NICT NEWS
独立行政法人
情報通信研究機構
National Institute of Information and Communications Technology
2011
SEP
No.408
9

NIRVANA: nicter Real-network Visual Analyzer

—Network Administration Support Tool that Shows Traffic in Real Time—

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After completing a doctoral course in engineering, Inoue joined Communications Research Laboratory (currently NICT) in 2003. After researching security for a new -generation mobile network project, he has been researching and developing network security, focusing on the Network Incident analysis Center for Tactical Emergency Response (nicter) since 2006. Ph.D. (Engineering)

Introduction

Networks have spread to every corner of our lives. Using handheld devices and tablet computers, we can access huge amounts of data stored elsewhere in the world and hold video-conferences with overseas colleagues. The communications environment surrounding us in the early 21st century seems to be evolving faster than Gene Roddenberry, the creator of Star Trek, could have imagined (Of course, subspace communications are not yet possible.). When it comes to network administration to ensure that the communications environment is functioning properly, however, we still cannot leave these duties entirely to a computer, such as that on board the U.S.S. Enterprise. This has always caused trouble for modern network administrators.

To mitigate the burden of network administration, which has become increasingly complex as communications technology advances, the Cybersecurity Laboratory of the Network Security Research Institute has developed NIRVANA *1. NIRVANA visualizes the traffic flowing through a network in real time, which allows a network administrator to promptly check the network for proper connections, fault detection , congestion, and settings errors. The support tool makes the network administration duties in an organization much more efficient. The mechanism of visualization is based on a group of technologies used in the Network Incident analysis Center for Tactical Emergency Response (nicter), which is currently under development in the laboratory.

From Darknet to Livenet

The nicter conducts large-scale monitoring of unused IP addresses (hereinafter, referred to as the darknet) using multiple sensors installed on the Internet to detect cyber-attacks at an early stage. Malicious traffic (hereinafter, darknet traffic) enters the darknet in large quantities, including malware*2 scanning for the next target of infection. The nicter automatically analyzes darknet traffic and visualizes it in real time. R&D activities are underway to make sure that prompt security operations are taken.

NIRVANA is a spin-off that applies the visualization technologies that were developed for darknet traffic in the nicter to livenet traffic (the traffic that flows through an actual network connected to a user's terminal or server). The result is a powerful network administration support tool.

System Structure of NIRVANA

NIRVANA consists of three sub-systems: a sensor system that collects traffic from the network to be monitored, a gate system that combines the collected traffic, and a visualization system that visualizes the combined traffic (see Figure 1). The system has the same structure as nicter's darknet monitoring system.

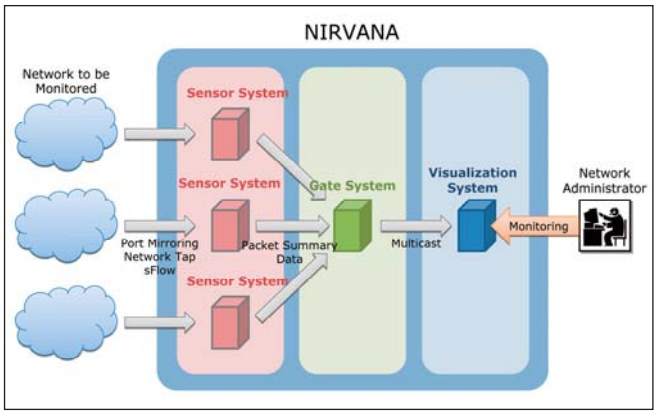

Figure 1●System Structure of NIRVANA

The sensor system accepts livenet traffic as input. This input is copied or branched through port mirroring or a network tap from the network to be monitored. It also accepts information sampled using sFlow*3, which allows flexible selection of the monitoring method according to an organization's network environment. Multiple sensor systems can be installed in the network to be monitored. Therefore, the system can be used even when an organization's network is distributed throughout the country.

