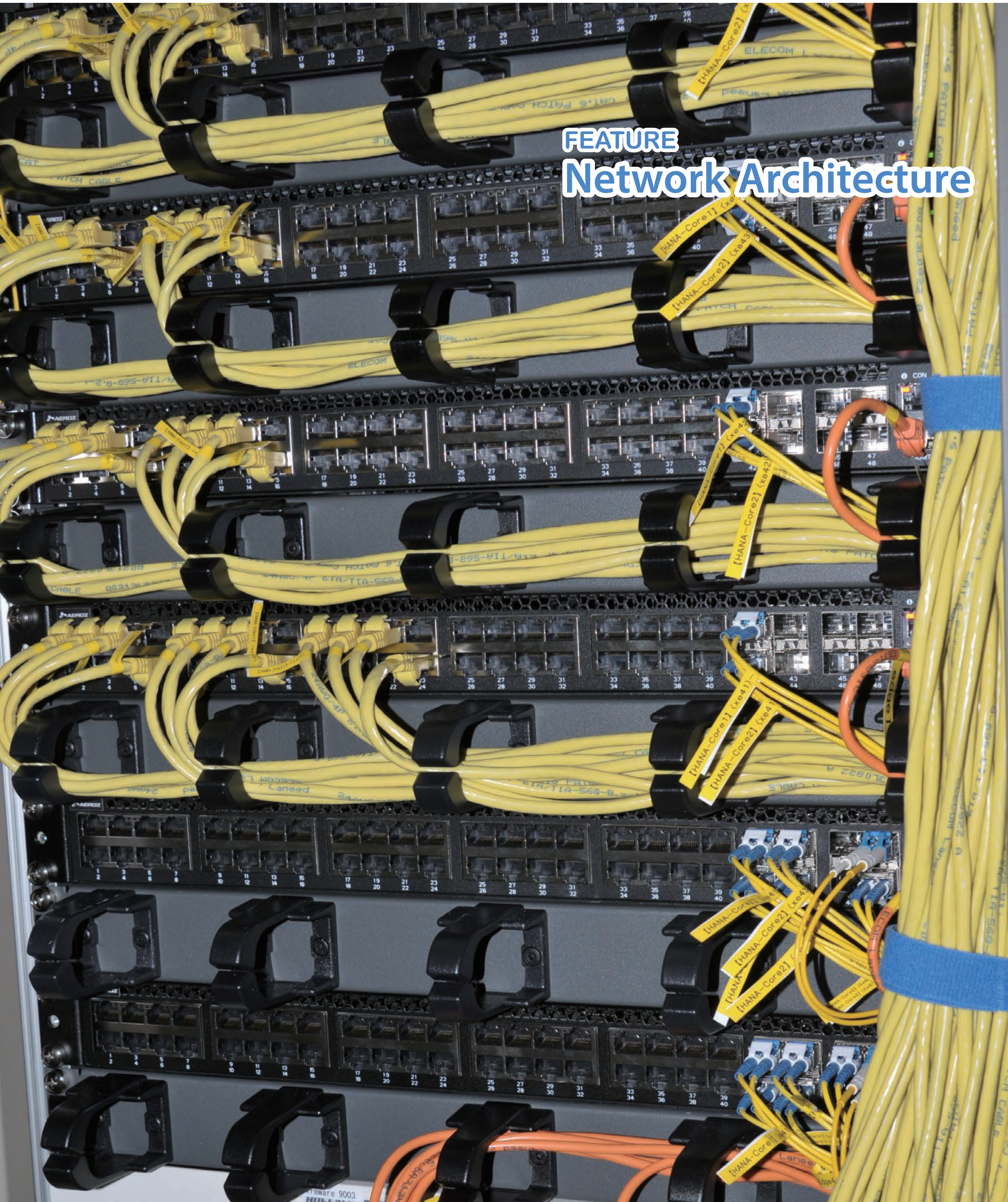
NICT National Institute of Information and Communications Technology

NICT NEWS

No.453 AUG 2015

FEATURE
Network Architecture



NICT NEWS No.453 AUG 2015
National Institute of Information and Communications Technology

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Cover photo

A Layer 3 switch supporting Hierarchical Automatic Number Allocation (HANA), which is a technology for building networks automatically. It is installed and being used in the working network of the Network Architecture Laboratory.

INTERVIEW

Directions for Continuously Developable Networks in the Future

Hiroaki HARAI
Director of Network Architecture Laboratory, Photonic Network Research Institute
After completing his doctoral course, he joined Communications Research Laboratory (currently NICT) in 1998. Engaged in research and management related to optical networks and future networks. Ph.D. in information and computer science.

As the amount of information continues to increase dramatically in our information and communications society, optical network technologies are becoming a key element supporting the flow of that information. NICT Photonic Network Research Institute is conducting research and development on this key element, optical networks, to make continuous growth of information and communications possible in the future. One of three laboratories of the Institute, Network Architecture Laboratory conducts research on architectures that will set the direction for new generation networks. We spoke with Dr. HARAI, Director of the laboratory.

Network Architecture Concepts

— To begin with, I'd like to ask about what "Network Architecture" is, as both the name of your laboratory, and the theme for your research?

HARAI Architecture means configuration and structure. Briefly, it refers to the principles used in building the type of network required. Currently when thinking about networks, the key concepts are optical communications technology, and mobile networking technology. In this context, our mission is to bring together conditions for creating better networks. Organizationally, Network Architecture Laboratory belongs to the Photonic Network Research Institute, but on the other hand, many of the researchers also belong to the New Generation Network Laboratory, which studies new generation networks, and how optical and mobile networks should be built.

The Major Evolution Process of Networks

— But your research themes aren't limited to photonic networks, are they?

HARAI No, they aren't. It is good to build the core part of the network using optical technology, for its high speed and energy savings, but the network cannot be built with optical technology alone. Considering usability of user terminals, mobile technology is very significant, so it is important to consolidate how optical and mobile technologies are to be connected.

As the name suggests, fiber-to-the-home (FTTH) has brought optical connections to individual households, so they can use high-speed, high-capacity communications. However, we also want to make it possible to connect to advanced networks smoothly when we are out, and not just when we are at home.

The transition has also begun from IPv4, the current main communication protocol used on the Internet, to the IPv6 specification. IPv6 is the successor of IPv4 and uses unique, 128-bit numbers for addresses. The result is that currently, a mix of these two different communications formats is being used, and we need to consider how networks will connect and function together in this environment.

Objectives and design goals for future networks

— What are the goals of research and development in the Network Architecture Laboratory?

HARAI The International Telecommunication Union (ITU) has summarized the objectives and design goals for future networks in ITU-T Recommendation Y.3001. NICT played a major role in establishing this recommendation, which gives four objectives and 12 design goals for future networks in Y.3001 (Figure 1).

The four objectives are:
1. Service awareness
2. Data awareness
3. Environmental awareness
4. Social and economic awareness

Related to these four objectives, there are 12, more-detailed design goals, and some of these design goals, such as Network Management,

INTERVIEW

Directions for Continuously Developable Networks in the Future

Mobility, Reliability and Security, Energy Consumption, and Identification, are particularly closely related to R&D objectives at Network Architecture Laboratory (Figure 2). Of course, the design goals are closely inter-related, so we also consider the other design goals.

■Preparing for further traffic increases

── Specifically what sorts of research topics are you working on?

HARAI One is R&D on optical packet and circuit network service infrastructure technology. There are various issues with current network infrastructure, such as limitations on the speed of electronic processing, and power consumption. As the amount of traffic increases, without technical innovation, it is estimated the amount of power consumed in the communications field will more than double between 2005 and 2020.

