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Virtualized WiFi Network

—Providing better service accessibility by virtualizing WLAN base stations even in a congested WiFi network—

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He joined Communications Research Laboratory, Incorporated Administrative Agency (currently NICT) in 2003. He is engaged in research and development on new-generation network architecture, mobile network virtualization technology, and mobile networks. Ph.D. (Engineering).

SHOJI Yozo
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New Generation Network Laboratory,
Network Research Headquarters

He joined Communications Research Laboratory, Ministry of Posts and Telecommunications (currently NICT) in 1999. Since then, he has engaged in researches and developments on millimeter-wave communications systems. He is now engaged in a research and development on mobile networks for the new-generation network. Ph.D.(Engineering).

Introduction

To accommodate the rapidly increasing mobile traffic due to popularization of smartphones and other mobile devices, the WiFi network is becoming increasingly important. However, WiFi networks employ wireless access control methods that uniformly degrade the communication quality of each terminal when the number of connected terminals increases. Because of this, when terminal density is crammed, it is not possible to improve the quality of a particular communication as a priority. Therefore, it has been difficult to use applications such as VoIP in stable condition in a WiFi network, which strictly requires a low latency.

In our laboratory, we are conducting research and development of a new-generation network to be implemented for practical use by around 2020, as well as working on research and development on network virtualization technology as part of the project. In wired networks, this technology is expected as a method to provide a dedicated network to preserve and prioritize particular communication quality. However, in Wireless LAN, terminal mobility and limitations on communication protocols are a consideration, and it cannot provide a dedicated network in the same way as in a wired network.

Virtualized WiFi Network

We have developed "virtualized WiFi network" that enables to logically construct a software base station dedicated for particular service on a physical WiFi network. This allows us to establish an environment where users can prioritize connection to particular service such as VoIP service using WiFi even when the WiFi network is crowded.

In the past, there were wireless access protocols such as IEEE 802.11e that enabled class-based traffic control to handle particular services such as audio and video services with priority, however, it has been difficult to prioritize specific flows of a particular user or with a specific destination address. Another mechanism called VAP (Virtual Access Point) technology that set up multiple wireless LAN identifier (Service Set IDentifiers: SSID) for each WiFi base station and operated it as multiple virtual WiFi base stations was also incapable of allocation wireless access resources flexibly to each virtual base station.

As shown in Figure 1, virtualized WiFi network consists of multiple virtualization-capable WiFi base stations (vcBSs), and a WLAN switch to accommodate those vcBSs (vcBS-SW). vBS-SW is a centralized controller for vBSs, and primarily works on creating/deleting virtual base stations in each vBS, setting up wireless LAN interfaces, and controlling hand over between virtual base stations. It also operates as a gateway for wired networks.

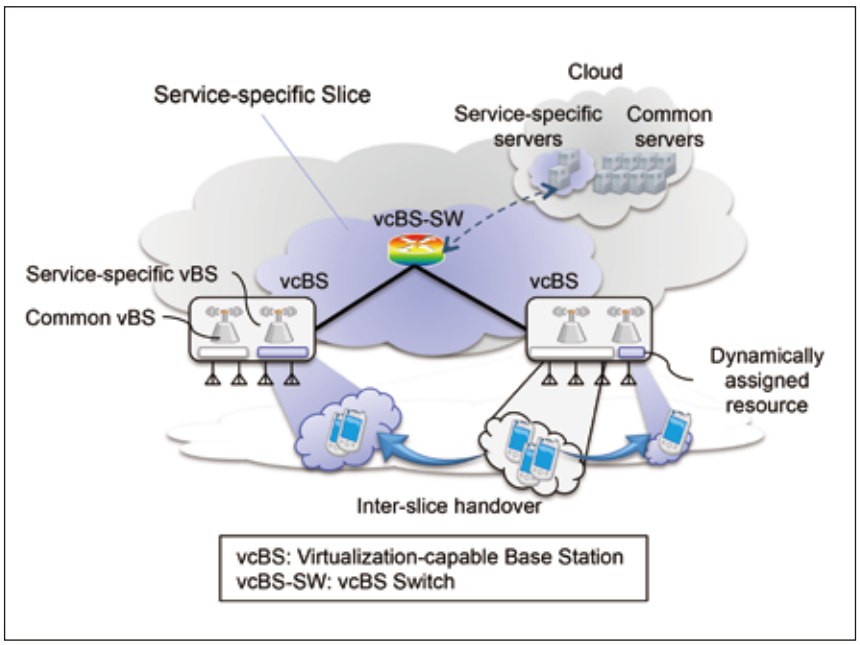


Figure 1 The overview of virtualized WiFi network

virtualization-capable WiFi Base Station (vcBS)

The Figure 2 shows the overview of the functional compositions and the snapshot of vcBS we developed. vcBS consists of 1) flow controller, 2) base station resource abstraction layer, and 3) base station resource stack.