The livenet traffic is converted to packet summary data*4 in the sensor system, and then combined and multicast using the gate system before entering the visualization system. It is also possible to install multiple gate systems according to an organization's network scale.

The visualization system receives the multicast packet summary data from the gate system and displays the data in real time as 3D animations. Since the information necessary for visualization is multicast, monitoring at multiple points is possible by adding hardware that allows the visualization system to receive multicasts when the network has more than one administrator.

*1 nicter real-network visual analyzer

*2 The collective term for the software that is designed to obtain information without authorization, destroy data, infect other computers, or engage in other abusive behavior. The term covers viruses, worms, Trojan horses, spyware, and bots, and was coined from "malicious" and "software."

*3 sFlow is an Internet standard (RFC 3176) for a technology that collects information from network switches, etc., thereby making administration of faster and bigger networks more efficient.

*4 This data is used for compressing packets into the header information of the network and transport layers and the hash values of the application layer. Compared with livenet traffic, the data volume can be significantly smaller.

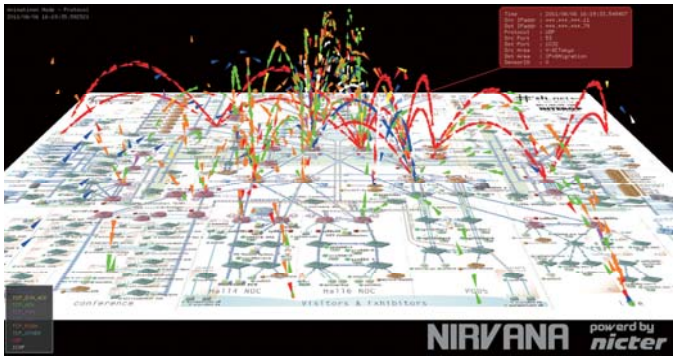

Figure 2●Visualization of Livenet traffic using NIRVANA (packet mode) *10

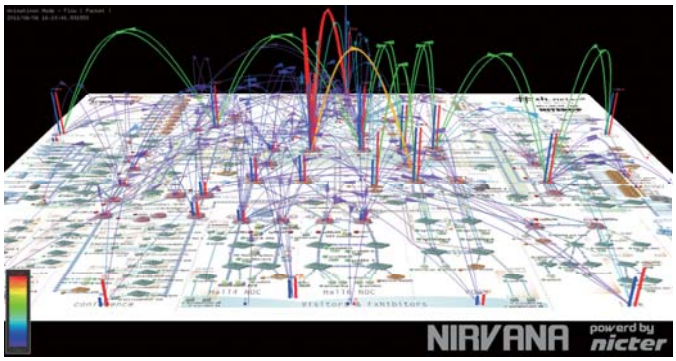

Figure 3●Visualization of Livenet traffic using NIRVANA (flow mode) *10

The visualization system can operate alone and also can use a locally saved PCAP file*5 for visualization.

Visualization of Livenet using NIRVANA

The NIRVANA visualization system has been designed and developed with emphasis on real-time operation, interactivity, and customizability. The livenet traffic visualized in real time can be zoomed in or out, looked at from a different point of view, paused, and shown in detail through operations by a network administrator. In addition, a variety of parameters can be customized, including the shape and color of a 3D object, the height of a circle, and the speed. The filtering functions also vary and allow traffic to be filtered by source/destination IP address, protocol, port number, ID of the sensor system, etc.

NIRVANA provides two modes: packet mode and flow mode. The packet mode visualizes livenet traffic by packet, which works especially well for checking network connections and detecting faults in a path. Figure 2 is a visualization of traffic in the packet mode, obtained when NIRVANA was installed in ShowNet*7, the network for the Interop Tokyo*6 2011 exhibition site. The different colors for each packet (rocket) correspond to the different types of packets*8, and the height of the circle for each packet is proportional to the size of the port number (logarithmic axis). The top-right window in red shows detailed information about a selected packet. Packets hop from router to router, and the path a packet takes is determined by the combination of source/destination IP addresses with a routing table obtained periodically by means of OSPF*9. Therefore, if the path changes during monitoring, the system can track it dynamically.

