8-2 Keihanna Info-Communication Open Laboratory

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The Universal Communication Research Institute operates Keihanna Info-Communication Open Laboratory as one of the open research facilities at NICT. Research Promotion Council of Keihanna Info-Communication Open Laboratory was founded to promote research and development in the related fields for the collaborations with government, industry and academia, including the purpose of the best use of the Keihanna Info-Communication Open Laboratory. In this paper, brief description and history about them will be made.

Keywords

Collaborations with government, industry, and academia, Collaborations with local communities, New-generation network, Universal communication

1 Keihanna Info-Communication Open Laboratory

The Keihanna Info-Communication Open Laboratory (Open Lab) was established in June 2003 [1]. To promote research and development relating to information communication technology (ICT), Open Lab aims to establish a research and development center equipped with a high performance network, open to universities, communication and broadcasting organizations, manufacturers, research institutes, venture companies, local governments, etc., to conduct the collaboration with industry, academia, and government, and contribute to human resource development.

Open Lab rents out rooms and experimental equipment to users, and now rents rooms to four companies with the obligation of submitting a utilization report every year. This is not for commercial use, but for experimental and/or research.

There is some rental space for fostering venture companies in the Kansai Bunka-gakujutsu-kenkyū-toshi (the Keihanna Science City), but it is characteristic that Open Lab specializes in research and development, and rents out spaces with unique experimental equipment. There is another merit in that research can be performed efficiently when a joint research is conducted, because there are NICT researchers in the same building.

Now, four kinds of equipment can be used as experimental equipment as described below.

1. New Generation Network Testbed JGN-X

    Equipping the research and development environments of national scale IP networks, optical networks, and optical transmission testbeds, and providing environment ready for a wide range of research and development from network related basic technology to application technology. A max of 10 Gbps is connectable at Keihanna. Application to the Network Testbed Research and Development Promotion Center is necessary for its use.

2. High resolution image transmission experimental system

    Consisting of high resolution large screen projector (200-inch, rear projection) with 8 million-pixel ($3,840 \times 2,048$ pixels, 4 times HDTV), high resolution camera, and high resolution image transmission system.

3. Ultra-realistic Communication Testbed

    Open testbed based on the image system and equipment including ultra-high

resolution three-dimensional images (4K3D). Consisting of a ultra-high resolution 3D camera, multichannel video recording and playback equipment, multichannel video transmission equipment, a 3D display, and various 3D content.

4. Tiled Display Testbed

Testbed mainly based on tiled display equipment which can display high resolution video on one big screen by combining multiple displays.

The research projects (total 68 projects) which were performed by the Open Lab are described as follows in chronological order.

- Study on communication assistance using machine translation
- Development of techniques for constructing Japanese-Chinese-English parallel corpora
- Memo pad support system using knowledge acquisition from spoken language
- Development of high definition TV transmitting system on grid-computing network
- Research of advanced photonic add drop node
- National-wide GMPLS C-Plane and D-Plane field trial using extended GMPLS protocol code
- IPv6 router interoperability testing project
- Development of secure network for GRID environment based on IPv6/IPSec
- Advanced information extraction method from large-scale uncontrollable uneven texts
- Development of video processing system on grid-computing network
- Trial for "Terabit class super-network technology"
- Research on the new user-initiated service model
- GMPLS protocol interoperability testing (C-Plane/D-Plane) project
- New inter-carrier network-to-network physical interface development project
- New inter-carrier network-to-network logical interface development project
- Nationwide GMPLS network construction project
- High-speed wide-band, photonic access

technology based on photonic networks
- Research on cross-media retrieval, browsing, and integration technology for video and web content
- Research on new business model based on web content
- Experimental study on the information-oriented library using a radio frequency ID system
- Photonic network technology using optical burst switching
- Universal knowledgeable architecture for real-life appliances
- Investigation about modeling GMPLS-controlled optical networks in a carrier environment
- Optical access system using optical code-division multiplexing technique
- Study of ultra-fast label recognition using spatio-temporal optical signal processing
- Research on sensing infrastructure of universal user utility environments
- The evaluation of the long distance transmission characteristics of DWDM photonic signals by optical regeneration, reshaping and retiming functions
- Real time transport of high definition video data on IP networks for the tele-science
- Experimental study on the intelligent office using information technology for resource saving
- Study of data granularity-adjustable wavelength-tunable and packet-selective optical add/drop multiplexing
- Development of content distribution service system on broadband networks using efficient distribution technologies
- Conversion and fusion of internet-content and broadcast-content
- Study of restoration in photonic networks
- Research on functional connections among different appliances and the relation between the history of a user's operations and their preferences
- Connectivity evaluation of multi-layer networking technologies for terabit class super-networks
- Research on the efficiency of tele-existence

