism. *i-face* is an user-interface framework for the wearable network environment. Mobile reservation is a service task scheduling mechanism for user to get service on time.

***Research Topics:***

- Service roaming support
- Service directory and event management
- User based task continuity
- Many-modal user-interface
- Optimal service task scheduling
- Self-organizing dynamic sensor node placement scheme
- Context-aware event management

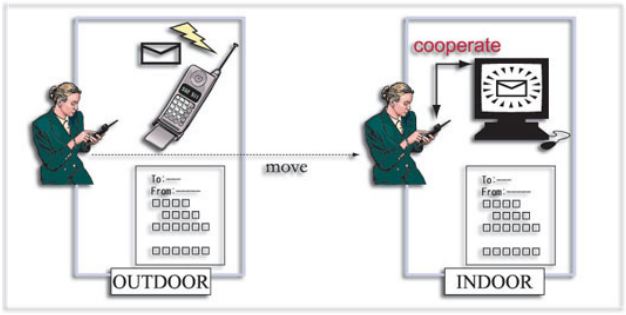


Figure 6: Wapplet Framework (Move!)

## HORN

Applications in ubiquitous computing environment should provide various functions for users, such as context-awareness, location awareness, adaptiveness to user's preference and so on. To realize these functions, applications should obtain various data and information from sensor infrastructure, such as location data, environmental information and user's personal data. On the other hand, several intelligent devices have been developed. Actually, many kinds of PDAs and smart appliances are in market. Furthermore, sensor devices have not only sensing facility but also computational power and communication facility like the Berkley Mote. The goal of HORN research group is to develop infrastructure which can mediate between these intelligent devices and ubiquitous applications. The infrastructure includes I/O interface for hardware devices and middleware for ubiquitous applications.

***Research Topics:***

- Heterogeneous sensor data management
- Intelligent sensor module
- Sensor support for mobile nodes

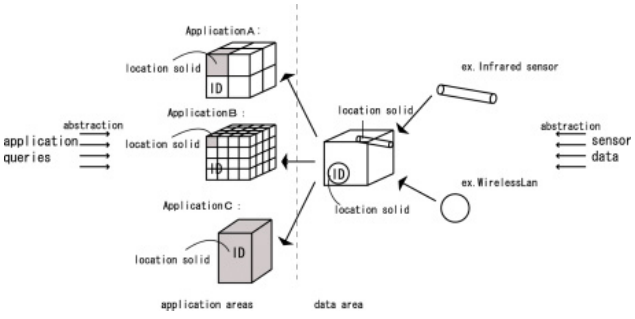


Figure 7: Location Service Middleware (HORN)

## Join Us!

Our Lab. was founded in April, 1992 in Keio-SFC. So, last year was 10th anniversary and we celebrated it. Every year, we have new students coming in and some students graduate from SFC. It is very hard to keep the active projects alive and to start a big project. However, because of our students' hard work and good guidance of group leaders, we could manage to accelerate our research activities for past 10 years. We really appreciate their effort and hard work for establishing such exciting research atmosphere. Now, it is the beginning of the new decade! We hope you will join us!!

## For More Details

For further information about our laboratory, please, visit our web-site: *http://www.ht.sfc.keio.ac.jp/index-e.html*.

## Reference

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# OHTSUKI LABORATORY at Tokyo University of Science

Tomoaki Ohtsuki (ohtsuki@ee.noda.tus.ac.jp)
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## About US

OHTSUKI Laboratory at the Tokyo University of Science is a research group within the Department of Electrical Engineering. We do research on communication theory, signal processing, information theory, and their various applications to new generation wireless/wired communications. We try to contribute enthusiastically to their fundamental research and education bits towards realizing the dream of communicating with anyone, anywhere, anytime, and anything.

OHTSUKI Laboratory started in 2000 in the same department. Now we consist of twenty-nine members, Associate Professor Tomoaki Ohtsuki, twelve undergraduate students, 15 graduate (MSc) students, and one visiting researcher. Our past members, though we are too new to have many, hold positions in the electric and communications industries. We hope we can provide good people to industries, academic fields, and government who contribute a lot and open up new world.

## Research

In OHTSUKI Laboratory there are following six research groups.

