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Cover image: Satellite antenna group for comparing time and frequency

Toward the Implementation of Information-Centric Networking

—The Internet changing from communication channel to content sharing infrastructure—

Hitoshi ASAEDA

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After working at IBM Japan Ltd., as a Research Engineer Specialist at the French National Institute for Research in Computer Science and Control (INRIA), and as a Project Associate Professor, Graduate School of Keio University, the author joined the NICT Network Architecture Laboratory, as a Research Manager in October, 2012. He has been in his current position since April, 2013. He holds Ph.D. (Media and Governance).

Background

On the Internet, which has developed into a large-scale communication infrastructure, the amount of rich content such as high-quality music and video distributed and exchanged has been increasing rapidly. Deployment of tablets, smartphones and other high-performance mobile terminals and the popularity of user generated content using, for example, social networking services (SNS) also spur further increases in the traffic on the Internet. Even for these new types of terminals and services, however, communication is done using the same procedure as conventional file transfer (FTP). The Domain Name System (DNS) is first used to find the IP address of the content server to communicate with, the server with that IP address (which could be quite distant from the receiver) is accessed, and then the procedure to retrieve the desired content is performed. Cloud computing has improved server load balancing technologies and decreased dependencies on a server's geographical location. However, it is not essential for users to ac-

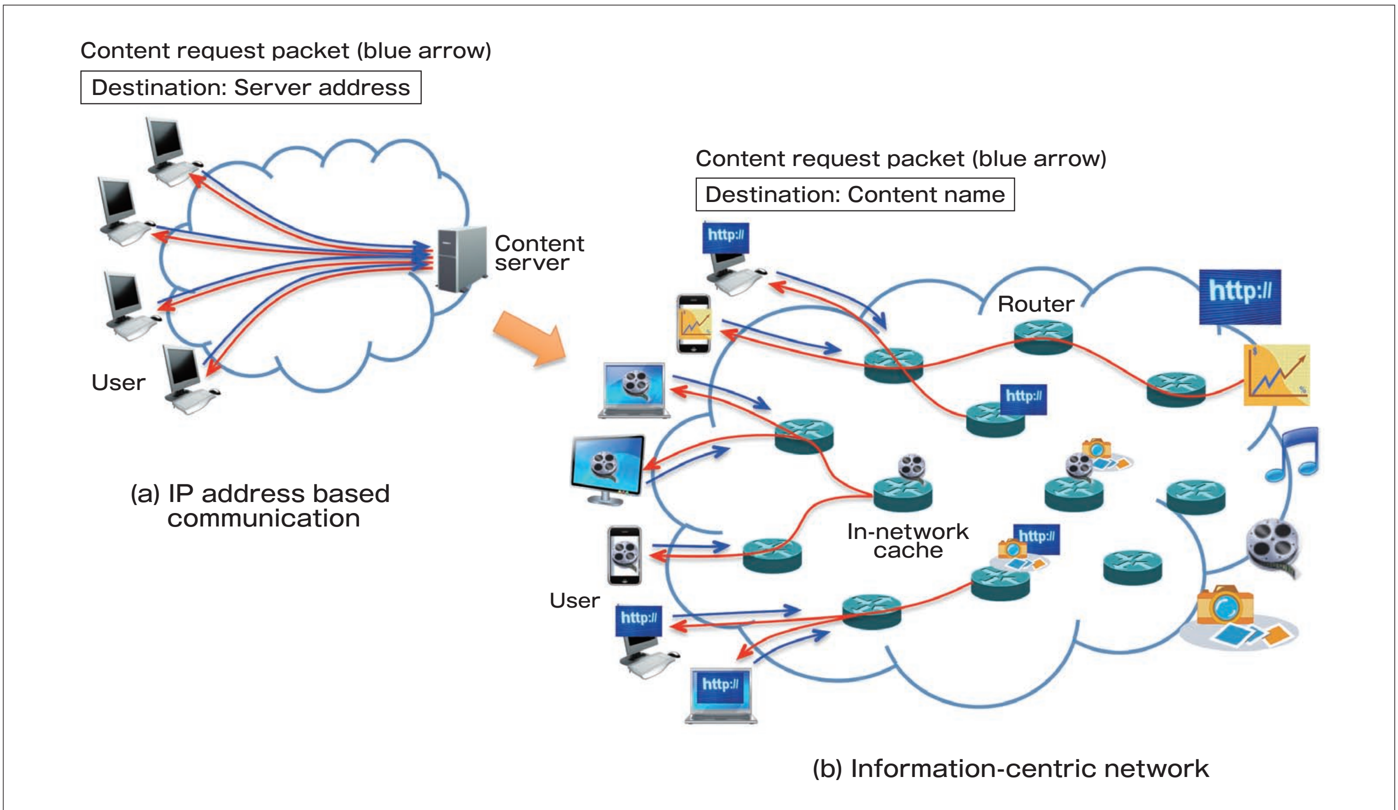


Figure 1 IP address based communication and Information-centric network

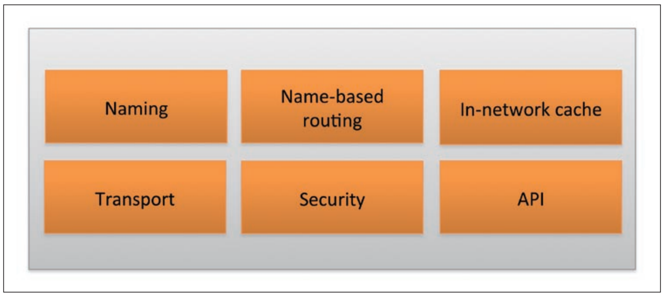


Figure 2 Main functions for implementing ICN

cess the server whenever they retrieve content. If a nearby router or node has the requested content, it would be more efficient to get the content from there. This concept suggests a communication technology that could address increasing communication volume in the future.

At NICT, we are conducting R&D on a future networking technology focusing on *information (content), called Information/Content-Centric Networking (ICN/CCN)*. When retrieving content using ICN, a content name rather than the server IP address is specified, so the content can also be retrieved from a closer router that has the content. This technology enables a number of users to provide content more quickly and efficiently.

