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NiCT NEWS

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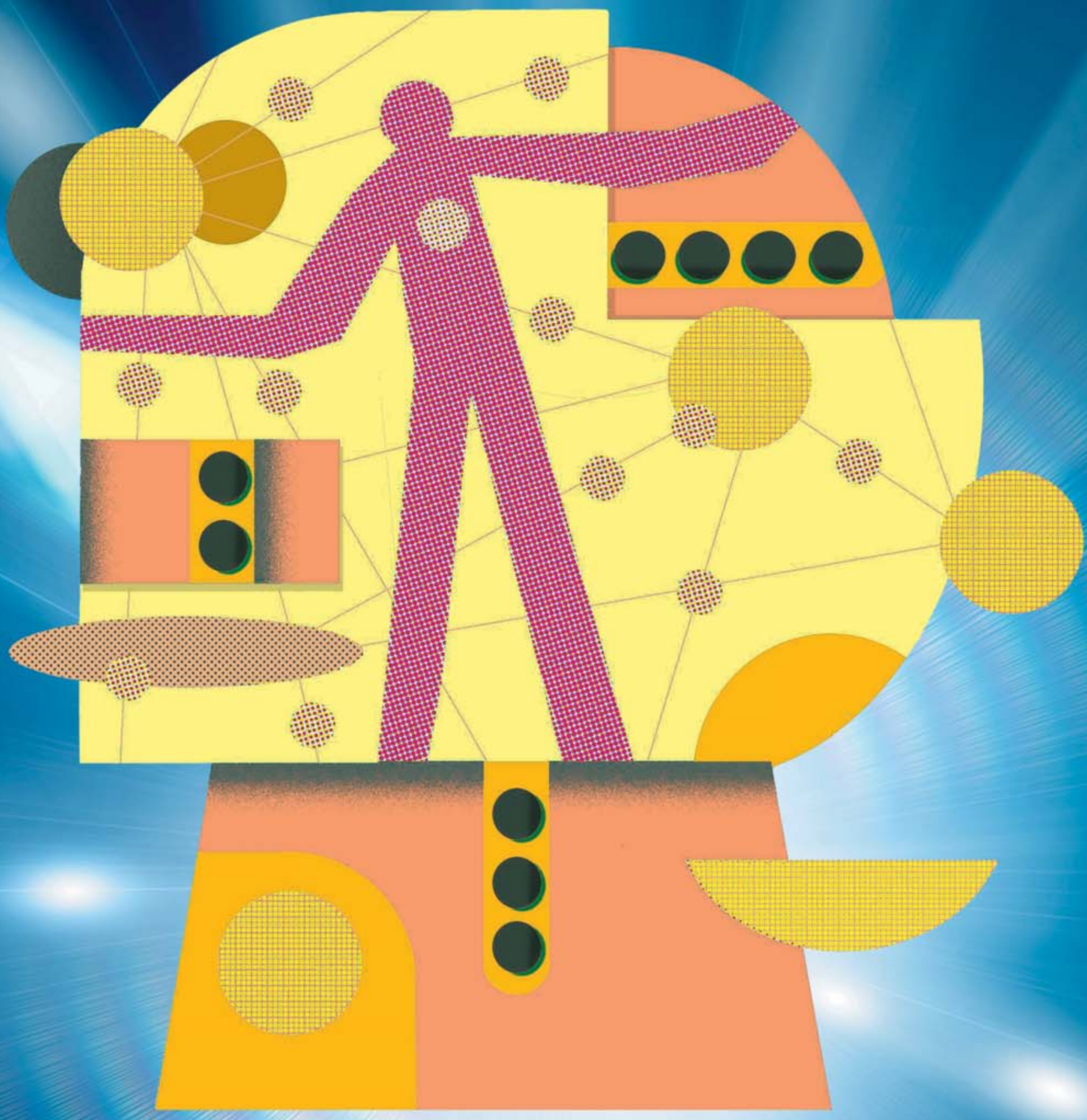

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Research and development of value-added technologies for more effective Internet use

— Development of multipoint high-definition remote videoconferencing system —

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Michiaki Katsumoto joined the Communications Research Laboratory (presently NICT) in 1996. Toward the realization of next-generation platforms, Dr. Katsumoto works on advanced development of the Internet protocol, as well as a number of next-generation applications. Ph.D. in engineering.