A variety of users use networks for a variety of services in a variety of locations. However, there are issues in handling individual usage scenarios, such as the lack of a service that can change, with flexibility and according to conditions, between using packets, for which quality fluctuates because the bandwidth is shared by a large number of users, and using circuits, which occupy channels exclusively. Another is that the bandwidth of optical cannot be utilized fully due to the need to convert between optical and electrical signals. As such, it is hard to say that electronic and optical networks are adequately integrated at this time.

One technology under R&D to resolve these issues is called optical packet and circuit integrated networking (Figure 3). As an example, we developed optical packet and circuit integrated node equipment in collaboration with Photonic Network System Laboratory of Photonic Network Research Institute. It is the first-ever integrated implementation of 100 Gbps optical packet and optical circuit switching functions and will enable provision of stable optical packet and circuit services. It also promises to yield significant gains in energy efficiency. This optical packet and circuit integrated node equipment is installed and operating on our test network.

■Technologies supporting the future society in 2020

── I understand you are advancing research on managing network connections…

HARAI Yes, R&D on autonomous management mechanisms for highly available networks is another major research topic.

It concerns an issue with the current Internet, that congestion and faults are not handled adequately due to the difficulty of managing networks cross-sectionally and handling fluctuations in scale. The research attempts to address the lack of procedures for automatically assigning locators to communications devices and terminals and configuring routes.

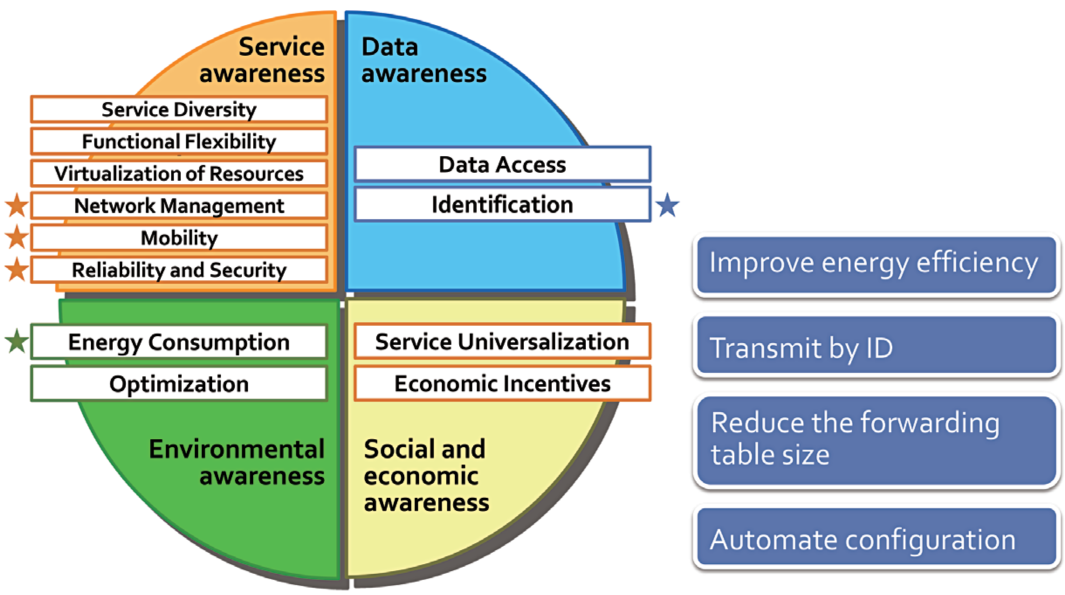


Figure 1 The four objectives and 12 design goals for future networks in ITU-T Recommendation Y.3001

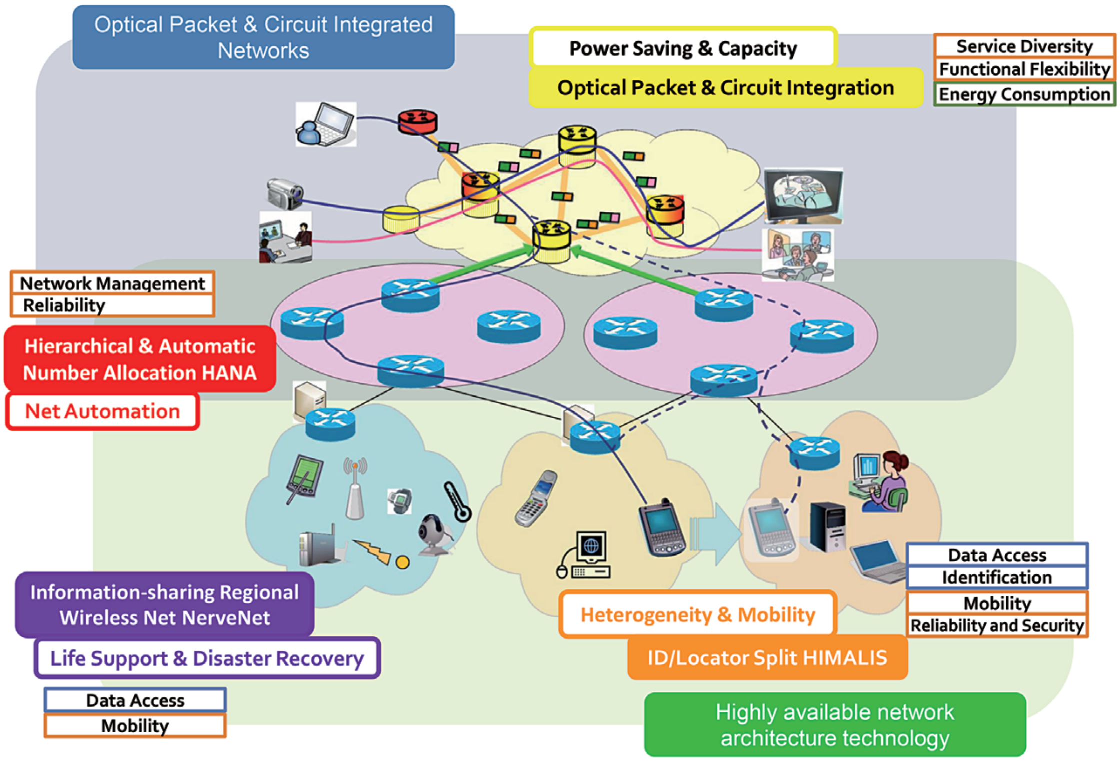


Figure 2　Research and development targets of the Network Architecture Laboratory

Specific technologies being developed for this include Hierarchical Automatic Number Allocation (HANA) and Heterogeneity Inclusion and Mobility Adaptation through Locator ID Separation (HIMALIS). HANA is a technology that automatically allocates hierarchical locator numbers so that rapid handling of network congestion and faults can be implemented. The idea of increasing redundancy by securing multiple routes itself is not new, but features of HANA include doing it automatically and making multiple routes available at all times. We are currently building this mechanism into commercial routers and conducting tests.

The objective of HIMALIS is to facilitate communication among heterogeneous networks and movement of terminals between networks by separating IDs and locators. With current technology, when a terminal moves to a different network, its ID also changes and the connection is lost. By separating ID and locator, such transitions can be made smoothly, without interrupting the connection.

Such developments, including optical packets and circuits, are not vague objectives in the future, and targets have been suggested in "Creating Networks to Support Future Society in 2020". Our research themes are usable technologies sufficient to implement this in the near future.