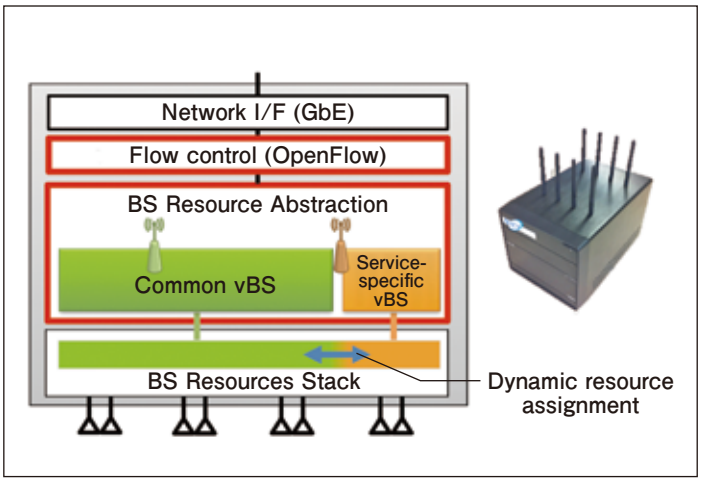


Figure 2 The overview of the functional compositions and snapshot of vcBS

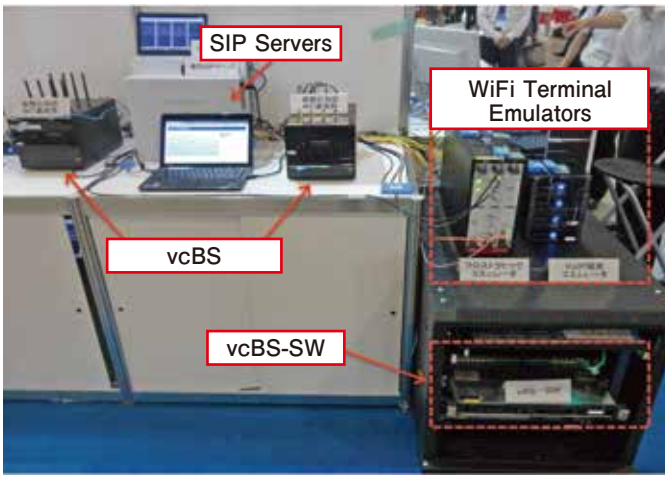


Figure 3 Demonstration system exhibited at Interop Tokyo 2013

1) The flow controller exploits OpenFlow to switch the packet (flow) among virtual base stations based on source or destination address, etc.

2) In the BS resource abstraction layer, we have developed a new mechanism to flexibly allocate network resources (frequency channels on WiFi) according to desired communication quality against each virtual base station(vBS). The vBS can be classified into either "common use" or "specific use", and all terminals are basically connected to "common vBS" at the beginning.

Once the common vBS is congested due to traffic concentration and communication quality degrades, the communication quality of a specific service can be improved by taking handover to a "service-specific vBS", where frequency channels are assigned with priority. We have developed inter-vBS handover mechanism to enable terminals to seamlessly switch base stations without any packet drop or service disruption by notifying the target vBS of corresponding terminal information in advance, which are required for handover.

3) The BS resource stack is a pool of wireless resource and enables to simultaneously allocate multiple WLAN interface modules with different frequency channels to a vBS. In the vcBS we have developed, four WLAN modules that support IEEE 802.11 a/b/g/n are embedded.

Also, in the virtualized WiFi network, the standard IEEE 802.11 protocol is used and all the control and management is centralized on the network side, so there is no need to install special software on terminals.

Demonstration system

Figure 3 shows the overview of the demonstration system. The virtualized WiFi network we developed and SIP (Session Initiation Protocol) servers are connected via the OpenFlow switch that emulates a wired network with network virtualization capability. We have constructed an emulation environment where the WiFi network is congested with dozens of WiFi terminals using VoIP, video streaming, Web, etc. using a WiFi terminal emulator.

In the demonstration experiment, VoIP/SIP terminals (VoIP terminal simulator) are also installed, which regularly generate 25 SIP calls per second in total.

It was demonstrated that even when the WiFi network is congested, the increase of both call setup time and packet delay of the VoIP service can be suppressed by taking handover from common vBS to service-specific vBS for VoIP/SIP terminals. Figure 4 shows the distribution of call setup time. We compare

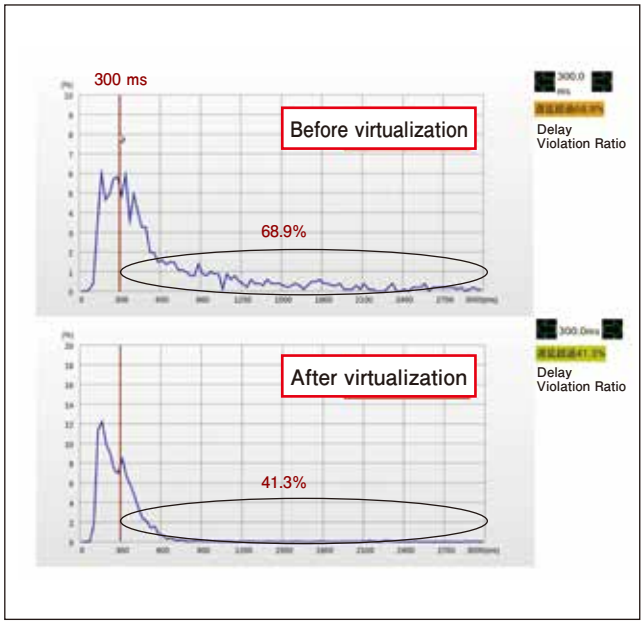


Figure 4 The distribution of call setup time in VoIP

the non-virtualized (normal) WiFi network, where both VoIP service and others are accommodated in a base station without any classification (before virtualization), and the virtualized WiFi network, where VoIP service is accommodated by service-specific vBS with a dedicated frequency channel (after virtualization). The ratio of SIP calls that take more than 300 ms to establish SIP sessions was improved from 68.9% to 41.3%.

We demonstrated this system at Interop Tokyo 2013 (June 12 to 14, 2013).

Prospects

As sensor networks progress and spread in the near future, utilizing WiFi network for services that require lower delay is expected to be encouraged. We are planning to construct a wide-area testbed of virtualized WiFi network and examine the performance for practical use as an infrastructure for large-scale sensor networks.