Introduction

High-speed Internet environments based on ADSL and fiber optic connections have recently become popular even in home use, and services based on large-capacity data distribution have already begun, including content distribution services providing movies and video-telephony services. Further advances in basic Internet technology and higher network speeds have enhanced the quality of these services, leading to high expectations for further increasing demand. However, if we are to provide these high-quality services, a variety of technologies will be required in addition to the basic Internet technologies in place. For example, videoconferencing systems will require more than simple measures against degradation of image and sound quality. These systems must combine basic Internet technologies with specific image and sound technologies to enable transmission of high-quality images over the Internet. Although basic systems are in place for simple one-to-one videoconferencing, more complex technologies will be required for communications and videoconferencing connecting three or more sites. Accordingly, the Internet Application Group has been conducting research on value-added technologies that will enable more effective Internet use, based on technologies that we have developed in the past. This article introduces the multipoint high-definition remote videoconferencing system as one example of a consumer application in this area.

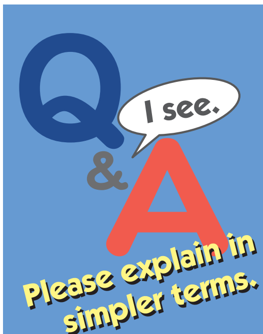
Activities toward realization of the system

A remote videoconferencing system using the Internet requires extremely high transmission capacity to generate acceptable image and sound quality. In response to this challenge, the Internet Application Group has developed and proposed technologies for the transfer of digital video (DV) and high-definition TV (HDTV) images over the Internet. However, these technologies are essentially aimed at one-to-one transfer and do not support multi-point transfer. We have therefore developed a new technology enabling connection among three or more sites as well as bidirectional, high-definition remote videoconferencing. The key elements of this technology address signal processing at each of the transmission sites, signal synthesis, data transmission, encoding at the receiving sites, and image synthesis. We have also combined these elemental technologies with basic Internet technology. In addition, we have devoted efforts to improving ease of use, recognizing that operation of the system by participants becomes complex with an increase in the number of parties to the conference, demanding a certain degree of knowledge and experience in operation. Specifically, we undertook joint research with Information Services International-Dentsu, Ltd., and developed software providing simple operations to participants through a generic Web browser. The plug-in software required to launch this program in the browser is automatically installed on the PC used in the videoconference, so that any person using the Internet—even simply for browsing the web—can configure their videoconference settings.

Overview of the system and service trial experiments

A conventional videoconferencing system generally requires transmission speeds of 30 Mbps to transmit digital video, and the required capacity increases with an increase in the number of connected sites. Thus, in view of a system that will combine high-speed networks with transmission bandwidths in the 1-Gbps class (established by universities and research institutions) and ordinary general-purpose servers, we have developed a videoconferencing system that can connect 10 sites with high-definition digital video. This system uses high-speed networks with a transmission capacity of 630 Mbps for sending and receiving data. User operation is extremely simple. As shown in Figure 1, the participants configure their conference settings on a web browser. Figure 2 shows an example of the setting panel display. The organizer of the conference can freely modify the configuration of

Figure 1: Conference Settings screen



Q What is APAN?

A APAN is an international consortium established in 1997 to provide an educational and research network in the Asia-Pacific region. APAN conducts research mainly in three fields: network technologies, network applications, and user communications. Countries are connected on a network that includes Japan, Korea, China, Malaysia, Thailand, Singapore, and Australia.