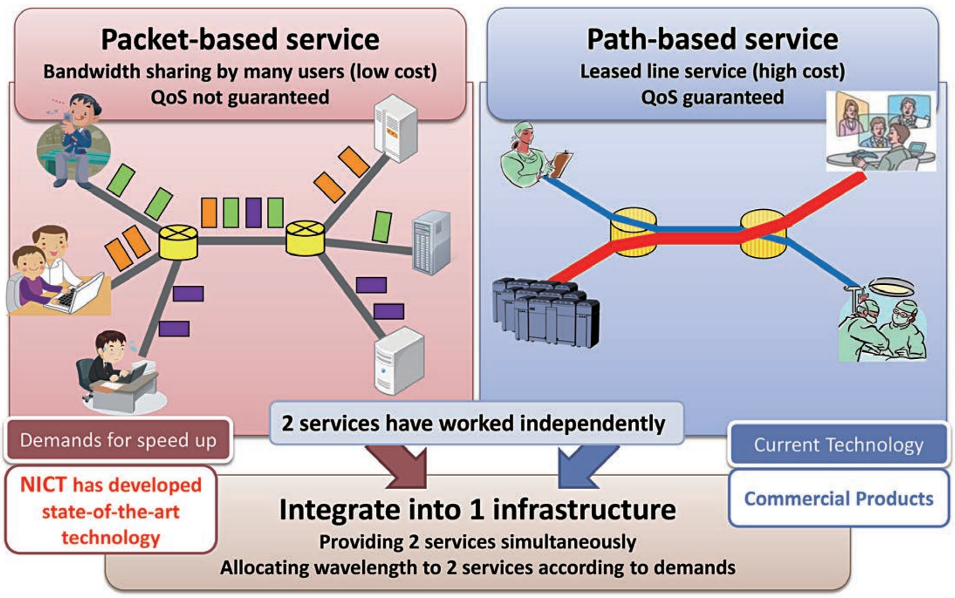


Figure 3　Optical Packet and Circuit Integrated Network

Optical Packet and Circuit Integrated Node

Realization of large-capacity and energy-efficient optical networks providing diverse services

Hideaki FURUKAWA
Senior Researcher
Network Architecture Laboratory,
Photonic Network Research Institute

After receiving a Ph.D. in engineering in 2005, he joined NICT in the same year. He is a member of the AKARI Architecture Design Project at NICT. His research interests include photonic information technology and photonic networks.

Optical fiber has the excellent characteristics of high speed and ability to transport signals over long distances, and huge optical networks have now been built spanning the entire world. NICT has proposed an Optical Packet and Circuit Integrated Network, as a new generation optical network able to provide a diversity of communications services and even higher capacity and lower power consumption than current networks. Here, we introduce Optical Packet and Circuit Integrated Node equipment that utilizes Optical Switching technologies, which is the key for implementing this new type of network.

Background

Information and communications technologies are being used increasingly around the world to resolve social issues such as realizing an energy efficient society. With this trend, the amount of data flowing on the Internet and mobile communications networks continues to increase, and the capacity of the optical networks accommodating this data needs to be increased while controlling power consumption. Circulation of a variety of content is also expected so functionality to provide various types of data communication is needed, from small-capacity, best-effort data communications (e.g.: Web browsing, e-mail, collecting sensor data, etc.) to high-quality, large-capacity data communication (e.g.: digital cinema distribution, remote medicine, etc.).

Current optical networks can provide high-quality communications when using optical circuits provided by optical add-drop multiplexer equipment, but this also presents difficulties in that circuits are exclusively occupied and switching circuits is time consuming. Because of this, electronic routers are used with packet switching, making it possible to provide services flexibly and to use resources efficiently. However, the switching process in electronic routers consumes large amounts of power. As such, we have proposed an Optical Packet and Circuit Integrated network (OPCI network) which provides both packet and circuit switching to enable a diversity of communications services and also realize large capacity and low power consumption, by introducing technology that performs optical switching without converting the data to electronic signals.

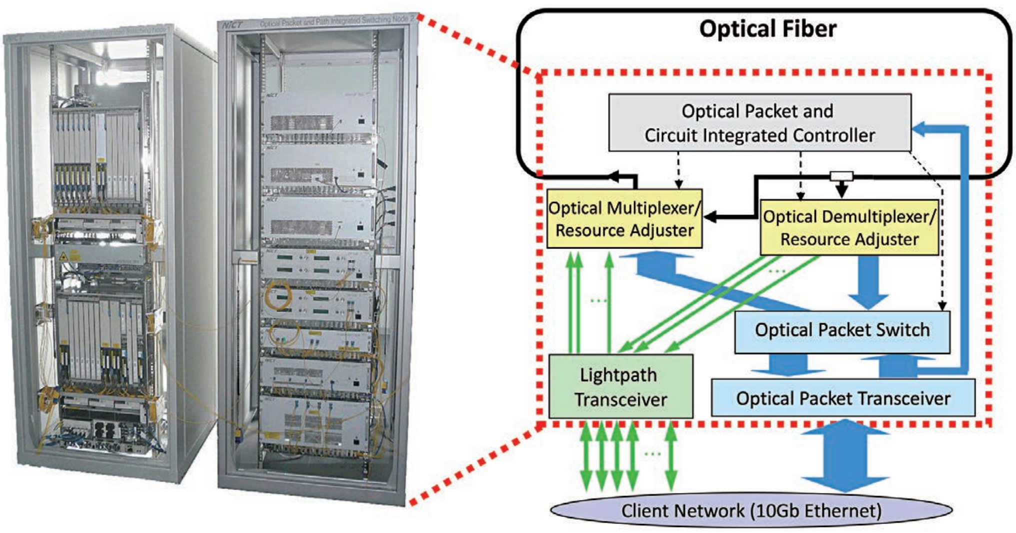


Figure 1　Developed Optical Packet and Circuit Integrated Node

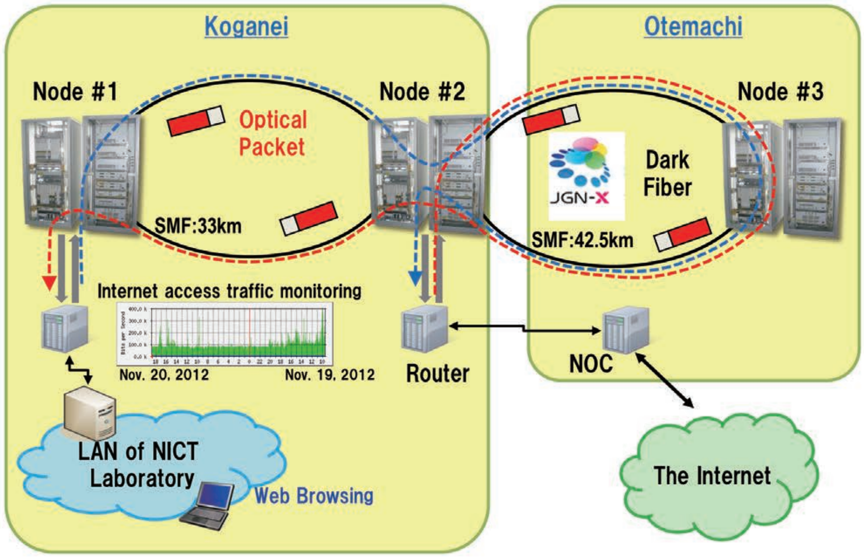


Figure 3 Optical Packet and Circuit Integrated network testbed

Optical Packet and Circuit Integrated Node

In an OPCI network, bandwidth is allocated separately for optical packet switching or optical circuit switching, and both switching formats are provided through wavelength multiplexing technology. We have developed the first ever, Optical Packet and Circuit Integrated Node ("Optical Integrated Node") that simultaneously realizes both optical packet and optical circuit switching, using devices we developed earlier that implement the latest technologies for optical packet signals (Figure 1).