Application Software "KoeTra" for Assisting Hearing-Impaired Persons

—Can't speak sign-language? There's an app for that !—

From left: UCHIMOTO Kiyotaka, HORI Chiori, SUMITA Eiichiro, ASHIKARI Yutaka

UCHIMOTO Kiyotaka
Research Manager, Planning Office / Information Analysis Laboratory, Universal Communication Research Institute

UCHIMOTO joined the Communications Research Laboratory, Ministry of Posts and Telecommunications (currently NICT) in 1996. He is working on making use of research results in society and is engaged in research about natural language processing. From October 2009 to March 2011, he worked at the Cabinet Office. Ph.D. (Informatics).

ASHIKARI Yutaka
Senior Researcher, Spoken Language Communication Laboratory / Planning Office, same institute

HORI Chiori
Director of Spoken Language Communication Laboratory, same institute

SUMITA Eiichiro
Director of Multilingual Translation Laboratory, same institute

Awakening encounter with special needs

In recent years, mobile devices have rapidly evolved, and smartphones with outstanding calculation, sound collection, and communication capabilities are now available to the public. Such technologies have made it easy to perform highly advanced speech translation on smartphones (Figure 1). At NICT, we developed a speech to speech translation app "VoiceTra", for smartphones and made it available on the App Store until March 2012. As a result, people were able to download and try the application for free.

One day, a teacher at Kumamoto School for the Deaf contacted us impressed with the performance of "VoiceTra's" automatic speech recognition technology. She said that the technology behind "VoiceTra" could be used to support communication between the hearing-impaired and normal listeners by mutually converting speech and text. This was a moment of epiphany for us to start developing "KoeTra". (Figure 2). This was in late autumn of 2011.

Developing "KoeTra", its release and reactions

We quickly made a prototype system and asked students in the school for the hearing impaired to use it both inside classrooms and outside the school. We quickly discovered that the interface for "VoiceTra" was not useful for many hearing-impaired people. We made improvements to the system after realizing some

Figure 1 Example of display in the speech to speech translation app "VoiceTra"

When speaking "Michini mayoimashita. Ekiwa dokodesuka?" to the application in Japanese, the voice is recognized and converted into text, and then translated into English. Then the synthetic voice "I'm lost. Where is the station?" is output.

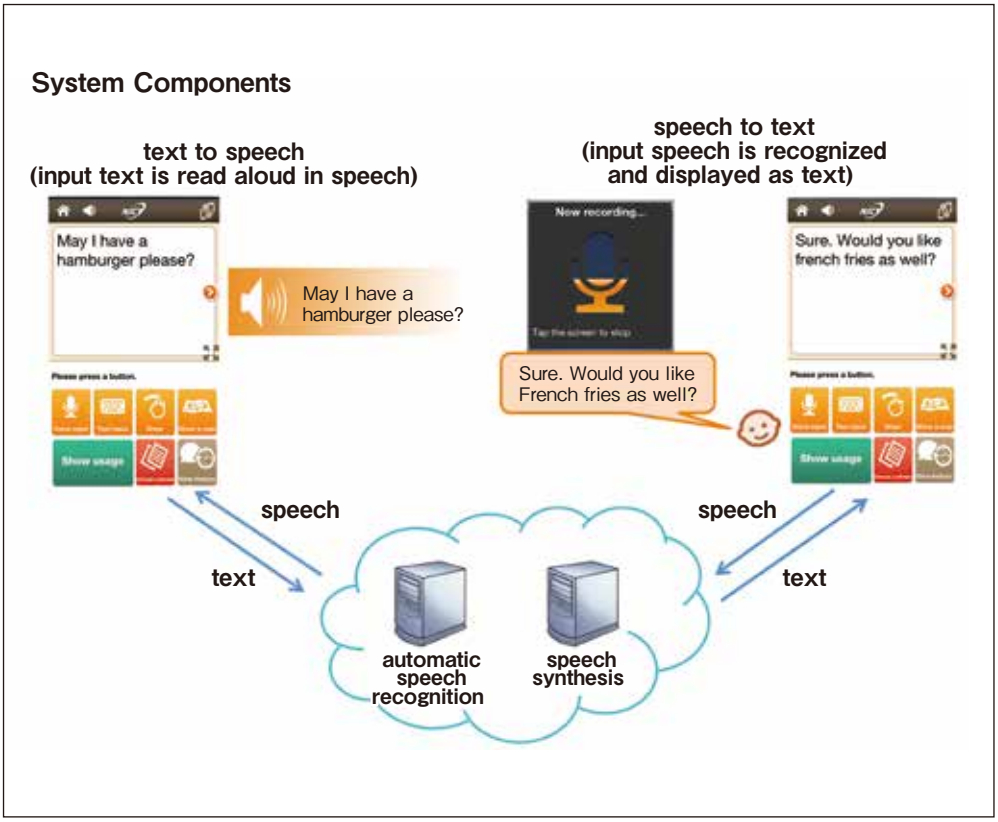


Figure 2 The mechanism of "KoeTra"

When the hearing impaired enters a question in text as shown in the display, the speech synthesis begins.

And when a normal listener inputs the answer by speech,

the speech is converted to text and displayed on the screen.

Figure 3 Example case of use

features needed for the hearing impaired through interviews and questionnaire surveys. The teachers at Kumamoto School for the Deaf continued to support the project, and introduced us to the Saga Prefectural School for the Deaf, and Miyakonojo Sakura School for the Deaf. Field tests of "KoeTra" were conducted in these schools, and we improved the system again and again. For example, as hearing-impaired persons and normal listeners interact using the application, they have a dialogue by inputting text and speech (Figure 3). A new function for registering and retrieving frequently used sentences was added to reduce time and effort for input operation (Figure 4). The field tests at these three schools gained attention by word of mouth and newspaper coverage began. In June 2013, the system was released on the App Store with the name "KoeTra"*. After its release, we received reactions from all quarters. To our pleasure, many people mentioned good automatic speech recognition technology performance. We also received requests about additional functionality, such as methods to have conversations with multiple people. We now feel the importance of making good technology better and more useful. Also, companies developing tools to support persons with disabilities contacted us with proposals to implement the technology. It is expected and hoped that the technology will expand widely through this sort of cooperation.