of super high definition images
- Research and development on construction methods for service applications with high-speed networks
- User detection and tracking for ubiquitous home platforms
- Digital document reading support system
- Research and development on ultrahigh-speed backbone photonic network technologies using JGN II
- Research and development of a terabit-class super-network
- Experimental study on network virtualization technology
- Research on universal cities
- Face-to-face meeting support system for argument concentration
- Research project for next generation video production and distribution technology
- Study for encoding/decoding for ultra-fast optical label recognition
- R&D on high performance photonic nodes with multi-granularity switching capability
- Transmission field trial for optical packets including IP packets using optical packet switch prototype
- Experiment of home networks
- OSGi home automation experiment
- Study on communication assistance using natural language processing technologies
- Quantum key distribution with superconductive single photon detectors
- Research and development of next-generation content distribution networks
- $4K \times 2K$ hi-vision projection display system
- λ utility; Research and development on optical 3R using JGN II
- The multi-point transmission experiment of 4K super-high definition video
- Experiment of next generation home networks
- Connectivity verification for information home appliances using communication networks
- Experimental study on the ODS streaming technology of digital cinemas
- Experimental research on 3D HD video transmission

- Research and development on super-high-speed gigabit wireless LAN
- Research on interactive content with super-high-speed internet and high definition wide screen systems
- Research and development of autonomous distributed information management
- Development of utilization of historic materials with 4K resolution
- Experimental study on cooperation devices of HD image transmission devices and hall equipment
- Preparation of automatic evaluation system of driving action for continuous usage during work time, and construction of a nation-wide map of driver action in response to traffic situations during driving work using its test system
- Demonstration of distance medicine and learning using high-definition projector and codec
- Business development of interactive technology

2 Research Promotion Council of Keihanna Info-Communication Open Laboratory

2.1 Constitution and activities

The Research Promotion Council of the Keihanna Info-Communication Open Laboratory (Council) was established in October 2002 in collaboration with industry, academia, and government in Kansai [2]. At first, promoting the Open Lab was the main purpose. Now, it is not necessarily restricted to the use of the Open Lab, but in promoting research and development related to ICT in Kansai, and it has constructed effective collaborations with government, industry, and academia regarding ICT, such as in terms of high performance networks and universal communication, aiming at new services and the creation of industries and working to contribute to the development of human resources. Also, it assists Kansai in playing a role toward the realization of a world leading state-of-the-art ICT nation, and will be conducive to the vital-

ization of the economy in Kansai. Masayuki Matsushita, vice chairman of the board of Panasonic Corporation, now serves as a Chief Director of the Council. There are 178 members (Fig. 1). Recently, the i-Energy Working Group (WG) mentioned below has been contributing to the increase of members.
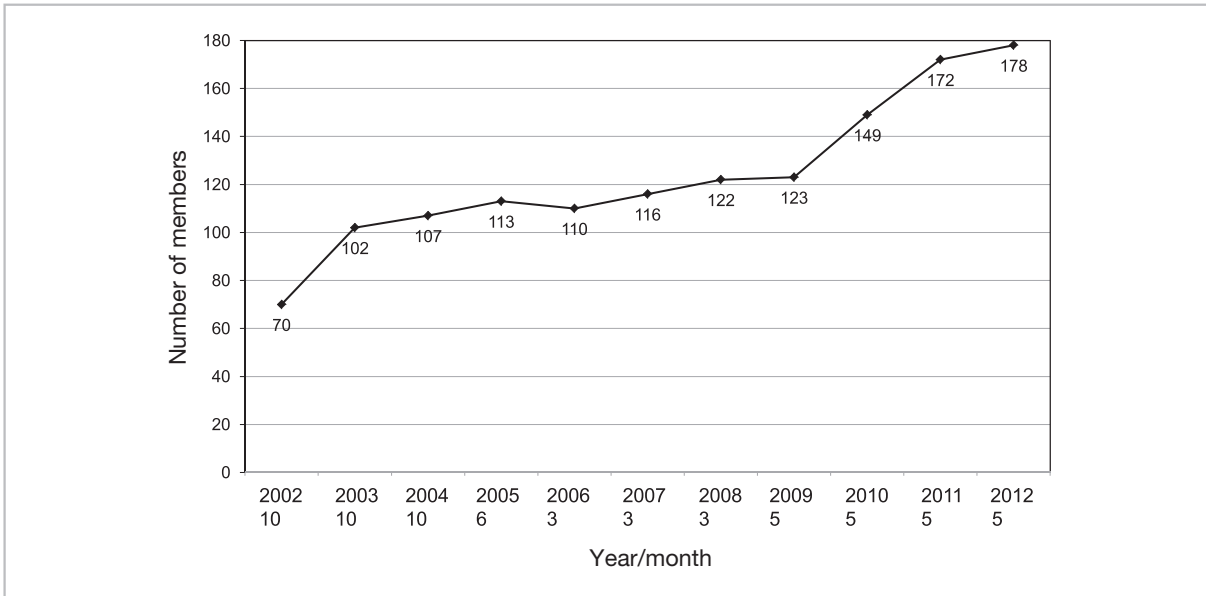
The organization of the Council is shown