The Optical Integrated Node was developed for use on ring networks, and is composed mainly of optical packet switches, optical add-drop multiplexer equipment (used for both wavelength resource adjuster and optical circuit switch), optical packet transceivers, optical circuit transceivers, and an optical packet and circuit integrated controller (Figure 1). Optical packets and optical circuits are separated using optical add-drop multiplexer equipment and the allocation of wavelengths for each switching type can be adjusted according to service volumes. Interfaces with client networks are 10 gigabit Ethernet, with optical packet transceivers converting format to 100 Gbps optical packets and optical circuit transceivers converting format to 10 Gbps optical circuits. On the ring network, optical packets and circuits are transmitted within the same fiber, and optical packets and circuits can terminate at any node according to instructions from the integrated controllers.

Optical packet switch with optical buffer

For this equipment, a new optical buffer was implemented to prevent packet collisions on output ports when optical packets arrive at the same time on different input ports of the optical packet switch. The optical packet switches are composed of Semiconductor Optical Amplifier (SOA) optical switches, a switch controller, optical fiber delay lines, and burst-mode optical amplifiers (Figure 2). In order to prevent collisions, the switch controller calculates the delay needed for each optical packet to avoid collisions, and then sends a control signal to the SOA optical switch in the optical buffer of the output port it is being sent to, so that the optical packet is transmitted to an optical fiber delay line that will add the calculated amount of delay. Collisions at the output ports are avoided by transmitting all optical packets that could collide through optical fiber delay lines with a delay of suitable length, so they are output at different times. We have conducted experiments verifying operation as described above, and confirmed that collisions between optical packets can be avoided in this way.

Construction of a testbed network and use for Internet access

To contribute to stability through improvements while demonstrating stable operation of the Optical Integrated Nodes, we built an OPCI network testbed between the laboratory network and an Internet-connected access line (Figure 3). The testbed network was built using three Optical Integrated Nodes and JGN-X dark fiber between Otemachi and Koganei. We are continuously conducting experiments using terminals in the laboratory communicating with external servers, transporting data with optical packets and measuring the resulting traffic.

In the future, we will conduct various experiments on the testbed network to make OPCI networks more practical, and increase our technical capabilities to a level that network operation is possible.

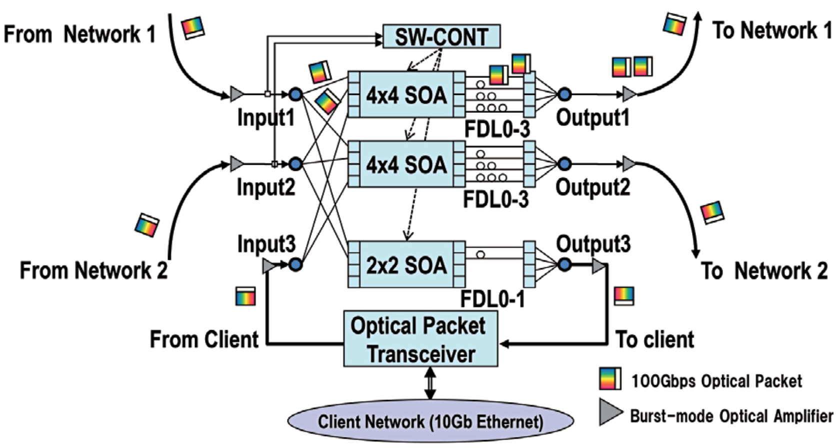


Figure 2 Optical buffer in optical packet switch

Host-ID/Locator Split Network

ID-based communication in future networks

Ved P. Kafle
Senior Researcher
Network Architecture Laboratory,
Photonic Network Research Institute

After completing his doctoral degree, he joined NICT in 2006. He is currently involved in the design, implementation, and evaluation of new generation network architectures and protocols, as well as standardization activities.

In Network Architecture Laboratoy, we have been researching identifier (ID)-based communication for future networks, and developing a new network architecture, called HIMALIS (Heterogeneity Inclusion and Mobility Adaptation through Locator ID Separation), which is better than the current Internet's IP address-based communication. In this article, we give an overview of ID-based communication, HIMALIS network components, features, implementation, testbed, and related standardization activities.

Overview of ID-based communications

ID-based new communication methods are in the demand of the future information society because they would enable users to securely communicate from any place, with any device, and freely move and reliably connect to any type of network, without disrupting ongoing communication services. In the current Internet's location-based communication method, IPv4 and IPv6 networks are not interoperable because their addresses (which represent locations) are incompatible. The ID-based communication can interoperate these heterogeneous networks. The ID-based communication has also been discussed in ITU-T Study Group 13, where NICT has actively contributed for the development of related ITU-T Recommendations, such as Y.3031 "Identification framework in future networks".

Figure 1 shows an ID-based communication framework. The major functional components of the ID-based communication framework are ID allocation and revocation, ID resolution, ID-based control, and ID-to-path mapping.

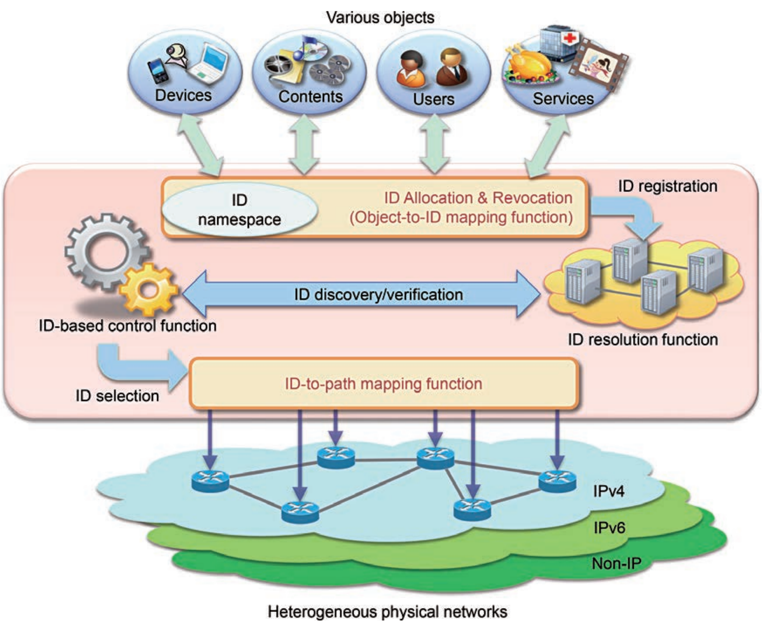


Figure 1 ID-based communication framework

HIMALIS network components

HIMALIS is a representative architecture of the ID-based communication framework, where unique hostnames and IDs are assigned to devices (called hosts) and used for identification, discovery, and authentication of devices as well as for the delivery of communication services securely over heterogeneous networks.

HIMALIS contains two types of networks: access network and transit network, which are connected through gateways (Figure 2). The access and transit networks can use different communication methods, for example, IPv4 and 6LoWPAN (a lighter version of IPv6 for low power sensor devices) in the access networks and IPv6 in the transit network. Beside the user devices, the access network also includes other entities such as authentication agent and name resolution agent. In the transit network, there are name resolution registries to store the mapping between hostnames and IDs, locators (i.e. addresses), and security parameters. To get sensing data from the sensor, the mobile device first finds the ID and locator of the sensor by sending a query to a name resolution registry, and then authenticates the sensor and establishes an end-to-end secure ID-based communication session in the application layer. In network layers, the communication takes place using different locator-based methods (e.g. IPv4 and IPv6). The gateways perform network protocol translation.