Q Where are the three sites in Japan and the seven sites abroad that were connected in the practical application experiment?

A The three sites in Japan consist of a conference site in Akihabara, the Kyushu University Hospital in Fukuoka, and the Iwate Medical University Hospital in Iwate. The seven sites abroad are located at the Bundang Hospital of Seoul National University in Korea, the National Cancer Center in Korea, the National Taiwan University in Taiwan, the Taichung Veterans General Hospital in Taiwan, the Tsinghua University in China, the National University of Singapore in Singapore, and Flinders University in Australia. The experimental videoconference consisted of an international medical meeting involving optical-based medicine, including an endoscopic inspection.

the conference by setting participant information and selecting screen layout in the "screen configuration" panel and by then selecting the layout for transmission from the "transmission pattern" panel. As shown in Figure 3, the participants can join a multipoint conference simply by clicking on the conference that the participants wish to join.

This system was used in a multipoint international remote conference in the APAN* Medical Working Group Workshop held on January 25, 2006, connecting three sites in Japan and seven sites abroad via high-speed networks (APAN and JGN II). This conference demonstrated the usefulness of the system both in terms of functions and performance (Figure 4).

*Asia-Pacific Advanced Network

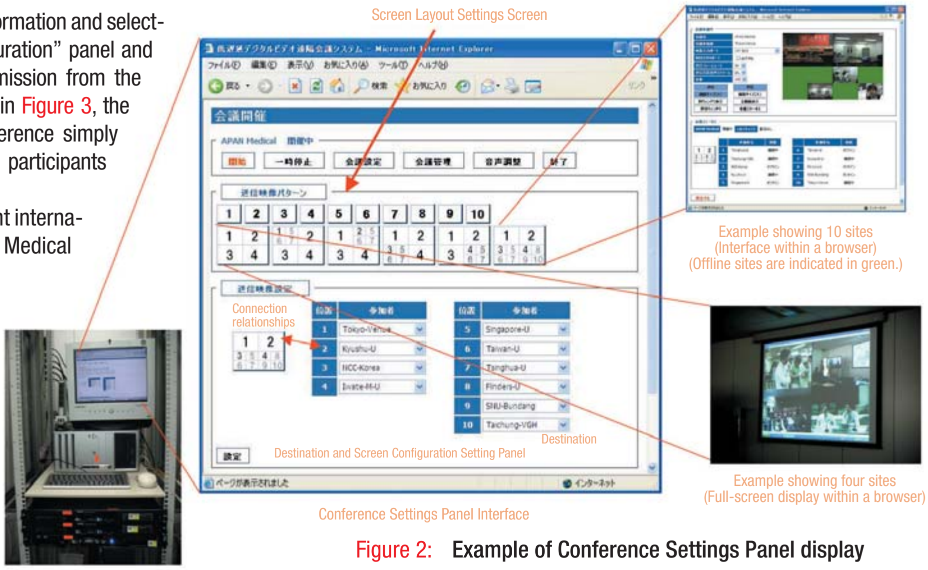


Figure 2: Example of Conference Settings Panel display

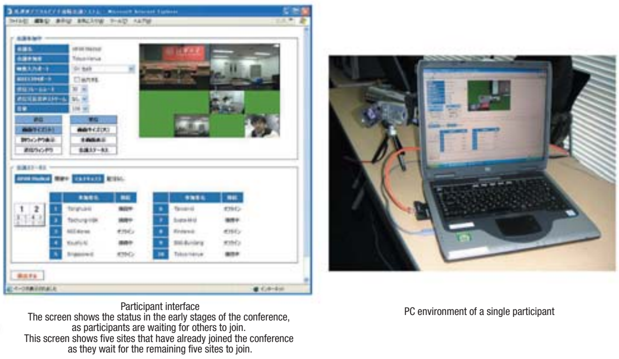


Figure 3: Interface for participants

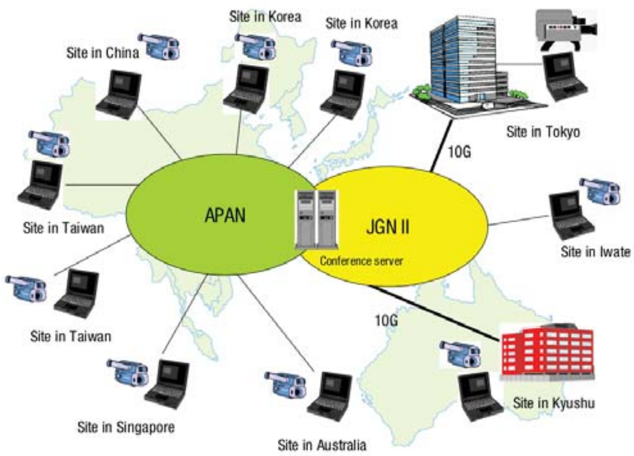


Figure 4: Configuration of the multipoint remote conference system (Example from the practical application experiment on APAN and JGN II)

Summary

This achievement is a result of the integration of basic technologies required for a next-generation platform technology, the focus of ongoing NICT efforts. Early practical applications are expected to incorporate new image application technologies in videoconferencing and in remote education, where high-quality, low-delay image transmission is required between three or more sites, whether within Japan or international. The importance of technology transfer with the industrial sector is also clear. Given these circumstances, Information Services International-Dentsu, Ltd., our partner in these research activities, began investigating the commercialization of a multipoint digital videoconferencing system based on the results of this technical development.