Fig.1 Trend of number of members of research promotion council of the Keihanna Info-Communication Open Laboratory
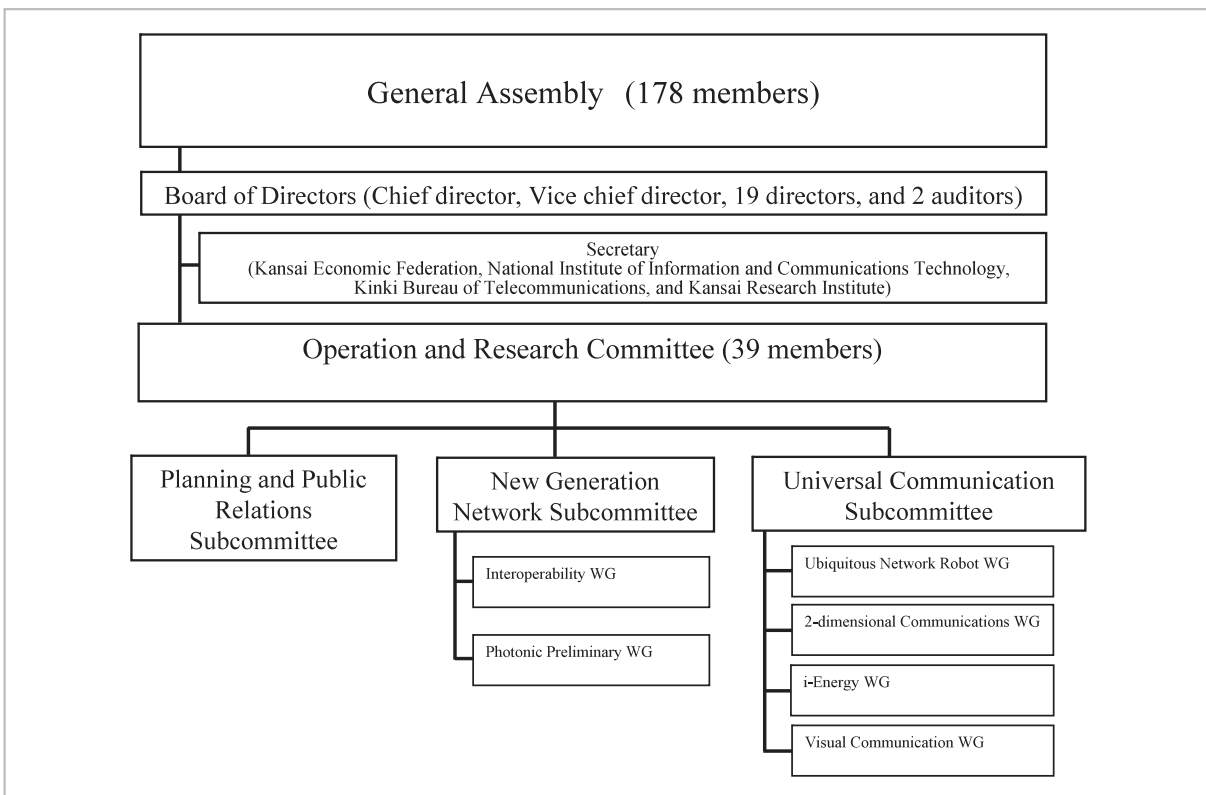