- **Broadband Wireless Communications**
- **Multi-Input Multi-Output (MIMO) and Space-Time Coding (STC)**
- **Low Density Parity-Check (LDPC) Codes**
- **Ultra-Wideband (UWB)**
- **Optical Communications**
- **Sensor Networks**

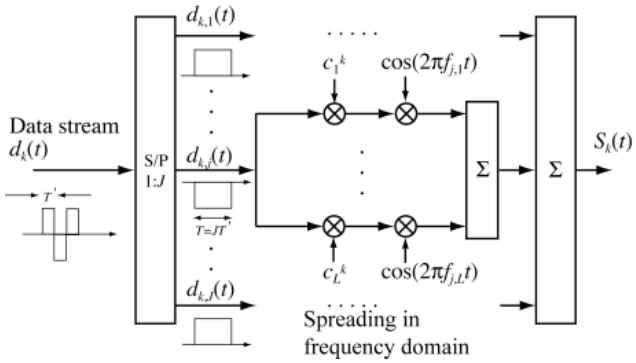
As you notice, some of them overlap and are closely related. We briefly explain what we are doing on the above research topics.

### 2.1 Broadband Wireless Communications

In future wireless communications high-bit-rate transmission is required for high quality communications. Typical broadband channel has a lot of multipath, which results in a heavy frequency selectivity. Multicarrier modulation, such as orthogonal frequency division multiplexing (OFDM), is a very attractive technique for high-bit-rate transmission in multipath fading environments. The fundamental principle of multicarrier modulation is to convert a high-rate serial data stream into a number of lower rate parallel data streams that are transmitted simultaneously over a number of orthogonal subcarriers. Thus, multicarrier modulation permits high data rates while maintaining symbol durations much longer than the channel's memory. Now there have been increasing demands for much higher data rates in wireless communications. ITU-R has discussed Beyond IMT-2000, where the target bit rate is 100 Mbit/s for cellular systems and 1 Gbit/s for WLAN. To realize such high data rates, we enthusiastically do research on the following topics for broadband wireless communications, particularly multicarrier modulations.

- Channel Estimation Techniques
- Transmit and/or Receive Diversity Techniques
- Multiuser Detection
- Peak-to-Average Power (PAPR) Problem
- Signal Processing in Time Domain and/or Frequency Domain

Fig. 1 MC-CDMA




### 2.2 MIMO and STC

Multiple input and multiple output (MIMO) techniques, including spatial multiplexing and space-time coding (STC) have received considerable attention for their high capacity. MIMO systems can be defined simply as the systems that are equipped with multiple antennas both at transmit and receive end where the transmit and receive antennas are combined in such a way that the quality of the communication for each link will be improved. To realize high spectral efficiency in MIMO systems, appropriate signal processing is needed at transmitter and/or receiver based on the available channel knowledge.

STC introduces temporal and spatial correlation into signals transmitted from different antennas to provide diversity and coding gain without sacrificing the bandwidth.

To realize broadband wireless communications, we do research on the following research topics.

- How to increase throughput with/without a limited amount of feedback information in MIMO
- How to exploit space and time diversity
- Design Criteria for Space-Time Trellis Codes (STTC) and Space –Frequency Trellis Codes (SFTC) on various channels with/without channel knowledge at Transmitter/Receiver
- How to increase the rate and diversity in STC