Scenes from the practical application experiment using APAN

Life & Technology

● Videoconferencing system: not just for business but for daily life as well

On hearing the term "videoconferencing," we think of large displays and multiple microphones in an in-house meeting for an enterprise with many branch offices both domestic and abroad. We also think of complicated operations requiring a videoconference control board. However, the current system, making use of the Internet and new software, should put rest to such scenarios. In addition, this system can be applied to remote education and academic meetings, beyond the limited applications of business meetings. We also expect new spin-off applications based on the ten functions provided, including high-quality images (exceeding television quality) based on DV-image transmission and CD-quality sound; or the combination of DV images and stereo sound from ten sites into one. It is thus highly likely that videoconferencing systems will become familiar features of daily life.

Standardization, Research and Development on UWB Technology

— Toward more convenient Wireless Personal Area Networks —

Li Huan-Bang

Senior Researcher, UWB Technology Group, Yokosuka Radio Communications Research Center, Wireless Communications Department

Li Huan-Bang received the Dr. of Eng. Degree in Electrical and Computer Engineering from the Nagoya Institute of Technology in 1994. He joined the Communications Research Laboratory (presently NICT) in 1994. After engaged in R&D on mobile satellite communications and in various other research projects, he joined the current group in 2004. He has been also a Visiting Associate Professor in the University of Electro-Communications since 2002.

What is UWB?

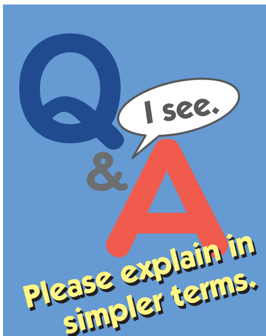
UWB (Ultra-wideband) refers to a wireless communication technology that uses radio waves at low power density in ultra-wide frequency bands. The frequency bandwidth used exceeds 500 MHz at or above 3.1 GHz. A UWB device can operate without a license if the power emitted is at or below the value permitted by the regulations. Low-power transmission enables the use and applies the advantages of CMOS (Complementary Metal-Oxide Semiconductor) technology, which leads to small size, lower power consumption, and lower cost. At NICT, the UWB Technology Group, based at the Yokosuka Radio Communications Research Center, collaborated with related Groups to approach universities and more than 24 enterprises in Japan to establish the UWB Consortium. We are now working on the standardization of UWB and on related research and development.