Functions for Implementing ICN

Both IP address based communication and ICN are shown in Figure 1. With IP address based communication, the user connects to a content server specifying its IP address as the destination. Conversely, with ICN, the user sends a content request packet including a content name to the upstream router. Upon receiving the content request packet, the router sends the content to the user if it is in the router's cache, and if it is not, it forwards the content request packet to the next upstream router in the communication path, or to a neighboring router that may have the content. This process is repeated, resulting in shorter response times than conventional IP address based communication. The reduction of communications also promises to increase network utilization and conserve server resources.

The basic functionality required to implement ICN is shown in Figure 2. The in-network caching function refers to routers in the network that cache content in a distributed and autonomous fashion, and send data in response to content requests from users. It must optimize the functions of deciding issues such as what content should be cached on which routers, and how long different types of content should be cached. ICN also performs name-based routing using a content name rather than a conventional IP adress. In other words, a router receiving a content request from a user must have a routing function that can forward the request packet to an upstream router based on the content name specified in the request packet. Name-based routing is linked to the in-network caching described above, and it is necessary to study how to forward the content request packet to a relatively close cache router to improve transmission efficiency.

Content Discovery from In-Network Cache

At NICT, we have proposed a method called Potential-Based Routing for ICN (PBR-ICN), which coordinates with in-network caches to find content near the user. PBR-ICN uses scalar values called potential values for each router storing (caching) content. The potential value is computed from the distance between the user and router (the hop count) and the router's processing capacity. Each cache router announces its own cache information to neighboring routers, so even if multiple routers have the same content in their caches, the user can obtain the content from the one that can transmit it most efficiently, so this can be expected to reduce response times.

In Figure 3, the content request packet is represented by a ball and the path through which it is transmitted (or rolls) is shown. From whatever position the user makes a content request, the packet flows toward the content provider (dotted blue line). However, if the content request packet passes through a cache router announcement area, the packet is forwarded (transmitted) to that router (solid blue line), the applicable content is retrieved from there, and it is sent back to where the content request came from (solid red line). If the content request packet does not pass through the announcement area of a cache router, it flows to the content provider, and the content is sent from there, as it would when using IP address based communication. The announcement area can be expanded to increase the probability that a packet will be forwarded to a cache router, increasing the transmission efficiency.

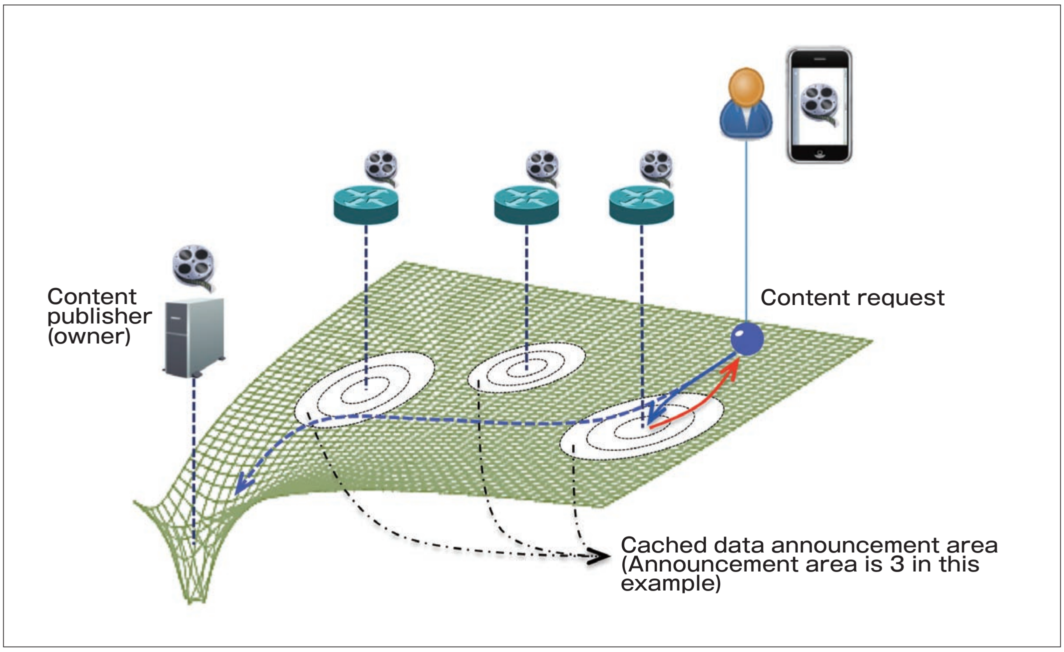


Figure 3 Content discovery based on potential values provided by PBR-ICN

However, if the announcement area is too large, the announce packets will flood a wider area and more routers, affecting the performance due to the increase in traffic, so it is important to set the size of the announcement area appropriately, according to network scale and capabilities.

Figure 4 shows the results of simulating cache hit rate and the distance travelled (hop count), in cases that the request arrived at a cache, vs. the overall number of cache routers distributed in the network (with a total of 1,000 routers in the network). When the cache router distribution in the entire network was 5% (in this case this would be 50 routers) and the announcement area was 1, content request packets were forwarded to a cache router with probability of approximately 75%, and when the announcement area was 3, it was over 95% as shown on the left. From the right side of the figure, we observe that when the cache router distribution in the entire network was 5% and the announcement area was 1, the hop count to arrive a caching router was approximately 70% smaller than in a network with no cache routers, and when the announcement area was 3, it was approximately 62% smaller.

PBR-ICN is also effective for mobile communication. For example, when the access point changes for a user receiving content through WiFi, it discovers a new upstream router with efficient transmission and receives the content from there. This allows content to be received continuously without conventional IP address based handover processing.

Community-Oriented Communication

SNS is currently one of the most popular types of communications service on the Internet. An SNS aims to share information among the users belonging to the same community, but many implementations of SNS use a mechanism by which the sender uploads information to the server, and then the receiver retrieves the uploaded information.