HIMALIS provides simple APIs (Applica-

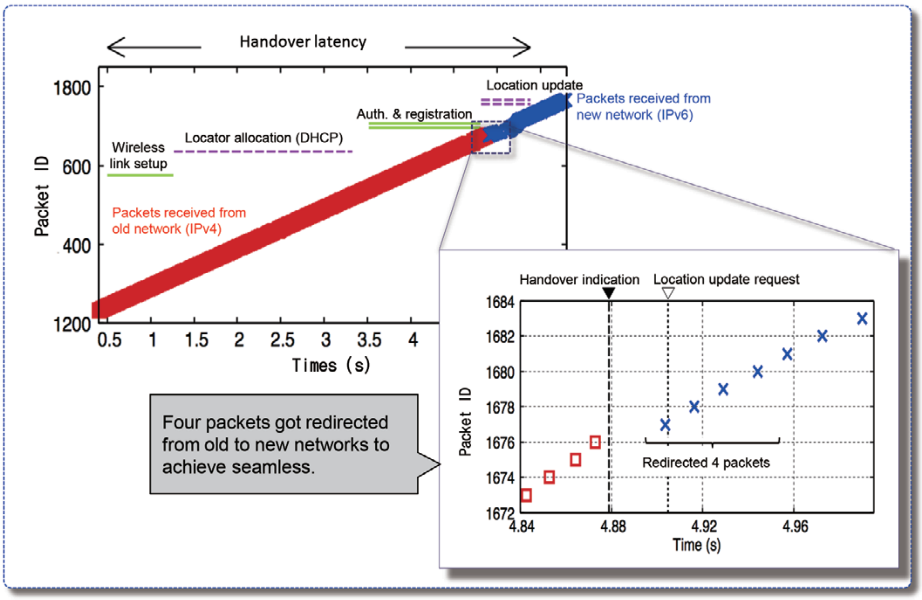


Figure 3 Packets receiving in mobile device during seamless handover in heterogeneous access networks

The handover process started at 0.5 second with wireless link setup in the IPv4 network, and then followed by the configuration of an IPv6 locator, authentication, and location update. During the handover process, the mobile device kept on receiving packets from the IPv4 network until it performed location update in the correspondent devices by sending a signaling message containing its new IPv6 locator. After the location update, it started receiving packets through the IPv6 network. For a little time, some packets were also relayed from the IPv4 network to the IPv6 network to avoid possible packet loss during the handover.

tion Programming Interfaces), which are similar to the current Internet socket APIs in their names and formats, except that IDs are used instead of IP addresses in the parameter lists. It supports both TCP and UDP transport services. Therefore, an application developer with experience in the socket programming can easily develop HIMALIS applications.

Implementation and testbed

We have implemented HIMALIS network functions on Linux Ubuntu software and have evaluated the performance of the HIMALIS ID-based communication in heterogeneous networks. Figure 3 shows an example performance of seamless handover when the mobile device moved from IPv4 to IPv6 networks. In this case the mobile device was downloading a file from a server located in a different access network.

We have also studied HIMALIS's other performances and have found that HIMALIS's end-to-end throughput (i.e. amount of data exchanged between the applications per unit time) and latency incurred in gateways for forwarding packets by performing protocol translation are almost similar with those metrics of the Internet and related technologies. However, HIMALIS brings about additional capabilities of efficiently handling of mobility and interoperating heterogeneous networks, thus enhancing reliability, security, and flexibility in communications.

HIMALIS technology has been available in NICT in three types of testbed systems to study its functions and performance in different environments such as sensor devices as hosts, physical computers as hosts, or only virtual machines as hosts.

To make mobile sensor hosts, we have installed HIMALIS host functions in various sensors and tablets. The mobile sensors and the mobile sensor gateways have been included in the JOSE testbed which is a Japan-wide large-scale smart ICT service platform testbed consisting of a large number of wireless sensors, cloud storage and computing resources. The JOSE testbed is available to use in the Japanese domestic and international joint projects.

For the second type of testbed, we have developed a software package which can be installed in several computers to make a HIMALIS network consisting of hosts and gateways, which communication with one another by using WiFi and Ethernet. That HIMALIS network can be set up in the user's premise and connected through the Internet with another HIMALIS network, such as one already setup in NICT Koganei, to perform various experiments.

The third type of testbed can be developed in a single PC by making multiple virtual machines (VMs) and installing HIMALIS software on them. This standalone testbed has benefit that it allows us to configure two/three HIMALIS access networks and a transit network in the same PC and study about the HIMALIS capabilities in term of the communication in heterogeneous networks, mobility, and failure recovery. We have been distributing the testbed software to interested users (university professors, researchers, or students), which can be used for the purpose of education on new networking technology as well as collaborative research with NICT.

Standardization and future work

HIMALIS technology related standardization activities are progressing in ITU-T Study Group 13. The HIMALIS name resolution registry structure and processes are similar to those specified in the group.

In future work, we apply HIMALIS technology components to IoT (Internet of Things) and M2M (Machine to Machine) applications which have a potential to create revolution in ICT business and services.

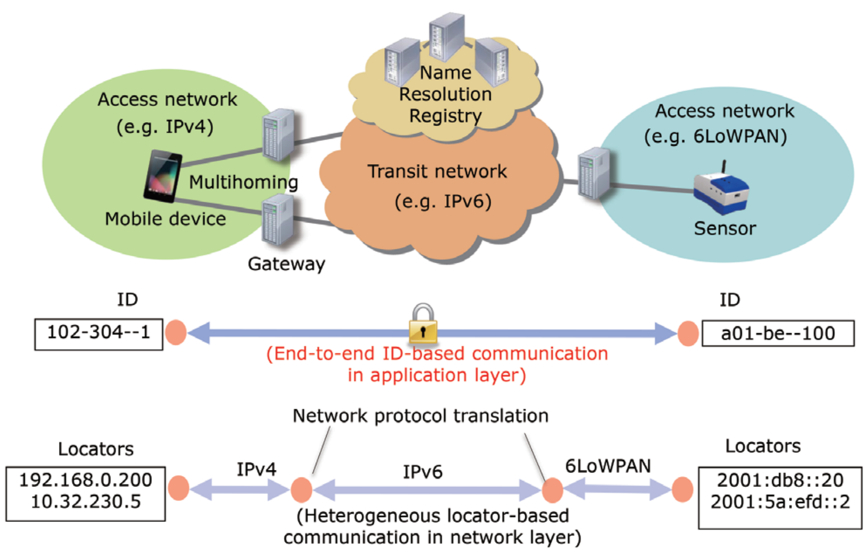


Figure 2 ID-HIMALIS network components

Application of HANA Automatic Network Configuration Technology to SDN

Automating SDN network address allocation to provide rapid service and prevent misconfiguration due to human error

Kenji FUJIKAWA
Senior Researcher
Network Architecture Laboratory,
Photonic Network Research Institute

After completing graduate school, became Assistant Professor in the Graduate School of Informatics, Kyoto University in 1997, Senior Researcher at ROOT Inc. in 2006, and joined NICT in 2008. Engaged in research on new generation network architectures.

The Network Architecture Laboratory has researched and developed Hierarchical Automatic Number Allocation (HANA), which is a technology for automatically allocating addresses. By applying HANA to Software Defined Networking (SDN), which can be centrally controlled with a network device controller, rapid provision of SDN networks is implemented.

Background

Software Defined Networking (SDN) defines how communication is controlled using software, so an SDN controller is able to control network devices on the whole network centrally, and flexible networks can be built. For example, data flow can be controlled automatically. However, to control an SDN, control addresses must be configured on network devices, and until now, manual address configuration was required when configuring an SDN network.