UWB technology lends itself most readily to WPAN (Wireless Personal Area Network) applications. There are two aspects to apply UWB to WPAN: one providing high-speed communication in short ranges, and another providing low-speed communications and high-precision ranging with a single physical layer. Working Group 15 under the IEEE 802 Standards Committee has assembled two separated groups of Task Group 3a (TG-3a) and Task Group 4a (TG-4a) to work out the standards for these two applications respectively. In general speaking, the objective of standardization is to define common specifications for devices designed for the same purpose and to guarantee interconnectivity between devices provided by different manufacturers.

UWB standardization under TG-3a

TG-3a received 24 proposals for standardization in the course of the March 2003 meeting. After repeated discussion and voting in the group, TG-3a selected two proposals at the meeting in September 2003: the DS-UWB (Direct-Sequence UWB) proposal put forth by NICT, Freescale, and others; and the MB-OFDM (Multi-Band Orthogonal Frequency Division Multiplexing) proposal suggested by Intel and others. The two proposals differ in the communication methods involved but both can provide transmission rates of 110 Mbps to 480 Mbps. Figure 1 shows one example of the high-rate WPAN applications suggested in TG-3a. UWB technology will mainly be used in high-speed data transmission between a PC and its peripheral devices and in content streaming among TV, audio, and video equipments. However, the member enterprises that submitted these proposals had already begun developing chipsets based on their own proposals during discussions on standardization. Consequently, the two parties failed to come to agreement, and a motion was adopted in the meeting of January 2006 to disband TG-3a. The respective technologies of the two parties are already in the stages of commercial application, and different approaches toward standardization are anticipated.

Figure 1: Example of UWB application in high-rate WPAN



Q Do UWB signals affect other types of communications and electronic devices?

A It is specified that the maximum spectrum density of UWB signal is -41.3 dBm/MHz. This value is quite weak: one hundred-thousandth of that emitted from a portable phone (W-CDMA signals). As this comparison indicates, the effect of UWB signals on other communications and electronic devices is considered to be extremely small. In the wireless band used for devices sensitive to faint signals, the permitted UWB power emission is set even lower to minimize the risk of affecting other wireless devices.

Q What are Task Groups TG-3a and TG-4a?

A IEEE 802.15.3 is the existing IEEE wireless standard for high-rate WPAN, and IEEE 802.15.4 is the standard applicable to low-rate WPAN. Task Groups TG-3a and TG-4a were assembled to provide UWB-based alternative physical layers corresponding to these two standards. TG-3a and TG-4a were formed to work on the UWB based standards of IEEE 802.15.3a and IEEE 802.15.4a, respectively.

UWB standardization in TG-4a

TG-4a received 26 proposals in the course of the meeting in January 2005. After the integration of all proposals in the meeting of March 2005, in December 2005 TG-4a put together a draft standard. This draft included numerous proposals from NICT. One of the main applications of the low-rate UWB is the implementation of a wireless sensor network. As the low-rate UWB supports both communication and ranging, it would be effective for applications like locating, managing, and tracking of goods and staff in the field of security, distribution, and medicine. Figure 2 shows a conceptual illustration of a home sensor network based on UWB. Here, the UWB nodes—placed in the rooms, in the entrance, and on the windows—are equipped with sensors. The system transmits the information collected by these nodes to indoor