Figure 4 Example of reducing effort to input text
Registering and retrieving of template sentences is available.

Prospects and expansion in the future

Through the field tests, we have come to realize two directions for future expansion. The first is to enable service provision even when we cannot access a network in times of emergency such as disasters. At the moment, a dedicated server for speech recognition/synthesis is set up inside the laboratory, and speech data from the application on devices are given in exchanged for speech processing results via network. Therefore, when network connections are not available on devices, the application service also becomes unavailable. In order to solve this problem, we are planning to provide a minimum service stored within the application and device. The second direction of expansion is to support elderly people who have become hard of hearing. We are considering improving usability for the elderly to send/receive information, as well as improving operability and legibility of tablet devices.

For hearing impaired persons, methods of communication with normal listeners are primarily sign language and writing, however, by no means is either one considered easy. Because of difficulties, hearing impaired persons tend to hesitate to ask questions or express their opinions, thereby limiting their sphere of activity and exchangeable information. With the development, distribution, and popularization of "KoeTra", we hope to provide a helping hand for hearing-impaired persons that will enable them to enjoy actively trying new things and properly receive information they need anytime they wish.

* The Japanese version of "KoeTra" is now available. The English version will be released next year.

Research on Compression and Encoding Method for Multi-view 3D Images

INOUE Naomi

Associate Director General of Universal Communication Research Institute

After completing his master's course, INOUE joined KDD (now named KDDI). He joined NICT after becoming the Director of Cognitive Information Science Laboratories, ATR.
He is engaged in research on the technology of speech recognition, information retrieval/information filtering, graphic processing, 3D images, 3D audio, and application for mobile devices. Ph.D. (Engineering).

Glasses-free 3D image technology

At the Universal Communication Research Institute, we have been developing ultra-realistic communication technology since 2006. In the first five years, we primarily worked on research and development of glasses-free 3D display technology that allows viewers to see autostereoscopic images without special glasses, and also developed a large screen display of 200 inches. We are now working on researching and developing transmission technology to transmit autostereoscopic images from a distance, as well as recording technology to capture images to be displayed on screen. In this article, we would like to introduce an overview of compression and encoding technology used to transmit glasses-free 3D images from a distance.

200-inch glasses-free 3D display

The 200-inch glasses-free 3D display developed by NICT is capable of showing approximately 200-viewpoint parallax images, where images appear to move as the viewer changes locations from side to side within a 40° viewing zone angle (Figure 1).

Figure 1 Snapshot of the 200-inch glasses-free 3D Display

The resolution of the image in each viewpoint is 1,080×1,920 pixels and it can display video at a speed of 60 image frames per second. Thus, displaying images on this display requires transmission of 60 frames of video data per second that are multiplied by the numbers of viewpoints (approximately 200 times). At the moment, there is no technology capable of transmitting super-multi-view images such as those with 200 viewpoints and there remains a need to develop new compressing and encoding technology to transmit them.

Compression and encoding technology

When paying attention to the front door, for example, each image in Figure 1 differs gradually as shown in Figure 2.

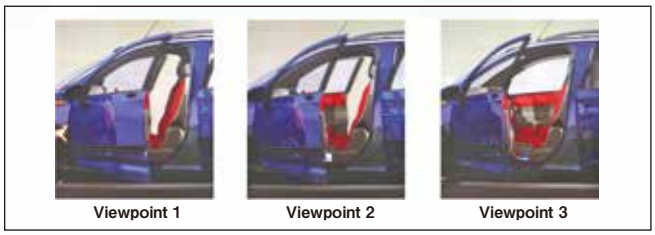


Figure 2 Example of a viewpoint-image

However, one characteristic of multi-view images is that the image looks almost the same when seen from closer viewpoints. Through compression and encoding technology, high compression efficiency can be thought to be obtained by using these similarities and transmitting the difference information between the original view and the neighboring view. Therefore, we focused on such difference information while implementing research and development of compression and encoding technology to make use of the differences. Figure 3 shows the overview of the decoder process. The encoder transmits original images from several viewpoints and difference data among the viewpoints. By taking the Figure 3 as an example, the original images from three viewpoints and two difference data between the original view and neighboring views among two viewpoints are transmitted. The decoder reconstructs the image of the transmitted difference data's viewpoints according to the original transmitted image and difference in data between original view and neighboring views. Through a simulation experiment, we found potential for realizing practical image quality even when fully high definition image data of 200 viewpoints was compressed to one fifth of its size before transmitting. We are now considering practical implementation in hardware.