Fig.2 Organization chart of research promotion council of the Keihanna Info-Communication Open Laboratory

in Fig. 2, and it consists of a General Assembly as the highest decision-making body, an Operation and Research Committee for the overall operation of the Council and for investigating the direction of research and development, and Subcommittees and Working Groups (WG) working on actual research, development and planning. The activities of subcommittees and WG have been presented in journals, international conferences, and exhibitions, and they have applied for many domestic and international patents.

The Planning and Public Relations Subcommittee discovers new research themes, and consolidates users' needs related to the preparation of the Open Lab research and development environment, and work for the promotion of utilization.

The New Generation Network Subcommittee promotes research and development in network related technology regarding each layer collaborating with government, industry, and academia to solve network problems toward the realization of a new generation network. Furthermore, it presents created technology for international standards, and attempts to maintain the international competitiveness of our country. In particular, research projects on the verification of the interoperability of network equipment from different vendors are characteristic. This project cannot be accomplished only by private companies who may have a conflict of interest, but by the Open Lab which provides the location for experiments. There are impressive results such as performing the world's first GMPLS carrier to carrier wide-area combination experiment, and submitting various proposals (ITU-T, IETF, OIF) [3] for international standardization. Now, there are 2 WG activities as follows.

- Interoperability WG
  Verifying global interoperability with regard to optical networks, and promoting new networking technology development and international standardization activity.
- Photonic Preliminary WG
  Conducting various collaborative experiments and developing advanced optical communication element technology regarding photonic network technology, which performs information transmission functions in the optical region from backbone to access lines.

The Universal Communication Committee conducts research and development in collaboration with industry, academia, and government, and addresses the creation of new industries, international standardization, and the development of human resources toward the realization of heart-to-heart exchanges of universal communication beyond the difference of language, culture, and ability. There are 4 WG activities as follows.

- Ubiquitous Network Robot WG
  Conducting utilization research of new robots by combining ubiquitous networks and robots. Having conducted shopping assistance service experiments using robots in Keihanna Science City, performed demonstration experiments of the remote tour guide experiment system and ubiquitous network robot systems such as conversation partners for aged persons and event information services.
- 2-dimensional Communications WG
  Developing 2-dimensional communication technology which can perform high speed and broadband communications and provide electric power using sheet style transmission media. 2-dimensional LAN sheets have been made practicable and have been commercialized using WG results.
- i-Energy WG
  Conducting research and development in optimal energy allocation to equipment and in intelligent management of energy flow in life from homes to local communities utilizing ICT, and aiming for the realization of safe and secured eco-life.
- Visual Communication WG
  Conducting demonstration experi-

ments with regard to the support of small-and-medium-sized companies and remote medical care diagnostics, utilizing the ultra-realistic communication testbed and the new generation network testbed JGN-X.

In addition to the activities of these subcommittees and WG, the Council hosts a symposium with a theme of the moment every year, with a lot of attendance. For fiscal 2011, "Keihanna Info-Communication Open Laboratory Symposium 2011" was held with the theme of "The role of information communication toward a new style of Japan" in Keihanna Science City. To discuss how the ICT can be utilized for earthquake disaster reconstruction, speakers who had suffered but kept working towards restoration and reconstruction in the Tohoku area were invited, and held lectures and panel discussions. Research projects which the Council is dealing with now were also introduced. In addition to the symposium, seminars and workshops are held as needed, and activities for the provision of information and the development of human resources are promoted.

2.2 Main activities

This section describes the main topics of the Council's activities chronologically.

○2002
- Research Promotion Council of Keihanna Info-Communication Open Laboratory was established. IUE Satoshi, Representative Director & CEO of SANYO Electric Co., Ltd. (at the time), took up the post of Chief Director.

○2003
- Open Lab was opened.
- Planning and Public Relations Subcommittee, High Performance Network Subcommittee, and Human Communication Subcommittee were established under the Operation and Research Committee.