Figure 5(a) shows community communication using the server-centric approach. When users always access the server, both CPU load on the server and traffic on the network become high, and the overall system performance goes down. Figure 5(b) shows the community communication paths established by CCNx, which is an implementation of ICN developed by a project in the U.S.A. CCNx has many excellent features. However, with CCNx, the sender is always the root of the data forwarding path. Since community communication can potentially have many senders, CCNx increases the number of community communication paths, and the CPU and memory usage on routers becomes high. This can affect the overall communication performance.

At NICT, we have proposed an architecture named "Community-Oriented Route Coordination on ICN" (CORIN) (Figure 5(c)). CORIN applies name-based routing to community communication. With CORIN, a data forwarding path connecting the users in the same community is formed. The communication path is bi-directional and rooted at a Designated Forwarding Cachable Node (DFCN). When communicating using CORIN, instead of a content name as used with ICN, a hierarchical "community ID" (e.g., Univ.A | Lab.B) is used. A service name (e.g., Meeting) or time can be added to a community ID, and this is called a "community information ID" (e.g., Meeting | Univ.A | Lab.B | 201407011300). Users specify a community information ID when sharing information among users in the community.

CORIN is advantageous particularly in real-time group communications, such as on-line meetings, chats, and live streaming. In general, the multicast technology is effective for real-time group communications in which multiple (or many) users are receiving the same content at the same time. Multicast makes routers receiving the data copy and send it simultaneously to downstream users and routers when multiple (or many) users are receiving the same

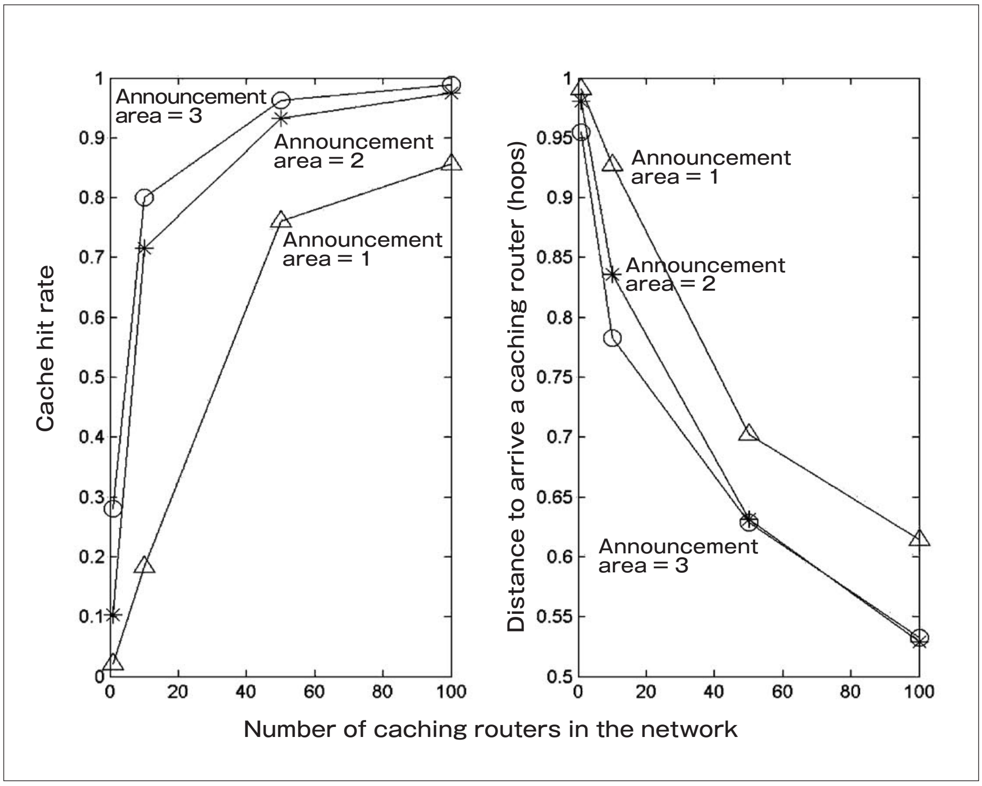


Figure 4 Cache hit rate and distance to arrive a caching router in the network (1,000 routers in total)