Research and Development of HANA Technology

Our laboratory has researched and developed HANA as a technology to allocate IPv4 and IPv6 addresses automatically and hierarchically, so that networks can be built automatically. Till now, automatic address allocation by DHCP has been used only on terminal devices such as PCs and smartphones, but HANA enables IP addresses to be allocated automatically to network devices as well. HANA makes changes to network configuration easier, so that network operation and administration are more flexible.

If the layer 3 (L3) switches used to build an enterprise or other network support the HANA protocol, only the core switch needs to be configured with an IP address in order to set IP addresses on the whole network. IP addresses for each of the ports on the core switch and ports on the other switches are set automatically (Figure 1). An L3 network with 1,000 or so PCs would previously require setting 100 individual addresses, but now requires only

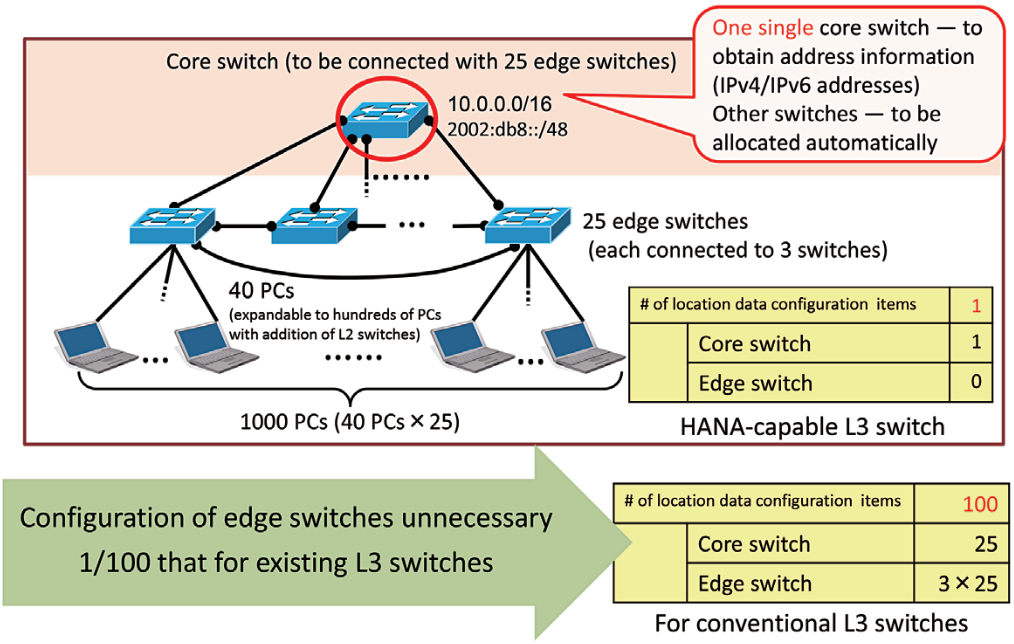


Figure 1 Example of IP address configuration on an enterprise network using the HANA-capable L3 switch

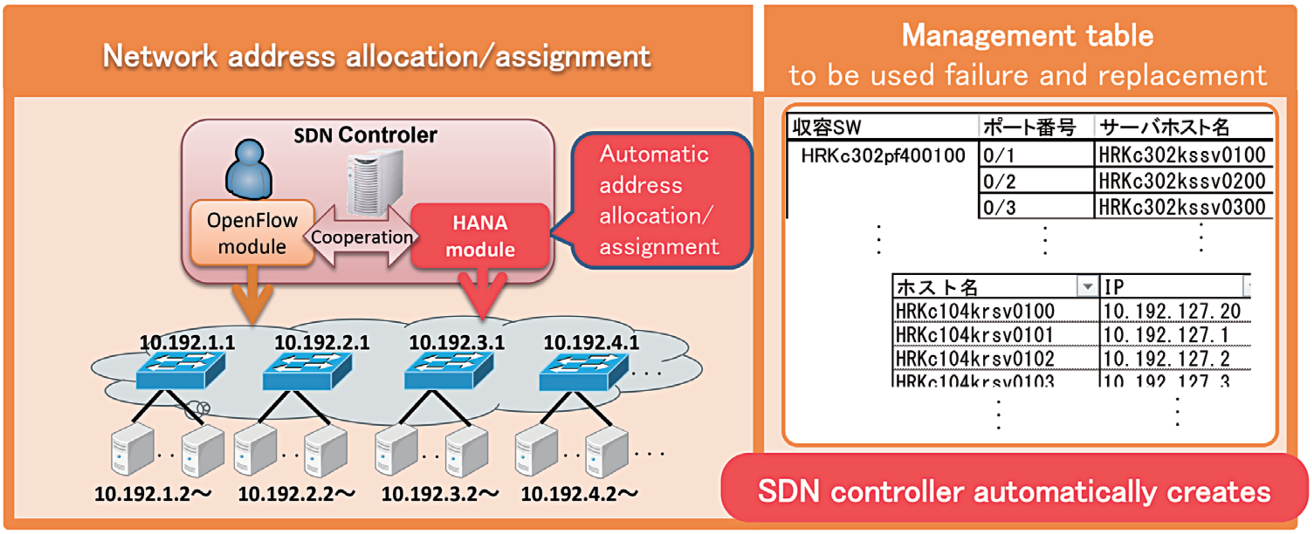


Figure 3 Building SDN networks automatically with HANA

one address configuration, reducing address configuration tasks to one one-hundredth.

We have collaborated with manufacturers to build the HANA network device automatic IP address allocation mechanism into the most popular L3 switch hardware devices (Figure 2). Earlier, we achieved 2 Gbps on each of 8 ports on a test PC using software, but by implementing in hardware, we are able to use HANA with 10 Gbps performance on each of 48 ports. Using HANA-capable L3 switches, the IP address only needs to be set on the L3 switch that is the core of the network, and all other L3 switches, PCs and other devices have their IP addresses set automatically. Using HANA greatly reduces work for network administrators and network downtime due to human error in network configuration, so networks with high availability can be built. These L3 switches have been installed in NICT Headquarters Building 5 and are in trial operation.

Building SDN Networks Automatically with HANA

SDN can be used to control network flow automatically, but when building an SDN, IP addresses assigned to network devices must be designed and configured manually. When designing, the administrator creates a network management table, and based on it, manages the network devices (Figure 3). Human error can occur easily during this work, and if any changes to connections are required, the same work must be repeated.

By using HANA for configuration of an SDN network, design and configuration of IP addresses is automated, and at the same time, the network management table is also generated automatically. The SDN controller then performs flow control and other tasks based on the IP addresses generated automatically by HANA. Using HANA to automate construction of SDN networks, SDN network services can be provided rapidly. The workload for network administrators also decreases, and human error in configuring IP addresses can be prevented.

Future Prospects

With SDN, even more networks will be built dynamically for various services in the future. HANA contributes to building these networks automatically.

NICT is providing trial SDN networks, such as Research Infrastructure for large-Scale network Environment (RISE) and Japan-wide Orchestrated Smart-sensor Environment (JOSE), that can be built dynamically for various services. We will demonstrate the effectiveness of HANA by building it into these networks so they can be built automatically, and will continue to develop it in society.