○2004
- Network Robot Subcommittee was started.
- Conducted GMPLS interoperability

verification experiment utilizing JGN II. Recommended to international standard.
- Conducted transmission experiment for HD image of microscope with the cooperation of Osaka University and University of Illinois in the USA.
- Developed the infrastructure middleware, "YUKARI-Core" for the home network related standard, and started the demonstration experiment for the testbed, "ubiquitous home" which has various equipment and sensors for the life space.

○2005
- Info-Communication Promotion Month, received the award of the Minister of Internal Affairs and Communications (group).
- Succeeded the inter-multi-carrier ASON/GMPLS interoperability experiment between overseas vendors, and was selected as the most outstanding article by OFC.
- Conducted a total 70-day life demonstration experiment for the ubiquitous home, and collected an evaluation of services and behavior data.
- Conducted a compact car robot driving experiment on public roads and a facility information experiment interlocking different kinds of robots as a network robot demonstration experiment utilizing the special intellectual district of the Keihanna Science City.
- Developed the world's first robot-mountable 4K2K camera, and succeeded in remote robot control demonstration experiment.

○2006
- Received the award of the Minister of Internal Affairs and Communications for contributing to the collaboration with industry, academia, and government.
- Info-Communications Promotion Month, received the award of the Kinki Bureau of Telecommunications (individual).
- Restructured the Subcommittee in the New Generation Network Subcommittee, Universal Communication Subcommittee, and Universal & Robot City Technical

Subcommittee.

- Conducted an OTN connection experiment, and documented a 10 GE-OTN direct housing scheme in ITU-T.
- Network Robot open demonstration experiment (Yumehanna collaboration)
- 4K ultra high resolution image transmission open demonstration at Tokyo International film Festival

○2007
- Masayuki Matsushita, Vice Chairman of the Board of Matsushita Electric Industrial Co., Ltd. (at the time), became the Chief Director.

○2008
- Opened an intercommunication page for members in the Council webpage.
- Succeeded in a world first PCEP interoperability experiment.

○2009
- Terabit broadband LAN demonstration experiment.
- Conducted the world's first ubiquitous network robot multi point connection experiment.

○2010
- Renamed the Universal & Robot City Technical Subcommittee to Ubiquitous Network Robot Technical Subcommittee.
- Received JGN2plus advanced and base technology award.
- Verified the interoperability of optical control technology preparing for wide-scale disaster.
- Conducted a life data collection demonstration experiment in a smart condominium room in Kyoto.

○2011
- Integrated the Universal Communication Subcommittee and Ubiquitous Network Robot Technical Subcommittee.
- Succeeded in the interoperability of equipment which transmits 100 gigabit Ethernet signals on an optical network using the new ITU-T standard, as the first in the world.
- Demonstrated good transmission characteristics on the 537 km long-distant field fiber

(JGN-X) by real-time signal processing technology with a 100 gigabit Ethernet signal.
- Conducted a demonstration experiment of i-Energy at the power-of-Kyoto concentrated eco-house constructed in the Keihanna Science City.
- Performed a ubiquitous network robot social receptivity survey by holding public courses.

3 Future directions

This year is the 10th anniversary since the Council was established in October 2002, and an anniversary symposium is planned. Future directions will be discussed by looking back at previous activities and organizing challenges.

First, the Council is positioned as one member of a community, and various ideas and people's connections exist in the community. It is considered as an important fortune. It is required that the Council continues activities as a base point by utilizing the strength of the community.

In the future, it is crucial not only to spread generated new technology for new industry creation, but also to conduct research and development toward the realization of an ICT society which is convenient and comfortable for every person. It is important to make a good model for the collaboration with industry, academia, and government and also to be an international base point for research and development which enriches human life.

Furthermore, it is characteristic of the Council that regional partnerships play a large part in addition to the collaboration with industry, academia, and government. The Council is supported by members of companies and universities in the Keihanna area and Kansai, and there is a description in terms of its establishment that the Council should support the Kansai economy in revitalization. Under these conditions, it is also necessary for the Council to discuss environmental preparation for the easy use of the Open Lab, manage requirements, promote the support of research

activities towards open innovation through the collaboration with industry, academia, and government, strengthen collaboration in regional research and development activities, and discuss the research and development challenges for the Keihanna area and Kansai to utilize its potential fields.

Acknowledgments

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