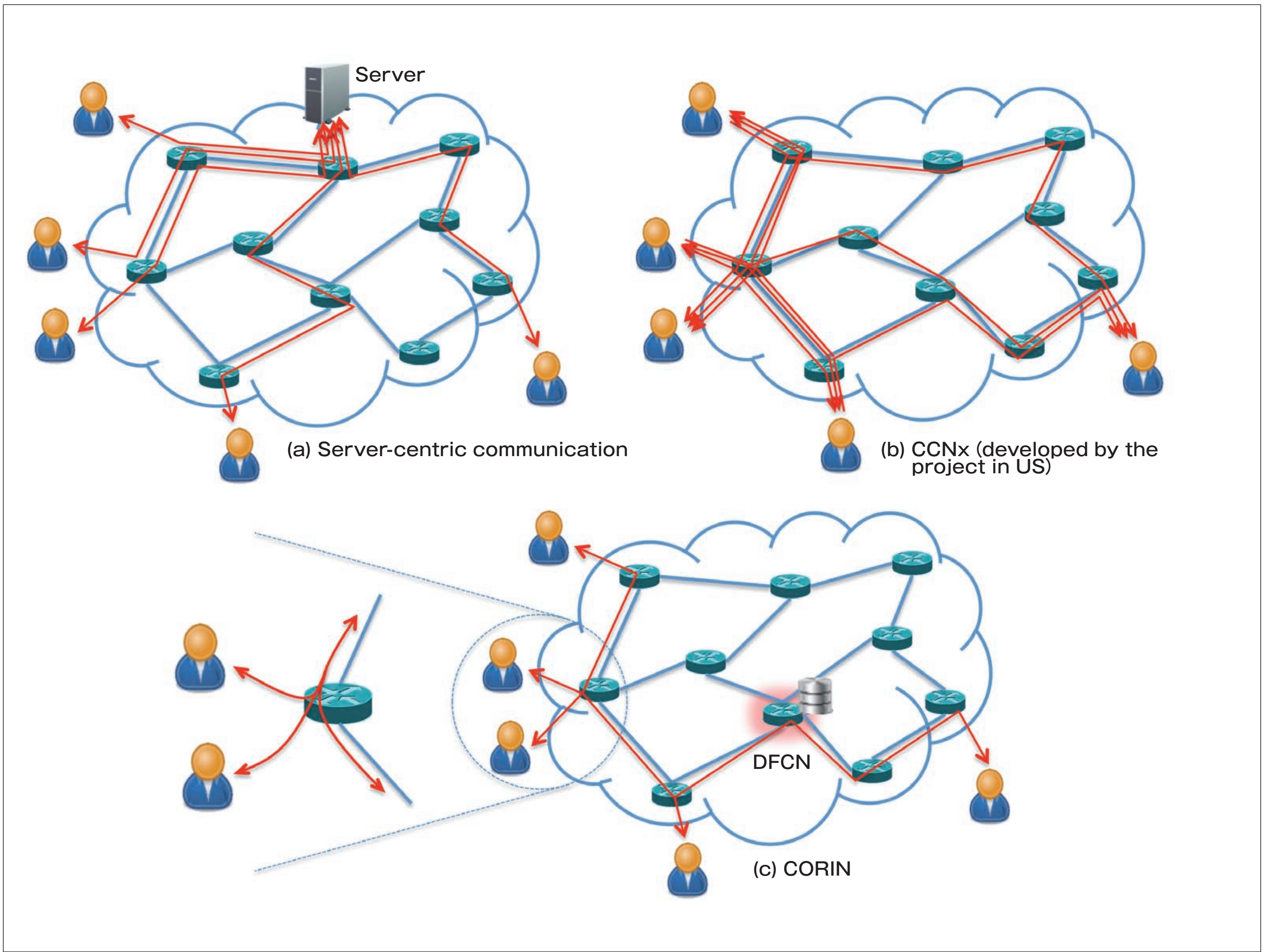


Figure 5 Routing paths enabling Community-oriented communications organized by different communication architectures

content at the same time, rather than having the sender transmitting the data to every receiver. In addition to supporting multicast, CORIN creates bi-directional paths that do not discriminate regarding direction of data flow (see inset on the left of Figure 5(c)). By using DFCN, which successively store the transmitted data in the network, and in-network caches, it is also possible for users that are off-line at the time to obtain the data later.

Currently, we are designing in-network caching according to the scale of the community, and implementing a prototype that operates on a testbed. At the next phase, we will apply CORIN to various types of community communication, such as those which form dynamically according to location, geography, time, urgency, or other properties of inter-community communication.

Future Prospects

As a new-generation network technology, ICN increases communication performance for users and also promises to contribute to better communication efficiency and energy savings through effective use of network and server resources. As such, at NICT, we will continue R&D to make ICN a technology that is useful to society in the future, as an important component of ICT social infrastructure. This will include both R&D toward practical implementations as well as standardization activities with organizations such as the ITU-T and IETF/IRTF.

Two-way Satellite Frequency Transfer with Highest Ever Precision, Developed by NICT

—Demonstration with three orders of magnitude better precision over 9,000-km baseline—

Miho FUJIEDA

Senior Researcher, Space-Time Standards Laboratory, Applied Electromagnetic Research Institute

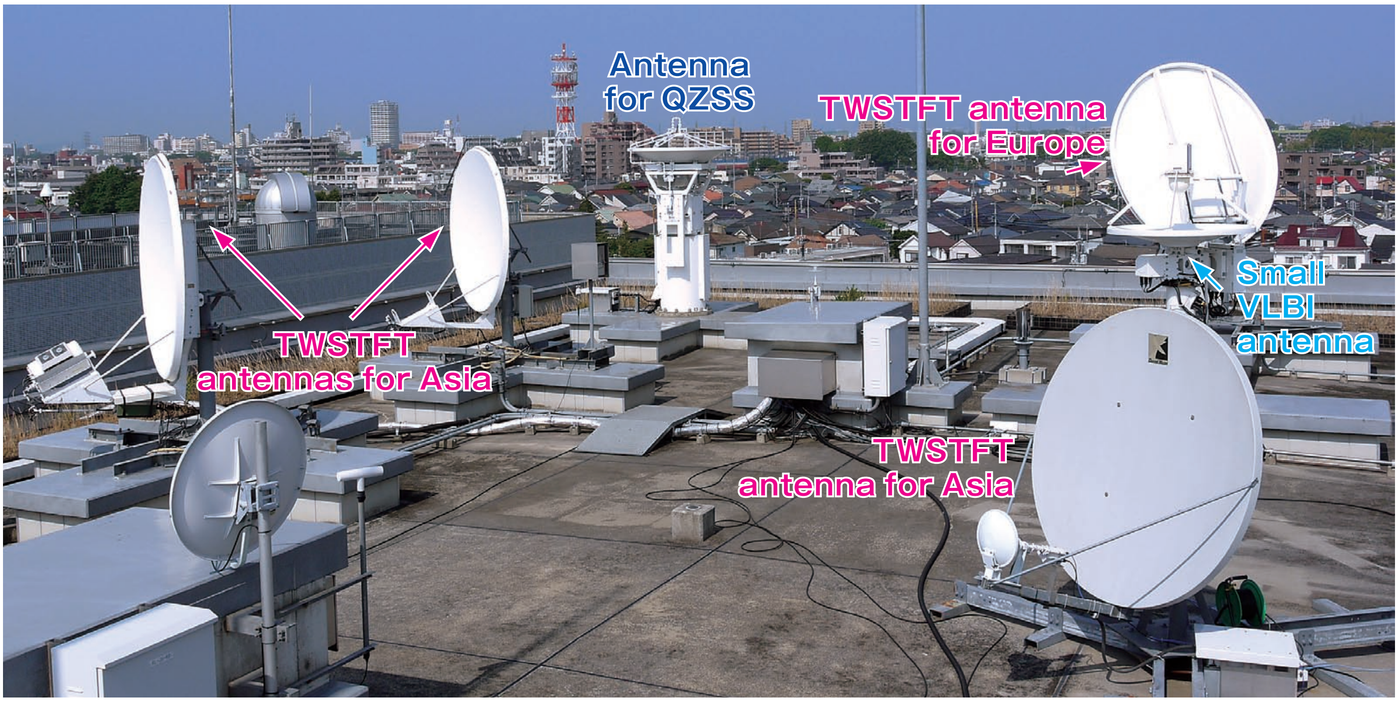
After completing her Ph.D., joined the Communications Research Laboratory (CRL, currently NICT) through a Young Scientist Fellowship of Japan Society for the Promotion of Science in 2003.
Engaged in research on time and frequency transfer using satellite and optical fiber. Ph.D. (Science).