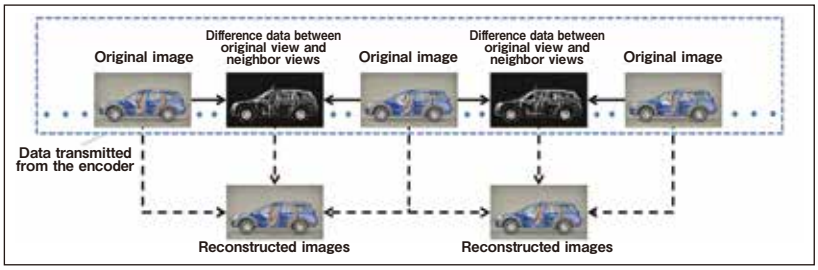


Figure 3 Overview of reconstruction process on the decoder

Awards

Recipient ● SASAKI Kensuke / Researcher, the Electromagnetic Compatibility Laboratory, the Applied Electromagnetic Research Institute

◎Award Date: March 20, 2013

◎Name of Award: **Young Researcher's Award**

◎Details:
In recognition of the presentations given at the 2012 IEICE General Conference and the 2012 IEICE Society Conference

◎Awarding Organization:
The Institute of Electronics, Information and Communication Engineers

◎Comment from the Recipient:
I received this award in recognition for my research on measuring the dielectric properties of biological tissue. This is a fundamental research for dielectric properties database construction for biological tissues. I am grateful for the Electromagnetic Compatibility Laboratory and everyone who offered guidance and support in advancing this research.

Recipients ● ITOH Kazuyoshi / Manager, Strategic Planning Office, Strategic Planning Department
SANO Chitose / Limited Term Technical Expert, Strategic Planning Office, Strategic Planning Department
TERADA Kenjiro / Chief, Information Systems Office, Outcome Promotion Department

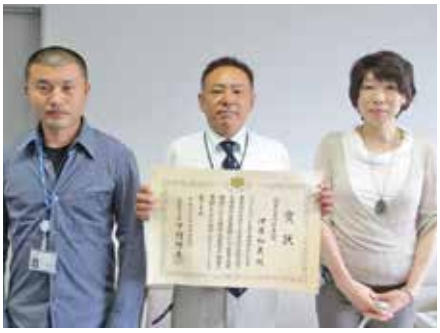
◎Award Date: April 15, 2013

◎Name of Award:
The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology, The Prize for Creativity

◎Details:
In recognition for improvement in research evaluation by shifting to a paperless system

◎Presenter of Award:
Minister of Education, Culture, Sports, Science and Technology

◎Comment from the Recipients:
It is a true honor for us to receive the Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology, The Prize for Creativity. The recognition to support office gives us huge encouragement to our future duties. We'd like to express our deep gratitude to everyone who supported us, and would like to continue in advancing the shift to paperless systems to contribute to time/labor/cost reduction as well as environmental conservation.



From left: TERADA Kenjiro, ITOH Kazuyoshi, SANO Chitose

Recipients ● HOSOKAWA Mizuhiko / Senior Executive Director
HANADO Yuko / Director, Space-Time Standards Laboratory, the Applied Electromagnetic Research Institute
IMAMURA Kuniyasu / Research Manager, Space-Time Standards Laboratory, the Applied Electromagnetic Research Institute
KUMAGAI Motohiro / Senior Researcher, Space-Time Standards Laboratory, the Applied Electromagnetic Research Institute
ITO Hiroyuki / Senior Researcher, Space-Time Standards Laboratory, the Applied Electromagnetic Research Institute

◎Award Date: April 16, 2013

◎Name of Award:
The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology, Prizes for Science and Technology (Development Category)

◎Details:
For their development of a standard time system with improved accuracy and reliability

◎Presenter of Award:
Minister of Education, Culture, Sports, Science and Technology

◎Comment from the Recipients:
The stability and reliability of standard time is improved by an ingenious system synthesizing multiple atomic clocks and its accuracy is calibrated by a primary frequency standard realizing the definition of the SI second. The NICT team caught an opportunity to develop both at the same time, and succeeded in development of high quality Japan Standard Time system that contributes to the world, which led to the award. The award is an achievement for everyone involved in development and operations, and we would like to express our deep gratitude to NICT for the opportunity of development.

From left: KUMAGAI Motohiro, IMAMURA Kuniyasu, HOSOKAWA Mizuhiko, ITO Hiroyuki, and HANADO Yuko

Recipient ● FURUKAWA Hideaki / Senior Researcher, Network Architecture Laboratory, Photonic Network Research Institute

◎Award Date: April 16, 2013

◎Name of Award:
The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology, The Young Scientist's Prize

◎Details:
In recognition for the research on network infrastructure technology that integrates optical packets and optical paths

◎Presenter of Award:
Minister of Education, Culture, Sports, Science and Technology

◎Comment from the Recipient:
I am very honored to receive the Young Scientist's Prize. The research is promoted jointly by the Network Architecture Laboratory and Photonic Network System Laboratory. The members of the laboratories, as well as planning office, have helped me a lot in supporting this research. I would like to express my gratitude to those involved. This award is an incentive to continue to endeavor toward my research activities.

Utilizing "The Subsidy for Production Costs of Sign-language Programs"

Towards realization of information barrier-free CASE 1

From right, Mr. OSHIMA, Managing Director and Secretariat staffs at the Organization of Broadcasting for People with Disability

At NICT, we are working to realize an information barrier-free society by supporting projects with various subsidy programs. In order for the larger public to understand and be able to make use of these subsidies, we introduce activities of corporations and organizations which provide communication/broadcasting services by utilizing this grant program in three serial issues from this one.

It is said that there are 300,000 hearing impaired people in Japan with holding a physical disability certificate and is estimated that 60,000 people are natives of Japanese sign language. However, television programs accompanied with sign language are less than 1% of total broadcasting hours. In this issue, we interviewed Mr. SATO and Ms. MINATO of the Organization of Broadcasting for People with Disability, a non-profit organization—They said that they would like to enrich the communication of all people by using new technologies.

—What is the background in founding the organization? Also, please give us an overview of major projects.