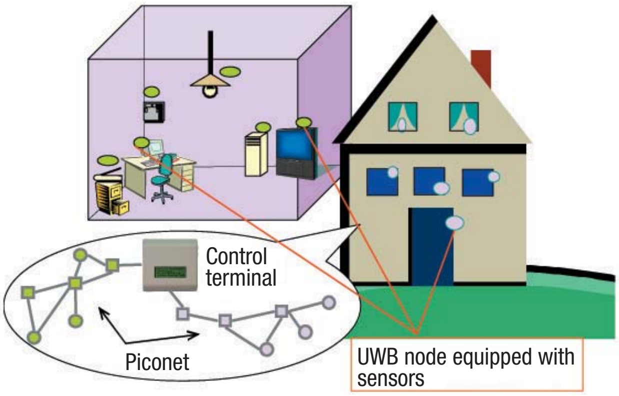


Figure 2: **Conceptual illustration of home sensor network based on UWB**

control terminal through the established Piconet* along with the necessary positional information. The information is used for intruder detection, automatic temperature and lighting control, and fire alarm purposes. The above draft standard obtained more than 75% support in the letter ballot in Working Group 15 in January 2006. TG-4a is now updating the draft, in view of the establishment of a complete standard.

*Piconet is a network temporarily established between terminals when they are brought within range of each other.

Researches and developments on UWB in NICT

The UWB Technology Group plays an extremely important role in the UWB standardization process described above. At the same time, the Group conducts researches and developments related to UWB. The UWB Technology Group has produced many research and development achievements: construction of a UWB signal testbed for the design, transmission, and reception of arbitrary UWB signals; ubiquitous UWB terminals that support Piconets; and a Chirp UWB transmitter and receiver based on the TG-4a proposal. As an example of these researches and developments, Figure 3 shows the prototype DS-UWB system, equipped with both communication and ranging functions, and the monitor screen display used with this system. Nodes A, B, C, and D on the monitor screen indicate DS-UWB devices. Among them, Nodes A, B, and C act as controllers of different Piconets, with positions assumed as known. D is a new node that has moved into the area. For example, Node D can measure the distances to Nodes A, B, and C and can join the Piconet of the node identified as nearest to it. It can also estimate its location from the distances to Nodes A, B, and C.

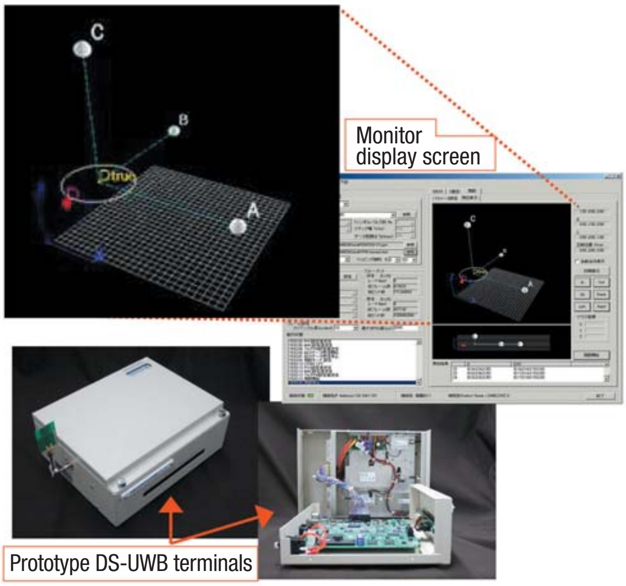


Figure 3: **Prototype UWB system equipped with communication and distance measurement functions**

Future activities

UWB technology has raised expectations for many applications other than those described here. NICT will continue to explore new applications and to conduct researches and developments on UWB technology tailored to these applications. Here it is worth providing a brief description of the legal standing of UWB. After the US granted conditional permission for the use of UWB wireless devices without a license in 2002, Japan and Europe each specified the conditions under which UWB wireless devices may be used without a license. These conditions will be finalized soon. Given this background, it is clear that UWB wireless devices are poised to spread rapidly on a global scale.

Life & Technology

● UWB technology anticipated for use in domestic applications

UWB technology will have a deep impact on our daily lives, both in the office and at home. It is now possible to produce small, inexpensive UWB products, which are expected to generate an extremely large market. Soon we will be surrounded by a steady stream of UWB products, including wireless USB based on UWB, wireless printers, wireless home theaters, and home security systems.