Introduction

In order to determine Coordinated Universal Time (UTC) and Japan Standard Time, research institutes around the world maintain and manage atomic clocks that generate time and frequencies, and these must be compared with each other with high precision. Generally, methods for international transfer of time and frequency use artificial satellites, but unfortunately the precision of methods currently in use (Figure 1, solid blue and black lines) is several orders of magnitude lower than that of the atomic clocks that are the basis for standard time (Figure 1, dotted gray line). As an example, measurements must be continued and averaged over a full day to reach the precision of a Cesium Atomic Fountain Primary Frequency Standard, which is used to define the second. To obtain the equivalent precision to an optical clock (Figure 1, green line), which is the most promising future candidate for redefining the second, measurements over more than 100 days would be required. To improve on this situation, NICT has developed an optical carrier transmission system using optical fibers, incorporating an efficient fiber-noise cancelling technology, and has conducted the first-ever direct comparisons of optical-lattice clocks between NICT and the University of Tokyo. These confirmed that the frequencies of optical lattice clocks at the two facilities coincided to a high precision of 16 decimal places. However, using optical fiber is expensive and international comparisons would require submarine cable, so the method is still not practical for intercontinental transfer. Because of this, NICT is working to increase the precision of satellite comparison and transmission technologies, and comparison technologies using VLBI techniques that receive noise signals from radio stars outside the galaxy.

Two-way frequency comparison by geostationary satellite using carrier phase

Methods for comparing time and frequency by satellite are shown in Figure 2. Comparison using GPS satellites is done by receiving signals sent from navigation satellites. The precision of these methods, using codes or carrier phase, are approximately 5 ns and 50 ps, respectively (Figure 1, black line). Conversely, with two-way comparison using geostationary satellites, in which two



Satellite antenna group for comparing time and frequency

TWSTFT: Two-Way Satellite Time and Frequency Transfer QZSS: Quasi-Zenith Satellite System

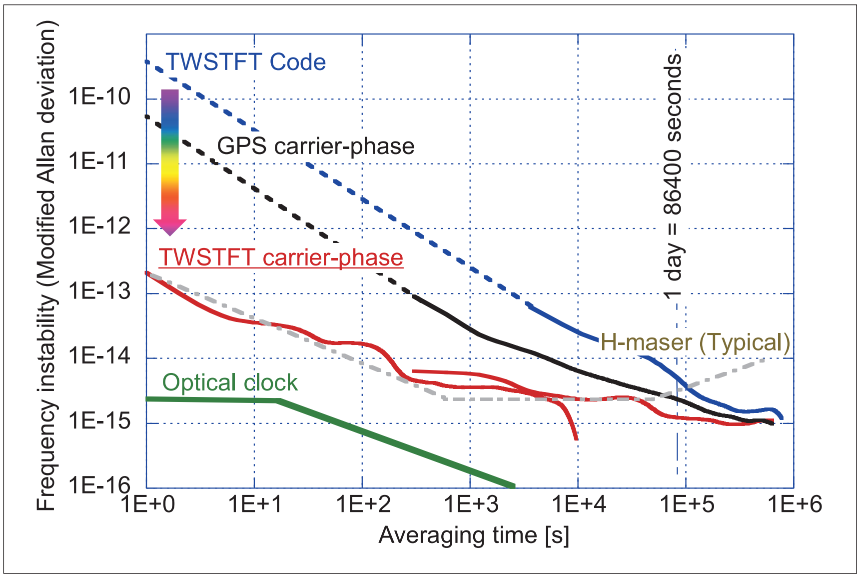


Figure 1 Instability of frequency comparison between NICT and PTB

Red: TWSTFT carrier-phase, Blue: TWSTFT code, Black: GPS carrier phase .
Gray dashed line shows a typical frequency instability of Hydrogen maser. Each frequency comparison is performed using a reference signal supplied from a local standard time generated from Hydrogen maser. The long-term instability is limited by the local time.

earth stations send and receive signals simultaneously for comparison, the signal path is identical in both directions, so atmospheric delay, orbital effects, and other factors almost completely cancel out and higher precision can be achieved. Conventionally, approximately 500 ps precision (Figure 1, blue line) can be obtained using a 2.5 Mbps code phase. Even higher precision could be obtained using a higher-speed modulated signal, but use of a geostationary satellite is expensive, so in the past 10 years, there have not been significant improvements to this precision.

To resolve this, we began research and development to introduce the use of carrier phase, as is done with GPS, to two-way satellite comparison. We developed a method that cancels the phase noise that the signal receives when the frequency is converted at the satellite and frequency shifts caused by Doppler effects due to small oscillations in the geostationary satellite orbit. Then, we did experiments using the ETS-VIII satellite, followed by more using a real, commercial geostationary satellite, and verified improvements in precision using this method, from approximately 500 ps conventionally, to 0.2 ps (Figure 1, red line). Thus, NICT has achieved for the first time, the highest precision in the world for frequency transfer using satellites. A 0.2 Mbps modulated signal was used in the measurements to assist signal capture, and measurements were completed using a satellite transponder having 1/10 the bandwidth of those used with conventional methods.