Component device	Off-the-shelf L3 switch
Throughput	10Gbps per port
# of I/O ports	48 ports

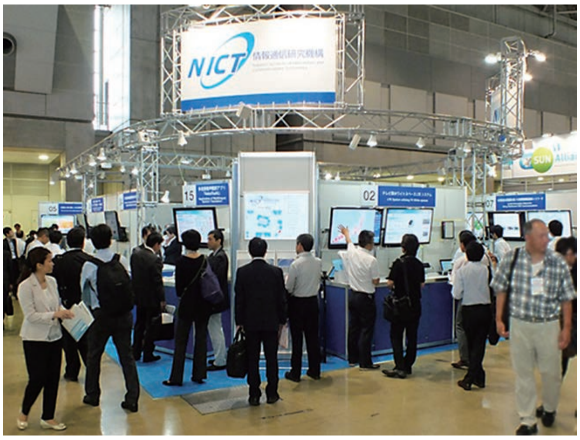
Figure 2 HANA-capable L3 switch

Report on WIRELESS TECHNOLOGY PARK 2015

Planning Office, Wireless Network Research Institute

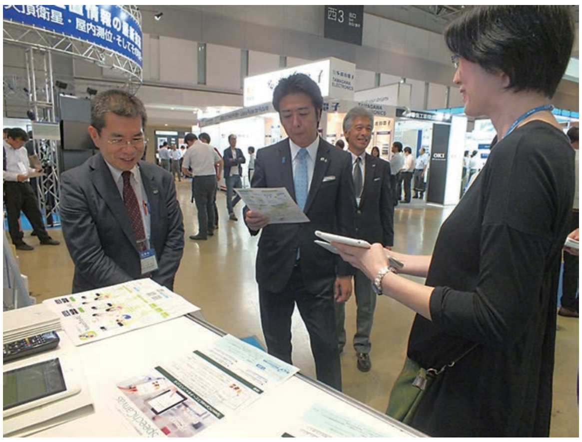
From May 27 to 29, 2015, at Tokyo Big Sight, NICT held the Wireless Technology Park 2015 (WTP 2015) in collaboration with the YRP R&D Promotion Committee and the YRP Academia Collaboration Network.

WTP is an event specializing in wireless technology R&D, composed of an exhibition presenting the latest wireless technologies, seminars focused on trends in wireless communications, and academic sessions for university research laboratories to present their research. For this tenth year of the event the theme was, "Social Innovation evolved with Wireless Technology". It was a great success, with attendance of approximately 45,000.



NICT booth, crowded with many visitors

From "NICT Session—NICT's latest trend of researches in wireless field"



Mr. Soichiro TAKASHIMA (second from the left), Mayor of Fukuoka City, receiving an explanation of VoiceTra4U, the application software of multilingual translation

Approximately 120 organizations exhibited at the exhibition, and the latest technologies related to 5th-generation cellular phones attracted great interest from visitors. In planned exhibits, there were seven facilities exhibiting in the "Intelligent Transportation Systems (ITS)" pavilion, 18 facilities exhibiting in the "Latest technologies in position and location data—Quasi-Zenith Satellite and Indoor Positioning and Applications" pavilion, and there were also very popular sections for ICT Utilization, Industry Collaboration, and History Exhibits.

NICT had 15 exhibits of the latest research results showing promise for use in real society, including "LTE System utilizing TV White-spaces", "Just Put on! Sheet Medium Communication for Data and Power Transmissions", "Synergy of Phased Array Weather Radar with Social Big Data Utilization for Disaster Prevention/Reduction", and "Application of Multilingual Speech Translation".

The seminars were divided into 26 courses by theme, and there were 125 presentations by experts from industry, academia and government. NICT contributed 11 presentations, including "NICT Session—NICT's latest trend of researches in wireless field", and "Social ICT— Social Renovation with ICT –ICT Solutions to tackle Social Issues–".

We will continue to work even harder to enrich the offering for next year, and hold an event that will be satisfying all of our participants.

Report on Interop Tokyo 2015 Exhibition

NICT presented exhibits at Interop Tokyo 2015, an event specializing in networking technology held from June 10 to 12, 2015, at Makuhari Messe in Chiba City. The theme was "New Generation Network Technologies Cultivating the Big Data Era", and many visitors came to see our exhibits of the latest research results on new generation network technologies, testbed technologies, and network security technologies. In one corner of our booth, we also held mini lectures on the latest network and network security technologies, which overflowed into the walkway with visitors. This reflected the high degree of interest in these technologies.

We also provided exhibit space to venture companies that presented at the "FY2014 Kigyouka Expo", in order to facilitate business matching with attendees.

NICTER Mini lecture

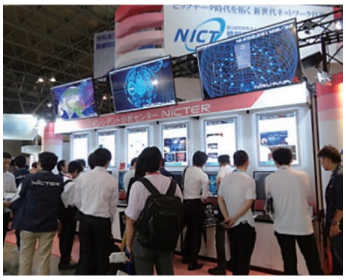
Exhibit content

Multi-tenant SDN for the IoT era

We introduced multi-tenant SDN allocation technology, which efficiently builds infrastructure-sharing management platforms, such as IoT infrastructures and networks that can quickly accommodate multiple tenants reaching to edge services, with separate tenants for services that require different functionality (routing, security standards, etc.) and different devices that comprise the service.

NICTER (Network Incident analysis Center for Tactical Emergency Response)

An exhibit was given demonstrating NICTER, which provides a highly accurate, real-time analysis of cyber attacks occurring on the network, together with spin-off technologies including NIRVANA, DAEDALUS, NIRVANA Kai, and a functionally advanced NIRVANA Kai.



FY2014 Kigyouka Expo venture company

Six of the venture companies that presented at "FY2014 Kigyouka Expo" on March 4, 2015, made presentations of their businesses and new services.

Awards

Junta MIZUNO / Researcher, Information Analysis Laboratory, Universal Communication Research Institute

Keita NABESHIMA, Naoaki OKAZAKI, Kentaro INUI (Graduate School of Information Sciences, Tohoku University)

The 2014 Web Intelligence Congress

The 2014 Web Intelligence Congress AMT 2014 BEST PAPER AWARD

(August 13, 2014)

"Mining False Information on Twitter for a Major Disaster Situation"

Active Media Technology 2014 (AMT2014) is an international conference on technologies using Web data, sensor data and other digital data. We are very pleased that our paper was chosen for this award, the only one among the 54 accepted papers. Our research extracts false information from the tens of millions of tweets posted during the Great East Japan Earthquake, using expressions correcting the posts. This is a result of research done jointly with Tohoku University, and we will continue increasing our efforts in the future.

From the left: Keita NABESHIMA, Junta MIZUNO

Koji ZETTSU / Director of Information Services Platform Laboratory, Universal Communication Research Institute

The Database Society of Japan (DBSJ)

DBSJ Young Researcher's Achievement and Contribution Award

(March 3, 2015)

For excellent research in the field of databases and great contributions to the activities of the Database Society of Japan

It is a great honor to receive the DBSJ Young Researcher's Achievement and Contribution Award. I intend to continue to work to produce synergistic effects between the society and NICT, to respond to the demands of the big & open data era. I would like to offer a heartfelt thanks to all who have supported me till now.

From the left: Masaru KITSUREGAWA, Director of the Database Society of Japan, Koji ZETTSU

Daisuke MAKITA / Researcher, Cyber Tactics Laboratory, Cybersecurity Research Center
Junji NAKAZATO / Researcher, Cybersecurity Laboratory, Network Security Research Institute
Daisuke INOUE/ Director of Cybersecurity Laboratory, Network Security Research Institute

Katsunari YOSHIOKA (Yokohama National University), Tsutomu MATSUMOTO (Yokohama National University), Jumpei SHIMAMURA (clwit, Inc.)

Information Processing Society of Japan

Specially Selected Paper

(March 15, 2015)

"Correlation Analysis between DNS Honeypot and Darknet toward Proactive Countermeasures against DNS Amplification Attacks"

This paper analyzes a type of DoS attack called a DNS Amplification attack and shows that precautionary and early response measures are possible. The paper further develops research results submitted to the 2014 Symposium on Cryptography and Information Security (SCIS), and was submitted to the Information Processing Society of Japan Journal. I am very proud to have received a paper award from SCIS, and then this honor from IPSJ. I would like to express deep gratitude to all supporting me in receiving this award.