Takahiro Ueno
Executive Director,
Collaborative Research Management Department

Report on JGNII Symposium 2006 in Sendai

NICT held a symposium regarding the JGNII testbed network for research and development from Wednesday, January 18 through Friday, January 20, 2006, at the Sendai International Center. Many Japanese, as well as foreign experts in the network field participated in this symposium, which included lectures and panel discussions as well as demonstrations and panel displays of various JGNII experiments, designed as an introduction to research activities utilizing the JGNII.

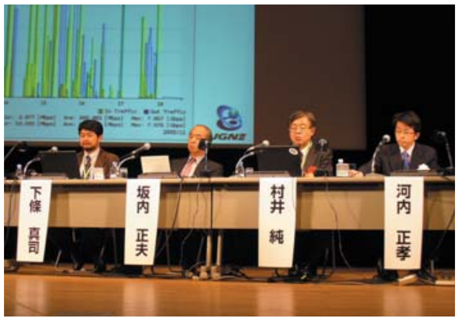
On the first day of the symposium, Mr. Kawauchi, Vice President of the NICT gave an opening speech, followed by statements from a number of esteemed guests, including Mr. Matsumoto, Councilor for General Technical Affairs from the Ministry of Internal Affairs and Communications, and Mr. Miura, Vice Governor of Miyagi Prefecture. And then both Dr. Noguchi, President of the Sendai Foundation for Applied Information Sciences and Mr. Tsuge, a member of Council for Science and Technology Policy conveyed their shared belief that the JGNII ought to be viewed as an important platform for research and development by the industry, the academia and the government, encouraging further efforts from all of the parties involved.

Opening Speech by Mr. Kawauchi, Vice President of the NICT

Following these speeches, Prof. Aoyama of the University of Tokyo gave a lecture including the first IP transmission demonstration of uncompressed 4K images in the world. The demonstration involved connection between Tokyo and the symposium site in Sendai via the JGNII, conversion of 4K images into uncompressed IP-packets, and live relay of the packets at a transition speed of 6 Gbps. The images projected onto the screen conveyed a vivid three-dimensional image, to the amazement of the audience. The demonstration was successfully performed and appealed the super-high speed of the JGNII.

The research presentations on the second day included the Okayama JGNII Research Center's transmission experiment involving the Sapporo Snow Festival via the IPv6 multi-cast, an annual event, as well as the Kitakyushu JGNII Research Center's presentation on the research and challenges in access network technologies. Additionally, a remote special lecture by Prof. Jianping Wu of Tsinghua University in China was relayed from Beijing. After the lecture, a panel discussion was followed and in it, overseas researchers provided a presentation of testbed networks in Europe, the U.S.A. and China. All the participants shared in recognition of the importance of the international deployment of the JGNII testbed network and the necessity of further international collaboration.

Scene in the Main Conference Room



Session: "Future Activities Involving the JGNII"

The last session was titled as "Future Activities involving the JGNII," and consisted of a panel discussion by Mr. Kawauchi of Vice President of the NICT and a number of well-known personalities in the field concerned. The discussion included a number of useful comments, including the observation that the JGNII activities need to be conducted in view of establishing a "ubiquitous" society, with a long-term awareness of a certain new-generation global network architecture.

In the hall where were held the demonstrations (20 booths) and panel displays (80 projects) of various experiments using the JGNII, the symposium also exhibited its research achievements, allowing visitors to the hall to enjoy and enliven itself.

Demonstrations and Panel Displays

A total of 800 people were roughly counted as participants in the symposium during two days from January 18 to 19. Many participants also joined the meetings organized as associated events on January 20 to exchange their opinions and comments. These meetings included ones by the Technical Committees of the Institute of Electronics, the Information and Communication Engineers (Technical Committee on Internet Architecture, or IA, and the Technical Committee on Technologies and Applications of the Internet, or TAI), Technical Committee meeting of the Information Processing Society of Japan (Technical Committee on the "Quality Aware Internet," or QAI), ICOIN2006*1 and JANOG17*2. The symposium and these associated meetings were successfully performed.