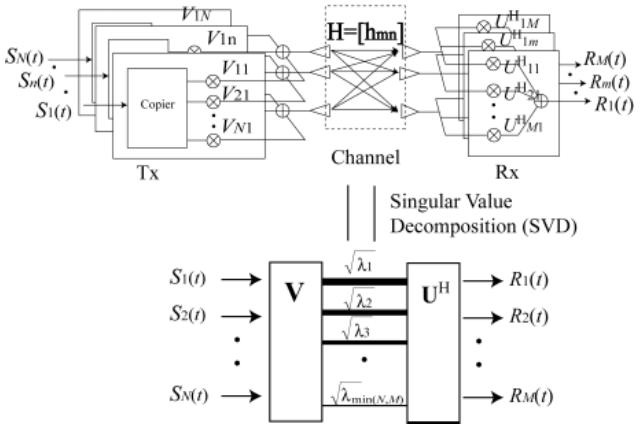



Fig. 2 Singular Value Decomposition (SVD) of MIMO channels

## 2.3 LDPC

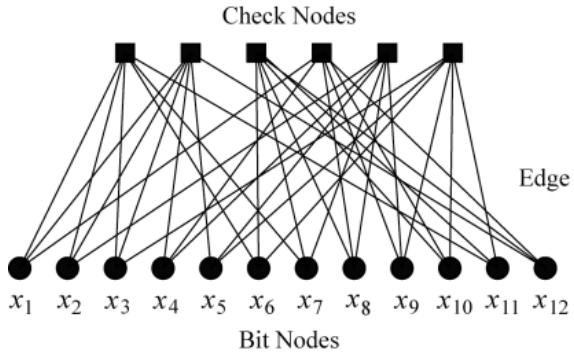
Low-density parity check (LDPC) codes, proposed by Gallager in the 1960's, and later rediscovered by MacKay and Neal appear as a class of codes that can yield very good performance. LDPC codes can achieve near the Shannon limit error performance with practical decoding complexity on an additive white Gaussian noise (AWGN) channel outperforming turbo codes of the same block size and code rate. LDPC codes have certain advantages, such as simple descriptions of their code structure and fully parallelizable decoding implementations.

LDPC codes can be decoded with a soft decision iterative decoding algorithm called belief propagation (BP) algorithm, or sum-product algorithm. The BP algorithm provides a powerful tool for iterative decoding of LDPC codes. Unfortunately, the hardware implementation of the BP algorithm is limited by its complexity.

We are focusing on LDPC codes as error correcting codes for the next generation wireless communications. We succeeded in developing less complex decoding algorithms for LDPC codes based on soft-decision and hard-decision decoding algorithm. Our research results presented in Transactions and Proc. of international conferences have attracted much attention and have made a lot of people in the wireless communication field interested in LDPC codes.

Some of our research topics on LDPC codes are as follows.

- Less Complex Decoding Algorithm
- Concatenation with Space-Time Coding




- Automatic Repeat Request with LDPC codes

Fig. 3 Tanner graph representation of LDPC code

## 2.4 Ultra Wideband (UWB)

In February 2002, a law-and-order of the Federal Communications Commission (FCC) gave approval to commercial applications of Ultra Wideband (UWB) systems with spectral mask in the range 3.1-10.6 GHz. Since the FCC's approval, UWB has attracted much attention particularly in high speed indoor multiple access radio communications. In addition to the possibility of very high-speed communications within relatively short distances, UWB technology allows for very accurate delay estimates, providing position and localization capabilities within a few centimeters. However, to realize these attractive features, UWB research and development has to cope with formidable challenges.

We are doing research to realize the attractive features of UWB. Some of our research topics are as follows.

- Less Complex Rake Receivers
- Channel Estimation
- UWB for Long Range

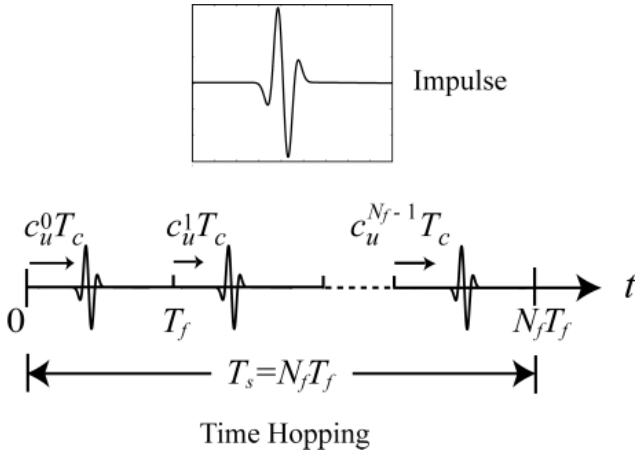



Fig. 4 Time-Hopping UWB-IR

### 2.5 Optical Communications

We are doing research on optical wireless communications for indoor and outdoor, and photonic networks on optical fiber.

Optical wireless communications can provide an attractive means to achieve high-speed wireless communications in indoor and outdoor environments. In optical wireless communications, particularly in indoor environments, output power is limited by eye safety considerations. Thus, how to reach longer distance with high data rate under the output power constrains is one of the research topics in this field.