The Organization of Broadcasting for People with Disability was formed back in 1998 by the Japanese Federation for the Deaf and the All Japan Association of Hard of Hearing and Late-Deafened People (At that time, it was named the Organization of Preliminary Experiment Broadcasting for People with Disability). What triggered the organization's founding was the Great Hanshin Earthquake in 1995. Many victims of the disaster with hearing disabilities were unable to obtain crucial and urgent information via television broadcast such as evacuation and distribution information. We established the organization in hope to bridge such information gaps and started broadcasting "Listen with Eyes TV", a television program with sign-language and subtitles for people with hearing disabilities through disaster-resistant CS Satellite Communication. People with hearing disabilities participate in the making of the program, in roles such as an anchor or videographer, and broadcast various information ranging from news, local trends, sports, a sign-language learning program, and information in time of disaster.

Figure 1 "Eye Dragon 3", an information receiver for hearing-impaired persons
Together with CS antenna and emergency warning device, it is designated as daily living aids for people with physical disabilities.

—Could you tell us about sign-language translation video?

Currently, the "subsidy for production costs of sign-language programs" grants production of sign-language translation (shooting, editing, and translating to sign-language). We add sign-language to recorded programs with subtitles and add real-time sign-language to live broadcasts for news and information programs.

To watch our programs, you need a dedicated tuner for satellite communication called "Eye Dragon 3" (Figure 1) as well as an antenna sold at special agents. With this, you can watch not only the programs at "Listen with Eyes TV", but also regular digital broadcasts with subtitles. There are currently about 11,000 households using it.

— How do you produce a sign-language translation program?

In front of the translator, we place a television monitor, and the translator speaks in sign-language to fit with the content of the video. We capture the gesture with chroma key (Figure 2) and transmit sign-language video information to dedicated receivers via a satellite called "SUPERBIRD C2." The receiver then overlays the information with the content (Figure 3). The video consists of three layers. The green basis set on the receiver is in the lowest bottom of the layer. Above it is terrestrial television content, and the sign-language translation video captured with chroma key is combined on top (Figure 4). The great feature is that it consists of PIP*1 instead of wipe where you see a small window in the monitor.

*1 PIP
PIP (Person in Presentation) is studio preshot content presented via video by a person.

Figure 2 Snapshot of real-time sign-language translation shooting

The viewers can change the size of the screen from three different selections. We are connected to information provider facilities for the hearing-impaired across the nation, and, by communicating daily with program production, we work to provide easy-to watch screen structure ratios.

— I was amazed to witness at the production site that there was only several-second delay between the audio and sign-language. What are the tricks of the trade in sign-language expression?

To operate simultaneous translation in sign-language, one requires substantial skills. The translator cannot stop and ask what the speaker said, especially in real-time sign-language translation. Unless one is an experienced translator, you can easily stutter. Just like speaking Japanese, sign-language expressed on television for mass audience requires speed in showing body movements, and is different from daily conversation. It is a demanding profession both physically and mentally.

As such, our organization is supported by about 30 translators, each person working 15 minutes at one time. Also, in order to improve quality, we organize meetings among sign-language translators to examine ways to summarize simultaneous translation, ways to express with bigger, clear and easy-to-understand gestures, and to share achievements. For example, in news programs, one can prevent errors by comprehending the outline of the news beforehand. Furthermore, we work in cooperation with the Japan Institute for Sign Language Studies, National Center of Sign Language Education Community which works to assert and disseminate standard sign-language, in order to acquire the latest standard sign-language.

—What is your aspiration for the future?

Currently, we are producing roughly 15 programs per month.

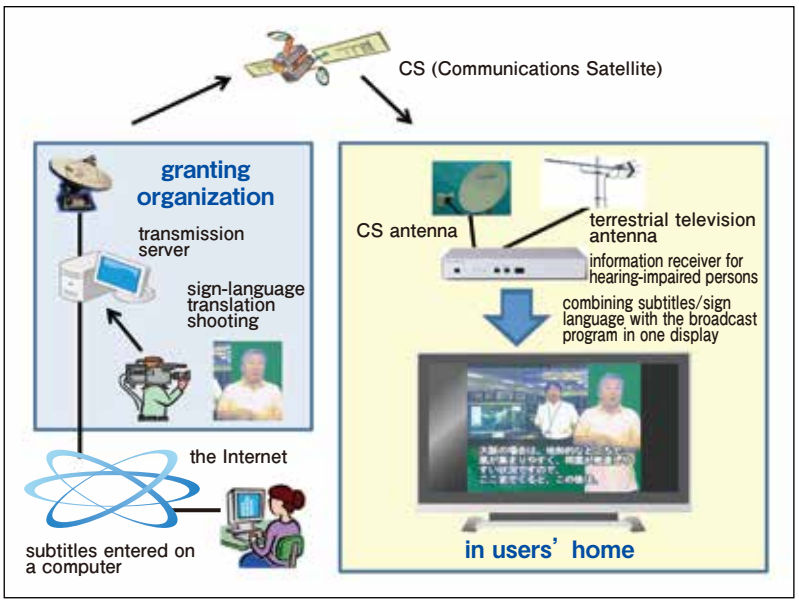


Figure 3 The mechanism for providing sign-language translation video

Figure 4 Image overlayed using "Eye Dragon 3"

Our viewers have given us requests that they would like us to increase the number of sign-language translation for terrestrial broadcasters, and to increase the variety of programs. We'd like to enrich both content and broadcasting hours to give higher level of user satisfaction. Also we are hoping to provide useful content for not only hearing-impaired people but also for those who study sign language. We aim to provide useful services that can be used for larger audiences by taking IPTV*2 streaming and audio description*3 broadcasts for visually-impaired persons.

—Thank you very much.