Intercontinental frequency transfer with Germany

The Physikalisch-Technische Bundesanstalt (PTB) in Germany plays a central role in the time-comparison network that defines UTC, and is a top-class laboratory for frequency standards development. We first checked the measurement precision of two-way comparison using carrier phase with experiments over the short distance between Kashima and Okinawa. Then, we conducted a long-distance, international comparison experiment over 9,000 km with PTB, confirming the same precision as in the short-distance experiments (Figure 1). However, because of the long distance and local time difference, there were ionospheric delay effects, appearing as a diurnal variation of approximately 150 ps. This error appeared due to the frequency difference between uplink and downlink frequencies (14 GHz uplink, 11 GHz downlink), and was not observable with earlier two-way comparison measurements using code phase due to the lower precision. We confirmed that the reduction of this error was possible by correcting for the effects of ionospheric delay using total electron content (TEC) maps created by NICT and the Royal Observatory of Belgium for the skies over Japan and Europe (Figure 3).

Future prospects

By improving measurement precision by three orders of magnitude over conventional methods, new factors contributing to error have come to light. The effects of the ionosphere are one such effect, but there are others, such as degradation of mid and long-term measurement precision due to phase fluctuations caused by temperature fluctuations in field instruments. These were not an issue at conventional levels of precision. NICT will continue to collaborate with international research institutes to develop systems that can control such error factors and achieve still higher precision, and to conduct tests to verify these systems.

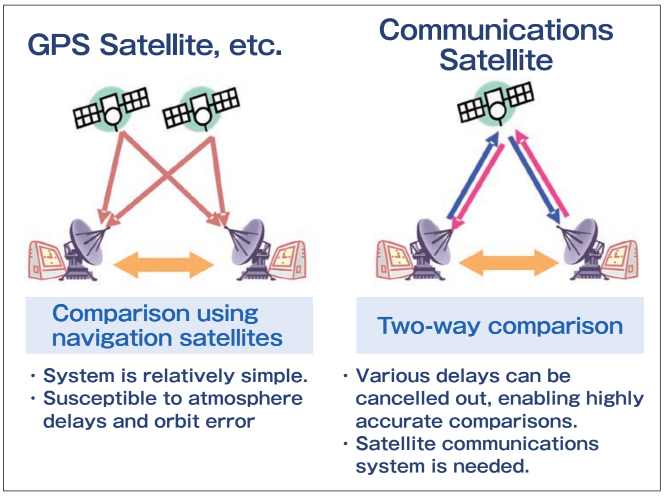


Figure 2 Time and frequency transfers using satellite

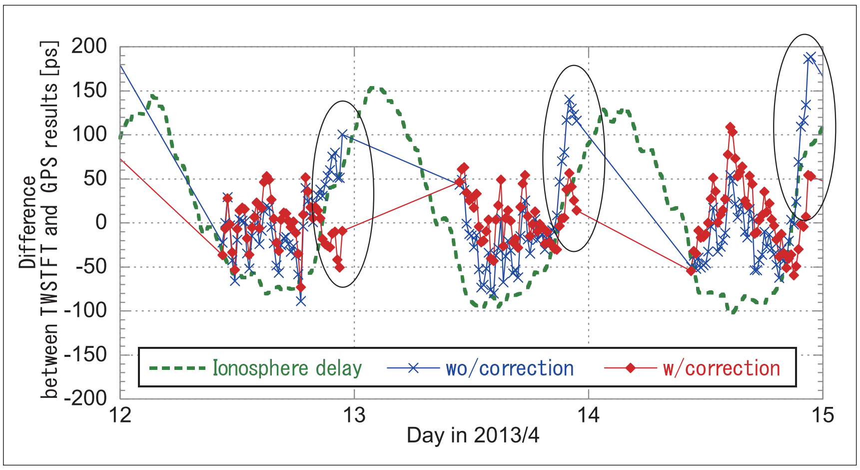


Figure 3 Ionosphere effect in NICT-PTB TWSTFT link

15-min mean of difference between TWSTFT and GPS results. GPS result is ionosphere free.
Green: Ionospheric delay, Blue: without ionosphere correction, Red: with ionosphere correction. The difference shows the disagreement of two results. When the ionospheric delay becomes larger (area covered by ellipse), we can see that the correction works.

MOU Signed with Overseas Research Institutes

National Weather Service, National Oceanic and Atmospheric Administration, United States Department of Commerce (NOAA/NWS)

On April 9, 2014, NICT concluded a memorandum of understanding (MOU) with the National Weather Service (NWS), part of the National Oceanic and Atmospheric Administration (NOAA) in the United States Department of Commerce, to collaborate on research in the fields of space weather and remote sensing for the purpose of earth observation. Till now, NICT has had ties with the NOAA/NWS Space Weather Prediction Center (SWPC) for issues in the space weather field, such as receiving real time solar wind data from the NASA Advanced Composition Explorer (ACE) which conducts comprehensive monitoring of solar wind. This MOU is intended to build stronger cooperation, through periodic sharing of information and personnel exchanges, in areas including exchange of data for space weather prediction, development and evaluation of numerical space weather models, improving the reliability of space weather forecast services, and remote sensing research for earth observation.

At the same time, an amendment to this MOU was also signed, to receive and collaborate on real-time solar wind data from the ACE and its successor, the Deep Space Climate Observatory (DSCOVR).

The MOU was agreed upon at the Space Weather Workshop, which has been held every year since 1996 in Boulder, Colorado, USA, for enterprises, universities and government agencies to exchange information related to space weather. It was attended by Dr. Fumihiko TOMITA, Vice President of NICT, and Dr. William LAPENTA, Director of the National Centers for Environmental Prediction (NCEP) of the National Weather Service (NOAA/NWS).

NICT and NOAA/NWS affiliates

Dr. TOMITA, Vice President of NICT and Dr. LAPENTA, Director of NCEP of NOAA/NWS

German Aerospace Center (DLR)

On April 16, 2014, Dr. Masao SAKAUCHI, President of NICT, and German Aerospace Center (DLR) Chairman, Dr. Johann-Dietrich WÖRNER, gathered to sign a memorandum of understanding (MOU) between NICT and DLR to promote research collaboration related to technology for optical communications in space.

DLR is the German government agency handling aircraft technology and space development. It conducts development and use of earth-observation satellites, and conducts R&D in the satellite communication field. Its headquarters is located in Cologne, it has a total of 29 facilities in 13 cities, including Berlin and Bonn, and has approximately 5,700 employees. NICT has conducted R&D on use of lasers for communication between earth and satellites to significantly increase communication capacity, and DLR also has similar research in progress, so we are planning to conduct joint international experiments to verify this technology, based on this MOU.