In photonic networks wavelength division multiplexing (WDM) is a most major technique to realize high-speed transmission. However, the number of wavelengths is limited by the available bandwidth. Also, in access networks, the access technique based on WDM is not preferable because of its cost. To realize higher data rates in backbone networks and access networks, we are interested in code division multiplexing (CDM) and code-division multiple-access (CDMA) techniques that are popular in radio wireless communications. They can overlay virtual channels over WDM based networks.

Some of our research topics on optical communications are as follows.

- High-Speed Network Under Power Constraint
- High-Speed Signal Processing
- Photonic Networks based on CDMA

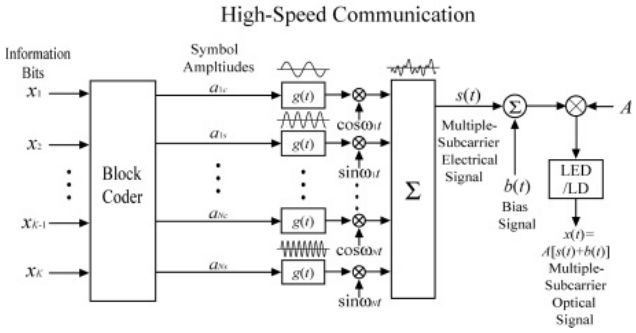



Fig. 5 Multiple subcarrier optical communication system

### 2.6 Sensor Networks

The basic idea of sensor networks is to have a number of independent sensors each makes a local decision and then to combine these decisions at a fusion center to generate a global decision. Either the Bayesian or the Neyman-Pearson criterion can be used. One of the research goals is to determine the optimum local and global decision rules that minimize the global error probability, that is, equivalently maximize the global detection probability.

When we consider the above problem, we should consider the effects of real wireless networks on the decision algorithms, which is of ten not examined.

Some of our research topics on sensor networks are as follows.

- Optimum Local and Global Decision Rule under the Effects of Real Wireless Networks
- Protocol for Sensor Networks
- Network Topology for Sensor Networks
- Routing for Sensor Networks

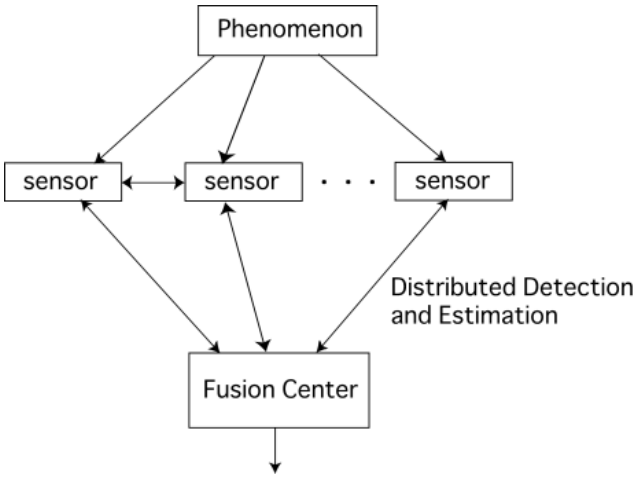



Fig. 6 Distributed detection and estimation for sensor network

## Student Branch of IEICE at Tokyo University of Science

We are actively involved in IEICE, IEEE, and other academic activities. We have a student branch of IEICE at Tokyo University of Science where we are planning some tutorials and meetings. Students at Tokyo University of Science are all welcome. Please join our branch.

### Get in Touch With Us

We invite you to visit our website at http://www.rs.noda.tus.ac.jp/~ohtsuki/ and check our research and publications. If you have interests, please come to see us, and also join our research groups.

## References

We have published our research results in Transactions of IEICE and IEEE, and Proceedings in the major IEEE conferences.

IEEE International Conference on Communications (ICC) and IEEE Global Telecommunications Conference (GLOBECOM) are our primary conferences where we present our research results first. We also present our research results at IEEE International Symposium on Information Theory (ISIT) and IEEE Vehicular Technology Conference (VTC). We show only a small part our publications here. If you are interested in our research results, please check our website. You can see not all but more of our publications.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(15) . Ishiyama and T. Ohtsuki, ``Performance Analysis of UWB-IR Systems with Multiple Modulation," 2003 International Workshop on Ultra Wideband Systems (IWUWBS), 5 pages, Oulu, Finland, June, 2003.