About the subsidy for production costs of sign-language programs

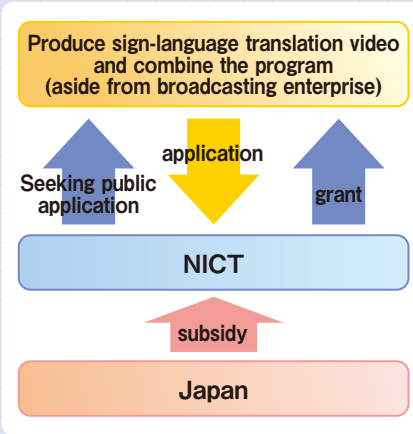
This subsidy program seeks applications from the public on February of every year and grants up to half of the required expenses in producing/providing sign-language translation video. The applicants are enterprises that produce and provide sign-language translation by combining broadcast content for hearing-impaired persons.

Eligibility for the grant has the following requirements: (1) The project should be highly convenient for the challenged (2) The effectiveness of the realized project should benefit many people (3) Applicants must have business implementation capability and an appropriate management system (4) Funding of the whole project is unable to be covered by the applicant itself (5) The applicant must have capacity to fund itself for the their own expenses.

The expenditure that is subject to the grant includes subcontract expenses, commission cost, labor cost, supplies expense, overhead expenses, machinery charges and so on. Programs with age restrictions will not be eligible for the grant.

If you seek funds from the grant program, please submit an application following the instructed format. After NICT examines the application documents, we will hear from an evaluation committee consisting of academics and experts of the field as necessary, upon which grantees will be decided.

A performance report should be submitted after completing the project. NICT will examine the report and proceed with grant payment.



For more information about the grant and application process, please contact the following:
TEL: +81-42-327-6022 FAX: +81-42-327-5706 E-mail: jimaku@ml.nict.go.jp http://www2.nict.go.jp/ict_promotion/barrier-free/106/index.html

*2 IPTV
IPTV (Internet protocol television) is a general term for services providing television images via dedicated IP broadband line networks such as optical cable and ADSL.

*3 Audio Description
Audio description is a type of television program that utilizes voice multiplexed broadcasting for explaining scenery.

Report on "NICT Summer Holiday Special Event"

From July 24 through 25, 2013, NICT held the "NICT Summer Holiday Special Event" at NICT headquarters (Koganei, Tokyo), where 661 visitors attended.

This event is aimed mainly at allowing children to become familiar with and deepen their interest in science and technology by introducing our research activities. This year, we held a science craft workshop, direct conversation with members of Showa Station (Antarctica) Research Expedition, a talk by an experienced worker of the Antarctic expedition team, hands-on learning corners on science technologies, as well as guided tours to Japan Standard Time, Network Incident analysis Center for Tactical Emergency Response (nicter), Space Weather Forecast, and Space Optical Ground Station Center.

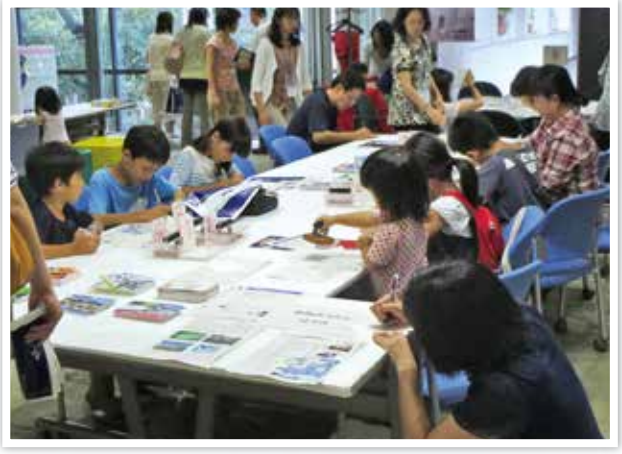
At the science craft workshop, participants created radios using every-day items like vinyl umbrellas and laundry clips, and enjoyed listening to the ones they made. At the talk by the Antarctic expedition team member and in conversation with Research Expedition members, children actively asked questions about Antarctica. Guided tour participants became more familiar with NICT's activities by actually visiting the facilities researching the definition of Japanese Standard Time, real-time cyber attacks, the impact of solar activities on communications, and the optical space communications. During the hands-on learning, participants operated a four-dimensional terrestrial globe, played with various types of encryption, and studied the mechanism of cloud generation, digital holography, and the mystery of light with polarizing plates.

Event Overview

Science Craft Workshop (creating a radio with an umbrella)

Conversations with Research Expedition members of Showa Station (Antarctica)

Hands-on learning corner (various types of encryption)



Antarctic postal service

【Guided tour】

Japan Standard Time

Network Incident analysis Center for Tactical Emergency Response (nicter)

Meeting for Space Weather Forecast

Space Optical Ground Station Center

Report on Facility Open House of Advanced ICT Research Institute

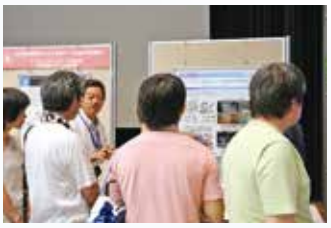
—Experience the future of information and communications!—

Facility Open House of Advanced ICT Research Institute (Kobe) was held on July 27, 2013 and welcomed 466 visitors on a sunny day. Many of them participated in the popular annual quiz rally and visited exhibition booths in order of the quiz. Participants enjoyed hands-on exhibitions carefully curated by each research group as well as question and answer sessions with researchers.

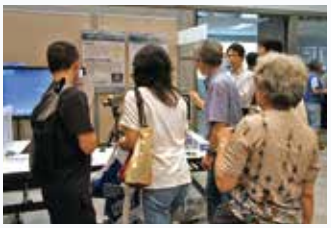
In the 6th annual research lecture meeting, many talks were given using familiar examples to introduce the public to nano / bio / brain research areas and explain the most advanced research. We also demonstrated brain-wave measurement in the talk on brains. The meetings were held in the morning and in the afternoon and both attracted a wide age range of attentive audiences. In Q&A sessions, the audiences asked questions eagerly and enjoyed conversation with the researchers amicably.