From the left: Daisuke INOUE, Daisuke MAKITA, Junji NAKAZATO

Ryu IIDA / Senior Researcher, Information Analysis Laboratory, Universal Communication Research Institute
Atsushi FUJITA / Senior Researcher, Multilingual Translation Laboratory, Universal Communication Research Institute

Yuichiroh MATSUBAYASHI (Tohoku University), Ryohei SASANO (Tokyo Institute of Technology), Hikaru YOKONO (National Institute of Informatics), Suguru MATSUYOSHI (University of Yamanashi), Yusuke MIYAO (National Institute of Informatics), Kentaro INUI (Tohoku University)

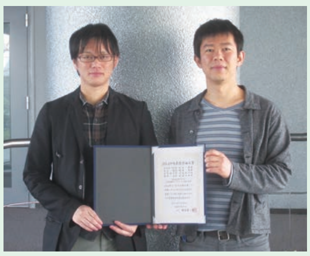
The Association for Natural Language Processing

Best paper award (First place)

(March 18, 2015)

"Issues on Annotation Guidelines for Japanese Predicate-Argument Structures"

This research discusses how to formulate two essential problems in natural language processing in Japanese, i.e., discourse analysis such as zero anaphora resolution and predicate-argument structure analysis, in which the relationship between a predicate and its arguments (noun phrases) is identified, and how to create a dataset for training and evaluating the analyzers for these tasks. Our paper was selected as the Best Paper among those published in the Journal of Natural Language Processing in 2014. Being encouraged by this award, we will continue to contribute to advancing natural language processing technology.



From the left: Ryu IIDA, Atsushi FUJITA

Maya MIZUNO / Senior Researcher, Electromagnetic Compatibility Laboratory, Applied Electromagnetic Research Institute
Kaori FUKUNAGA / Research Manager, Electromagnetic Compatibility Laboratory, Applied Electromagnetic Research Institute

Tetsuo FUKUCHI, Norikazu FUSE (Central Research Institute of Electric Power Industry)

The Institute of Industrial Applications Engineers

Best Paper Award, The 3rd International Conference on Industrial Application Engineering

(**March 31, 2015**)

Surface Roughness Measurement Using Terahertz Waves

In collaboration with the Central Research Institute of Electric Power Industry (CRIEPI), we have shown that measuring surface roughness of non-metallic materials based on terahertz wave effective reflectance is possible. It promises to improve the accuracy of thermal transmission rate calculations in the future, by applying it for non-destructive testing of heat-shield coatings for thermal power generation gas-turbine blades. Thank you to all related persons who provided cooperation in advancing this research.

From the left: Kaori FUKUNAGA, Maya MIZUNO

Takuya TSUGAWA / Planning Manager, Strategic Planning Office, Strategic Planning Department

Akinori SAITO (Kyoto University) (Leader), Yoko ODAGI (Kyoto University), Hiroki ICHIKAWA (Ehime University), Noriyuki NISHI (Fukuoka University)

The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology

Prizes for Science and Technology (Public Understanding Promotion Category) (April 15, 2015)

Public Understanding Promotion of Earth and Planetary Science with Three-Dimensional Digital Globe

The "Dagik Earth" is an educational project with a three dimensional digital globe to enable users in schools or at home to enjoy science and the latest research related to topics including the earth, the planets and space weather. We have participated in this project since it began, especially in areas such as large-screen display system development. We have used it in outreach such as exhibition events and visiting lectures. We are very happy that these activities have been evaluated so highly. We would like to express deep gratitude to everyone providing support and encouragement .

From the left: Takuya TSUGAWA, Yoko ODAGI, Hiroki ICHIKAWA

Takashi UEGUCHI / Senior Researcher, Brain Imaging Technology Laboratory, Center for Information and Neural Networks

Japan Society of Medical Physics

The Congress Chair Award of the 109th Scientific Meeting of the Japan Society of Medical Physics

(**April 19, 2015**)

Improved T1 correction for cardiac-triggered fMRI at ultra-high field

Ultra-high-field MRI is expected to improve the spatial resolution of functional neuroimaging because of its intrinsically high signal sensitivity. However, the enhanced susceptibility to a wide variety of physiological noise often limits overall performance in detecting weak signal changes related to brain activity. Our study aims to develop a novel method that reduces cardiac-related physiological noise. We are elated and honored to receive the award for this study. We would like to express our deep gratitude to everyone else involved in this research.

Satoshi SHINADA / Deputy Director of the Ministry of Internal Affairs and Communications
Hiroaki HARAI / Director of Network Architecture Laboratory, Photonic Network Research Institute
Hideaki FURUKAWA / Senior Researcher, Network Architecture Laboratory, Photonic Network Research Institute

The New Technology Development Foundation

The Ichimura Prize in Science for Excellent Achievement

(**April 23, 2015**)

Development of Optical Packet and Circuit Integrated Node

This prize winning R&D performs optical switching on diverse content with optical packet and circuit integrated node equipment that simultaneously provides both optical packets, which share communication channels and use resources efficiently, and optical circuits, which obtain high quality by occupying channels exclusively. It will realize reduction in power consumption and more efficient use of communications resources. We offer deep gratitude to everyone in industry, universities and other facilities, and associates at NICT for their cooperation toward receiving this award. We will work to contribute in this field even more in the future.

From the left: Hiroaki HARAI, Satoshi SHINADA, Hideaki FURUKAWA

NICT Open House 2015

October 22 & 23 (Thu.&Fri.) 9:30–17:00 (Closing time: 16:30 on Oct. 23)

NICT will be holding the "NICT Open House 2015", introducing our latest research results through lectures, laboratory tours, demonstrations, and panel exhibits.
＊ For details, please see the upcoming Open House Web site.

Opening Ceremony

■ Special Lecture

Dr. Hideyuki TOKUDA
Professor of Faculty of Environment and Information Studies, Keio University

October 22 (Thu.) from 10:00
(Free admission, no reservations required)

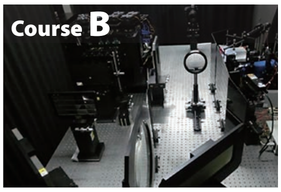
Lectures

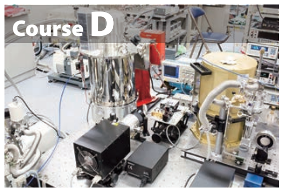
■ Lectures by NICT researchers on the latest research results

October 22 (Thu.) afternoon
October 23 (Fri.) morning and afternoon
(Free admission, no reservations required)

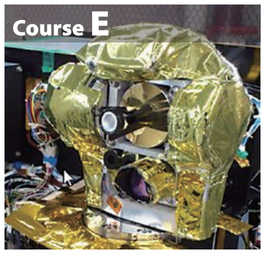
Laboratory Tours **Reservations required** (Free admission) October 22 & 23 (Thu. & Fri.)

■ Introducing the latest research activities through laboratory tours.





Course A | Advanced optical semiconductor device production environment : Clean room
Course B | Electronic holography three-dimensional image
Course C | Visualizing scientific Big Data
Course D | Terahertz transceiver systems: Research utilizing untapped radio frequencies
Course E | Telescopes enabling optical communications with satellites



Technical Exhibition

■ Many demonstrations and panel exhibits of the latest research results

October 22 & 23 (Thu.&Fri.)
(Free admission, no reservations required)

Location: NICT Headquarters
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