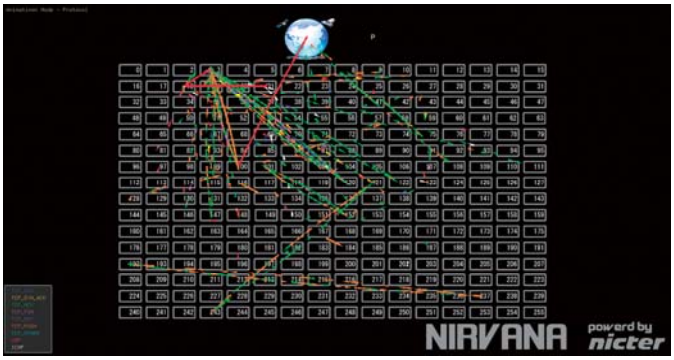

Figure 4●Visualization of traffic between address blocks using NIRVANA

On the other hand, the flow mode provides an intuitive understanding of the traffic volume. In the flow mode, a ribbon-shaped curve is used to express the traffic volume between network devices, while the height, width, and color of the curve represents the relative flow volume. Figure 3 is a visualization of the ShowNet traffic in the flow mode. The hopping between core routers, shown at the center of the chart, is expressed with a red ribbon, which indicates that the traffic volume flowing between those devices is the largest in the network. The blue and red bars displayed on each device represent the number of packets sent and received (or the data volume, depending on the setting), respectively. Using the flow mode enables the prompt detection of network bottlenecks. The combination of flow and packet modes drastically reduces network administration.

A network diagram of NIRVANA can be created with Microsoft Visio*11, a diagramming tool. NIRVANA can read the IP address for each object (network device) in a network diagram and automatically set the IP address on the coordinates of the diagram. Therefore, even organizations that frequently change their network structure can easily update the NIRVANA network diagram. Administrators also can create their own types of network diagrams. Figure 4 shows an example of the network diagrams that the Information Systems Office at NICT uses for daily administration tasks. In this chart, boxes are allocated for each IP address block of /24 (256) and the traffic between those address blocks is visualized (The globe at the top represents the network outside of NICT.). NIRVANA has been in operation at the Information Systems Office for about two years and has made network administration much more efficient. Moreover, it has uncovered quite a few settings errors and security incidents.

Conclusion

The development of virtualization technologies and the spread of cloud computing have made network administration increasingly complicated. To ease the burden, we will further develop and disseminate NIRVANA, a spinoff of research at nicter.

*5 A file format for saving packet information that is flowing on networks. The format is used in many network administration tools (tcpdump, Wireshark, etc.).

*6 One of the world's largest annual events in the networking field. Several hundred companies exhibit the latest network devices and solutions and many lectures and conferences are held.

*7 The network that connects the entire Interop exhibition site. It was created by domestic and international network vendors using state-of-the-art network devices.

*8 In Figure 2, blue = TCP SYN, yellow = TCP SYN-ACK, green = TCP ACK, pink = TCP FIN, purple = TCP RST, orange = TCP PUSH, light blue = TCP OTHER, red = UDP, and white = ICMP.

*9 Short for Open Shortest Path First. It is a routing protocol for creating a routing table for the shortest path using Dijkstra's algorithm.

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*11 Microsoft and Visio are trademarks or registered trademarks of Microsoft Corporation in the U.S. and other countries.