In the future, we will also identify common research themes, besides space optical communication, and strengthen our effective research collaboration with information exchanges, interaction among researchers, joint research, and holding research meetings.

Electronics and Information Technology Laboratory (LETI) of France

On April 14, 2014, Dr. Masao SAKAUCHI, President of NICT, and Dr. Laurent MALIER, CEO of the Electronics and Information Technology Laboratory (LETI) of the Nuclear and Alternative Energy Ministry of France, signed a memorandum of understanding (MOU) for research cooperation to promote widely ranging research collaboration in the ICT field.

LETI has its headquarters located in Grenoble and is a research institute focusing on applications of microelectronics and nano-technologies. LETI is known as a research institute which has actively conducted research and development focusing on the practical use through strong ties with industry. LETI is also playing a central role as the European side of the teams handling the topic, "Extending the cloud paradigm to the Internet of Things - Connected object and sensor clouds within the service perspective: Cloud of Things for empowering the citizen clout in smart cities" on a joint Japan-Europe research project on implementing new generation networks, which started last year.

Beyond individual cases of research cooperation in the past, LETI and NICT will start concrete cooperation in the fields of neuroscience and social ICT, and will promote study with activities such as workshops for researchers.

Dr. MALIER, CEO of LETI (left) and Dr. SAKAUCHI, President of NICT (right) at the signing ceremony

NICT and LETI affiliates after signing the MOU

The signing (From the left: Dr. Hansjörg DITTUS, Executive of DLR, Dr. WÖRNER, Chairman of DLR, and Dr. SAKAUCHI, President of NICT)

NICT and DLR affiliates after concluding the MOU

Awards

Recipient ● **Yoshinori AONO**/ Researcher, Security Fundamentals Laboratory, Network Security Research Institute

◎Award Date: January 22, 2014

◎Name of Award: SCIS Paper Award

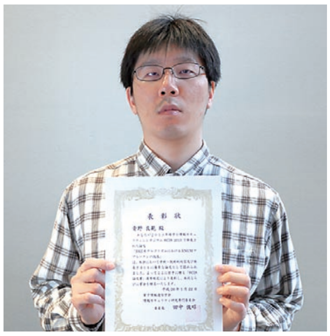
◎Details:
In recognition of the excellence of the paper "Improving enumeration subroutines of BKZ algorithms," for its academic and technical content and presentation.

◎Awarding Organization:
Technical Committee on Information Security (ISEC), The Institute of Electronics, Information and Communication Engineers (IEICE)

◎Comment from the Recipient:

I am very happy to receive the 2013 award for best paper at SCIS, which has a 30-year history and is the largest symposium on cryptography and information security in Japan. I would also like to express thanks to all those at the laboratory that have supported my research activities.

The paper tries to consider a space-time trade-off improvement and speed-up techniques for the shortest vector problem, whose hardness guarantees the security of lattice-based cryptography.



Recipient ● **Naomi INOUE**/ Distinguished Researcher, Universal Communication Research Institute

◎Award Date: March 17, 2014

◎Name of Award:
Knowledge Innovation Award 2013 for Excellence

◎Details:
To acknowledge the concrete results achieved toward "Creating new value causing change in the world," which was the goal since development began in Umekita. Programs that introduce cultural properties from temples in the Keihanna region using 3D imagery were produced and presented using the 200-inch glasses-free 3D display in operation in Umekita. This has contributed greatly to promoting these properties and making them more popular than ever, and the award recognizes this achievement.

◎Awarding Organization:
Knowledge Capital Association, KMO Corporation

◎Comment from the Recipient:

I am extremely honored to receive this Knowledge Innovation Award 2013 for Excellence, in recognition of concrete results toward "Creating new value causing change in the world." In our work we created 3D images of these precious cultural properties, with the cooperation of the temple in Nara (Kairyuouji Temple), and displayed them on the 200-inch glasses-free 3D display, which is a result of our research. This work has been well received by many, and is being recognized at this time. We hope to continue work on such applications in the tourism field in the future.

Recipients ● **Yukio YAMANAKA***i **Soichi WATANABE***ii **Kanako WAKE***iii **Lira HAMADA***iii **Tomoaki NAGAOKA***iii

*i Managing Director, International Affairs Department *ii Research Manager, Electromagnetic Compatibility Laboratory, Applied Electromagnetic Research Institute *iii Senior Researcher, Electromagnetic Compatibility Laboratory, Applied Electromagnetic Research Institute

◎Award Date: March 25, 2014

◎Name of Award: 59th Maejima Hisoka Award

◎Details:
R&D Regarding the Safety of Radio Waves
The recipients have conducted research on the safety of radio waves since mobile phones first started to become common. They have contributed to setting regulations for protection from radio waves within Japan, and procedures for evaluating the safety of mobile radio devices. They have also participated in international activities on radio safety, and contributed to international guidelines and radio-wave risk assessment projects. Further, they have contributed to Ministry of Internal Affairs and Communications efforts to raise awareness in the public and people in the industry in Japan, and to building an appropriate and safe environment for using radio waves.

◎Awarding Organization: Tsushinbunka Association

◎Comment from the Recipients:

We are extremely pleased that our research on the effects of radio waves on human bodies, our work setting policies for radio-wave safety, methods for measuring them, and our technical support for performing them is being recognized with this award, and that this work is seen as contributing to our mission as a national research institute.

We would like to express sincere thanks for the assistance from all of our seniors since the days of the Radio Research Laboratory (RRL), for the cooperation from researchers and related organizations within and outside of Japan, and for the support from the Ministry of Internal Affairs and Communications and the administration. We will continue our activities in our role as a research center in Japan.

From the left: Kanako WAKE, Soichi WATANABE, Yukio YAMANAKA, Lira HAMADA, Tomoaki NAGAOKA

Recipient ● **Masatoshi KAWAHARA**/ Chief, Electromagnetic Compatibility Laboratory, Applied Electromagnetic Research Institute

◎Award Date: April 14, 2014

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

◎Details:
Improvement in the reflective area of buoy support pole for radar detection tests

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

◎Comment from the Recipient:

Radar detection capability tests must be done under harsh environmental conditions such as strong winds and waves on the sea surface, and this also places conditions on the reflective surfaces of the targets that are being detected. Our work has contributed to operation of model radar measurements, improving the accuracy of measurements under these various conditions, while maintaining the mechanical strength of targets. We would like to express our thanks to all those who supported and collaborated with us in this work.