Finally, we would like to express our gratitude to many people who helped us in holding the symposium.

*1 The International Conference on Information Networking 2006
*2 Japan Network Operators' Group 17 Meeting

Yasuhiro Murayama
Group Leader, International Arctic Environment Research Project Group, Applied Research and Standards Department

Report on Sensing Network Symposium

The "Sensing Network Symposium — An Approach to the Urban Environment with Electromagnetic Wave Technologies and Telecommunications" was held on Friday, January 20, 2006, at Roppongi Academy Hills.

NICT has been working on the development of environmental measurement techniques based on electromagnetic wave (radio waves and light) and remote sensing techniques. In diverse fields including those involving ground-based, air-borne, and space-borne measurements, NICT has arrived at a number of internationally significant achievements. Based on these successes in past, NICT has now begun its new "Sensing Network" project. At the launch of the project, NICT held a symposium to obtain the fruitful input of experts who play important roles in their fields of governmental, public, academic, and private sectors, specifically addressing the issue of how NICT ought to promote the project going forward.

Speech of Vice President Dr. Shiomi (Upper left) and explanation of the symposium objectives by Executive Director Dr. Kumagai (Upper right)

The NICT Sensing Network project integrates the remote sensing technologies and the telecommunication technologies that form NICT's traditional areas of specialization. The project aims at precise measurement of the urban environment—which is certainly familiar to many people but has not been understood in detail—and to develop techniques for the effective network use of environmental information.

Lectures by experts including network conference with Sendai

Scenes from panel discussion and exchanges of participants

The symposium featured lectures and panel discussions, with valuable comments from Professor Yutaka Kondo (University of Tokyo), the main host, as well as from a range of experts from academic, governmental, and business fields. These organizations included the Tokyo Metropolitan Government, the Meteorological Research Institute, and the National Institute for Environmental Studies. There were a number of positive comments, including observations that the activities in question are opening a new era in improving the urban environment; comments on the enormous potential of these research fields, with a wide range of applications expected in the future; remarks that the initiatives will resolve problems in the urban environment of Kanto area; with participants also noting the ambitiousness of the project and its importance both in Asia and from a global viewpoint. To meet these expectations, we will continue our efforts to build closer partnerships with the relevant parties within and outside of NICT and to ensure that the new project will prove useful to the individual members of the related organizations, to those living in the Kanto area, and to residents working in cities throughout Japan and in Asia.

Urban area of Tokyo as viewed from the 40th floor of Roppongi Hills. The effects of such city structures to the atmosphere and environment is one of the targets of the project.

Report on the insertion of the first "leap second" in 7 years

A leap second was inserted directly before 9:00 am, January 1, 2006, JST, for the first time in seven years since January 1, 1999. With the spread of the Internet and radio-controlled clocks, people have come to realize the accuracy of time and the significance of a second. NHK and many key commercial broadcasting stations thus covered our tasks for the "leap second" that day, broadcasting images at the insertion nationwide on the midday news etc. Some 50 residents from neighboring communities, wishing to observe the "leap second" with their own eyes, visited the NICT Koganei Headquarters and watched the time display (digital clock) installed on the roof of the Main

Research Building. When the display showed "8:59:60 am" after "8:59:59 am," the visitors erupted into cheers and cries of amazement, expressing their frank feelings. Some recorded the moment with digital cameras. NHK news also broadcast a number of visitors' impressions. Many people noted that they were quite impressed by the valuable experience.

We perceive a second as something akin to a moment in time. However, the second has come to have an important specific meaning in the modern-day information society. This was

the first insertion of a "leap second" in seven years, so there was a sense of tension in the operation, in which there was no room for the slightest interruption or error. Nevertheless, the operation was completed successfully. NICT will continue ticking away the accurate seconds and providing stable and reliable Japan Standard Time through its various ways of delivery.

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