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# IEICE Overseas Membership Page

The Institute of Electronics, Information and Communication Engineers

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| **C. Electronics** | EC:Trans. on electron. | 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:Trans. on Inf. & Syst. | Theory/Models of Computation, Theory of Automata, Formal Language Theory, Algorithms, Computational Complexity Theory, Computer System Element, VLSI Systems,Computer Systems, Theory and Models of Software, Software Systems, Software Engineering, Databases, Network, Fault Tolerance, Applications of Information Security Techniques, Cooperation in Distributed Systems and Agents, Artificial Intelligence, Cognitive Science, Man-Machine Systems, Multimedia Processing, Educational Technology, Welfare Engineering, Pattern Recognition, Speech and Hearing, Image Processing, Image Pattern Recognition, Computer Graphics, Multimedia Pattern Processing, Natural Language Processing, Biocybernetics, Neurocomputing, Medical Engineering |

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***OMDP** is to support members from countries/areas of Asia, Africa, Central America, & South America.

★**Affiliate Member** is a person who is not a specialist of fields which IEICE subject to and who have an interest to our fields. And when you want to join IEICE as an Affiliate Member, you need recommendation of the society which you want to belong to.

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The Institute of Electronics, Information and Communication Engineers

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

**Personal Information** ☐Male

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

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

**Mailing Address** ☐Home ☐Office

Name of Company/School/College Department/Section

Street City State/Province

Postal code Country

TEL FAX E-mail

**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** I want to enter the IEICE from ☐April ☐October year:

***Membership:*** I want to apply for the following membership (check one item!)

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***Society registration (It includes one Transaction in English):***

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Additional Transaction subscription (optional): ☐EA: Fundamentals ☐EB: Communications ☐EC: Electronics ☐ED: Information & Systems

☐A (Japanese) ☐B (Japanese) ☐C (Japanese) ☐DI (Japanese) ☐DII (Japanese)

Journal subscription (optional) ☐(Japanese)

**Remittance** Remittance is available only in *Japanese yen* by a *credit card*.

Entrance charge……..\ Journal subscription (optional)……..\ _____

Annual charge……..\ Mailing option: ☐Air mail……..…….. \ _____

Additional Transaction (optional)……..\ ☐SAL mail……\ _____

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I recommend this applicant for IEICE membership.

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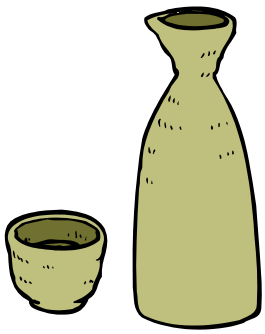
# From Editor's Room

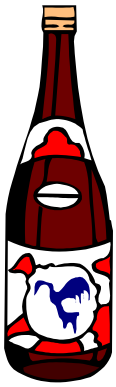
## ● Have you ever drunk any authentic Japanese rice wine ?

Last September, I attended at IEICE Communications Society Conference at Niigata, Japan.

Do you know Niigata ? Niigtata is one of the most famous places for the production of Japanese rice wine. Of course I had enjyoyed some kinds of delicious Japanese rice wines while staying in Niigata.

By the way, do you know what kind of Japanese rice wines are there ? Many kinds of Japanese rice wines are produced in Japan. First, there are some classes as follows:





- ✧ Jyunmai Dai Ginjyo
- ✧ Dai Ginjyo
- ✧ Jyunmai Ginjyo
- ✧ Ginjyo
- ✧ Jyunmai
- ✧ Hon jyozo

and so on. Here, these Japanese words "Dai", "Ginjyo", and "Jyunmai" mean "Excellent", "Quality ingredient" and "Pure rice", respectively. Generally, "Ginjyo" has aromatic and complicated fragrance, and "Jyunmai" has thick and strong tastes.Moreover, there are more than 1000 Japanese rice wineries in Japan !

Have you ever drunk any authentic Japanese rice wine ? If you have not yet, please come to Japan and attend at our IEICE conference. And please enjoy our authentic Japanese rice wines. If you like some white grape wines, certainly authentic Japanese rice wine will be your new favorite.

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