Recipients ● **Hiroshi HARADA**/ Managing Director, Social Bigdata ICT Joint Center
Fumihide KOJIMA/ Research Manager, Smart Wireless Laboratory, Wireless Network Research Institute

◎Award Date: April 15, 2014

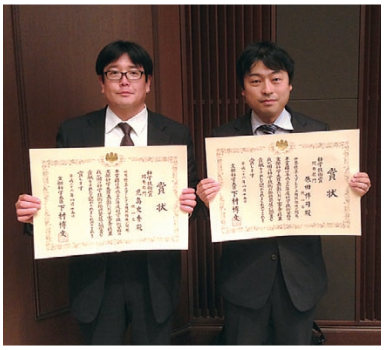
◎Name of Award:
The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology, Prizes for Science and Technology (Development Category)

◎Details:
Development of the world's first international standard compliant radio device for smart metering systems

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

◎Comment from the Recipients:

This award recognizes achievements in standardization and promotion for smart metering radio devices that suitably reflect Japanese industrial demands, and were led by NICT's R&D activities. Thus, we also feel this is a great achievement since it is an achievement in realizing NICT's ideal of promoting our research results. We would like to thank all of those within and outside of NICT for all of their cooperation. We will continue to advance our R&D to implement social ICT as promoted by NICT, not forgetting the ideals mentioned above.



From the left: Fumihide KOJIMA, Hiroshi HARADA

Recipient ● **Shiho MORIAI**/ Director of Security Fundamentals Laboratory, Network Security Research Institute

◎Award Date: April 15, 2014

Co-recipients:
Masayuki KANDA (Nippon Telegraph and Telephone Corporation)
Mitsuru MATSUI (Mitsubishi Electric Corporation)
Kazumaro AOKI (Nippon Telegraph and Telephone Corporation)
Toshio TOKITA (Mitsubishi Electric Corporation)

◎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:
Development of a Next Generation International Standard Symmetric Key Cryptosystem

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

◎Comment from the Recipient:

This award is in recognition of the design, evaluation, and standardization of the Camellia block cipher which I was involved in at NTT. This encryption scheme is an international standard adopted at ISO/IEC and IETF, and was also selected as one of Japan's e-Government recommended ciphers (evaluation and executive office contributed by NICT). Non-exclusive royalty-free licenses of the essential patents for Camellia are granted, and we have actively promoted it as open source, so we believe it will be widely used within and outside of Japan, contributing to implementing information security in society.

Recipient ● **Miwako DOI**/ Auditor

◎Award Date: April 15, 2014

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

◎Details:
"Promotion of Human Interface Technology for Document Processing"

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

◎Comment from the Recipient:

We have been promoting development of human interface technology, preparing for a time when ordinary users will take usage of computers for granted, and use them without programming to prepare documents and presentation materials, and perform tasks such as translation, easily. This activity contributes to information being digitized more easily, sharing information more smoothly, and penetration of information processing technologies more deeply into society. I was honored to receive the award from the Minister of Education, Culture, Sports, Science, and Technology on behalf of the group.

Photo provided by Toshiba Corporation

Recipient ● **Chikara HASHIMOTO**/ Research Manager, Information Analysis Laboratory, Universal Communication Research Institute

◎Award Date: April 15, 2014

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

◎Details:
Research on learning deep semantic knowledge of language from big data, and its applications

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

◎Comment from the Recipient:

This award recognizes our research program in automatically obtaining vast amounts of knowledge about languages and this world for computers to understand natural languages, from large amounts of textual data. The results of this research have already been used for a web information analysis system, WISDOM X, which is in development at the information analysis laboratory. The vast amounts of knowledge acquired by our technologies are being distributed as dictionaries through the ALAGIN forum. That is, we have started to share some results of this research for the common good. This award is a result of cooperation from everyone at this agency, and I would like to thank them sincerely.

NICT Special Summer Children's Open House

Admission Free

Dates: July 24-25, 2014 (Thu.-Fri.) 9:30-17:00 (No admittance after 16:30)

NICT will be holding a "NICT Special Summer Children's Open House" to familiarize visitors with science, including a tour of our research activities, hands-on classes for elementary-school students (gr. 4, 5, 6), a South-pole class with researchers who have participated in expeditions to Showa Station (Antarctica), and various participatory science exhibits. We sincerely hope you will all attend.

Location:
National Institute of Information and Communications Technology Headquarters
4-2-1 Nukui-Kitamachi, Koganei, Tokyo 184-8795, Japan
＊Please use public transit.

Inquiries:
NICT Special Summer Children's Open House Office
Public Relations Department, NICT

E-mail: summer-event-contact@ml.nict.go.jp

Some events require pre-registration. Please see http://www.nict.go.jp/summer-event2014/ (Japanese only) regarding event details.

2013 Event

Hands-on class (making a radio with an umbrella)

Participation exhibit (types of encryption)

Tour (Optical Space Communications Ground Center)

Facility Open House 2014 Advanced ICT Research Institute

Admission Free

Theme: Experience the Future of Information and Communications Technology!!

Dates: **July 26, 2014 (Sat.) 10:00-16:00 (No admittance after 15:30)**
Location: Advanced ICT Research Institute
588-2 Iwaoka, Iwaoka-cho, Nishi-ku, Kobe, Hyogo 651-2492, Japan
TEL: +81-78-969-2100
URL: http://www2.nict.go.jp/advanced_ict/plan/ippankoukai/2014/ (Japanese only)
Other: No registration necessary, parking available.

2013 Facility Open House

Watch, Listen and Learn! -lectures were held

Experiencing the world of ultra-low temperatures, where superconductivity phenomena occur

Observing plant cells by making a glass bead microscope

Commentary on the marvelous structure of the brain

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