Snapshots of the exhibition booth

Observing plant cells by making a glass bead microscope



Introducing a weather observation system with a sensor that uses radio and photons



How does an object look like with unexplored electromagnetic wave —terahertz waves?

Experiencing the world of ultra-low temperatures where superconductivity phenomenon occurs

Experiencing the process of language memorization through simple games

Explanation on decentralizing Standard Time System in order to preserve Japan Standard Time

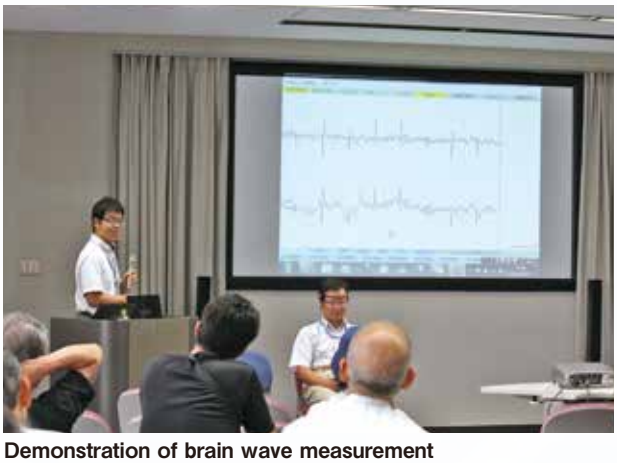
Experiencing light polarization by creating a "polarization box" with polarization sheets

Extracting DNA from broccoli, touching the extracted DNA, and observing it with a microscope

Introducing the latest research that uses quantum mechanical properties such as quantum cryptography, quantum communication, and quantum clocks

Kinki Region Bureau of Telecommunications, Ministry of Internal Affairs and Communications also participated in the exhibition.

Lecture meeting scene



Demonstration of brain wave measurement

Superconductivity grasps the particles of light

Future information communications by superconductivity

MIKI Shigehito
Senior Researcher, Nano ICT Laboratory

Microscopic manufacturing with living materials

Manipulating self-assembly

FURUTA Kenya
Senior Researcher, Bio ICT Laboratory

What can we do by measuring brain waves?

Working towards solving unexpressed messages

NARUSE Yasushi
Center for Information and Neural Networks
Associate Director of Brain Imaging Technology Laboratory

Announcement on "Joint Research in the Area of Future Generation Network with the U.S. Accepting Applications from the Public"

—NICT and NSF jointly accelerate research & development in new-generation networking—

[Application period]: Wed. July 10–Fri. October 11, 2013, noon, JST (for Submission to NICT)

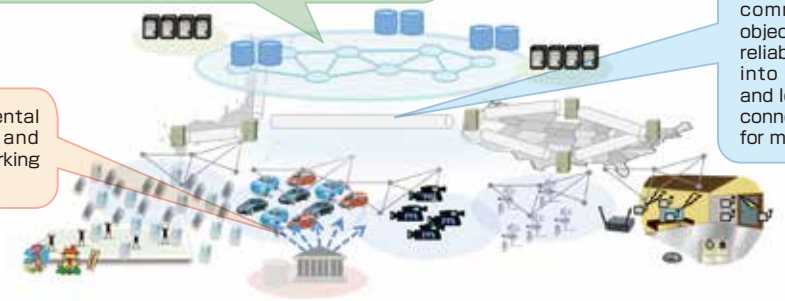
[Research subject]: Research on ultra-large-scale information network infrastructure technology for future network implementation

[Research outline]: In future networks, various problems will arise when trillions of objects are connected via the networks. In order to solve these problems, we seek the research in the following three areas which are expected to advance research and development in cooperation with NSF. Please choose one primary area in your proposal. One proposal submission can include more than two areas.

【Area 1】: Making use of achievements in information science such as biological models, statistics/analysis, chaos theory into network modeling, and establishing fundamental technology for network design methods and evaluation approaches that is not bound by existing information communication network infrastructure architecture.

【Area 2】: Establishing fundamental technology to realize secure and efficient mobile computing networking with mobile objects.

【Area 3】: Establishing optical network architecture and communication control technology that is capable of efficiently accommodating ultra-large-scale communication among multiple objects with energy efficiency, high reliability, and low cost, with taking into account broader bandwidth and lower delay as well as flow and connection mobility that is suitable for moving objects.



[Research period]: 36 months from contract conclusion in 2013

[Grant for R&D]: Up to 7,500,000 JPY per contract for the first year, 10,000,000 JPY for the second and the third year, and 5,000,000 JPY for the last fiscal year

[Number of research proposals to be accepted]: About 4. (There is no limit for a corresponding area)

[Application overview]: For the details how to apply and the application form, please visit the following URL.
http://www.nict.go.jp/collabo/commission/20130710kobo.html
*Applicants in Japan should submit the application to NICT, and applicants in the U.S. should submit to NSF.

☐ The latest information about application, please check out our twitter account @NICT_itaku

☐ About our commissioned research system, please visit the following URL.
http://itaku-kenkyu.nict.go.jp/

☐ Inquiry: Commissioned Research Promotion Office, Collaborative Research Department
Tel: +81-42-327-6011 E-mail: info-itaku@ml.nict.go.jp

Information for Readers

The next issue will feature energy-saving mechanism of biomolecules, evaluation of safety in cryptographic protocols, and radio-over-fiber technology.

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