Data Hiding and Watermarking

—Enriched multimedia for advanced functionality and usability—

Ryouichi Nishimura

Expert Researcher, Multisensory Cognition and Computation Laboratory, Universal Communication Research Institute

From 1998 to 2000, Nishimura was a Visiting Researcher at the Media Integration and Communications Research Laboratories, ATR. He was a Research Associate at Tohoku University from 2000 to 2004, and then an Associate Professor until November 2006. He currently is a Research Expert at National Institute of Information and Communications Technology (NICT), where he has been working mostly on audio signal processing for realistic sound.

Introduction

Data hiding and watermarking are a method of carrying additional information by manipulating not the header but the content of a multimedia file. The basic rule is that changes due to the manipulation of the data should not be perceptible to the listener when the media is played in a normal way. This kind of techniques has received considerable attention since around 2000, as a method for copyright protection, because it has an ability to store additional information indivisibly in the contents. It was during this time that more and more people shifted from buying multimedia data such as images and music as physical, packaged media to downloading them as digital data, thanks to the widespread use of the Internet.

Universal Media that Offers the Same Level of Service to Everyone

Encryption is an effective method for restricting access to the content itself. Data hiding and watermarking are therefore extending its application areas from just copyright protection to making universal media, exploiting its unique characteristics that any information can be added to the media. Please see Figure 1 for an example.

The chart shows how the quality of the sound data changes at various points for two cases: one where the sound data is directly transmitted, and the other where the sound data has additional information embedded as a watermark for repairing the data degraded through the communication channel. Media 1 has no embedded watermark. User A, closer to the source than the communication channel, enjoys the media with sound quality equal to the original signals, while User B, located beyond the communication channel, does not enjoy the same sound quality. On the other hand, Media 2 contains additional information to repair the sound quality. User A will hear slightly deteriorated sound quality because of the embedded watermark, but User B's listening experience will not be so bad because, even after passing through the communication channel, the sound quality can be restored using the information in the embedded watermark. In this chart, it should be noted that the final sound quality (b) of the repaired Media 2 is higher than the sound quality (a) of Mea 1 degraded through the communication channel. From the viewpoint of universal media, even more important thing is that the difference in the sound quality between before and after transmitting through the communication channel is smaller in Media 2 (d) than in Media 1 (c). That means that both User A and User B can enjoy similar services from the same media, regardless of their environment or situations.

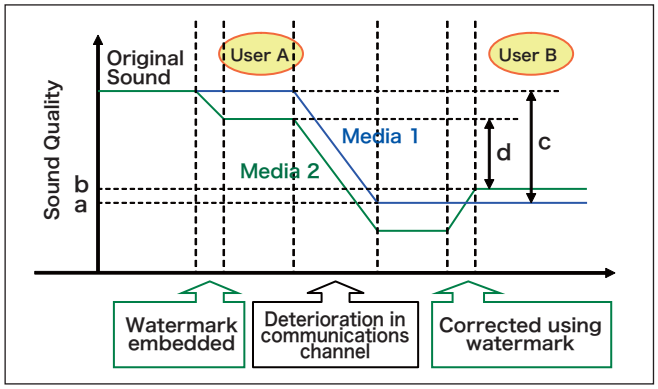


Figure 1● Shift in sound quality in the sound communication channel with and without watermark

Let's look at the same kind of services in the case of realistic communications. To allow people to perceive virtual objects as if the real ones were present, it is necessary for them to see different images and hear different sounds depending on where they stand. This goal can be achieved in two ways: reproducing the whole "scene" as physically the same as the original, or playing specific images and sounds individually to each user considering the user's situation. The former would require the communication of a huge amount of data, but it is not user-dependent. The latter does not require as much data, but does require a framework of interactive communications to acquire user's information. Taking stereo audio as an example, the former can be regarded as listening to audio through loudspeakers, and the latter as listening to audio through headphones. Listening to stereo audio through loudspeakers requires a large number of channels, while ordinary headphones need just two channels, for the right and left ears. Therefore, if we embed into the loudspeaker signal a watermark that contains the information needed to convert that signal into a headphones signal, it may be possible to create universal media that do not depend on a particular playing method.

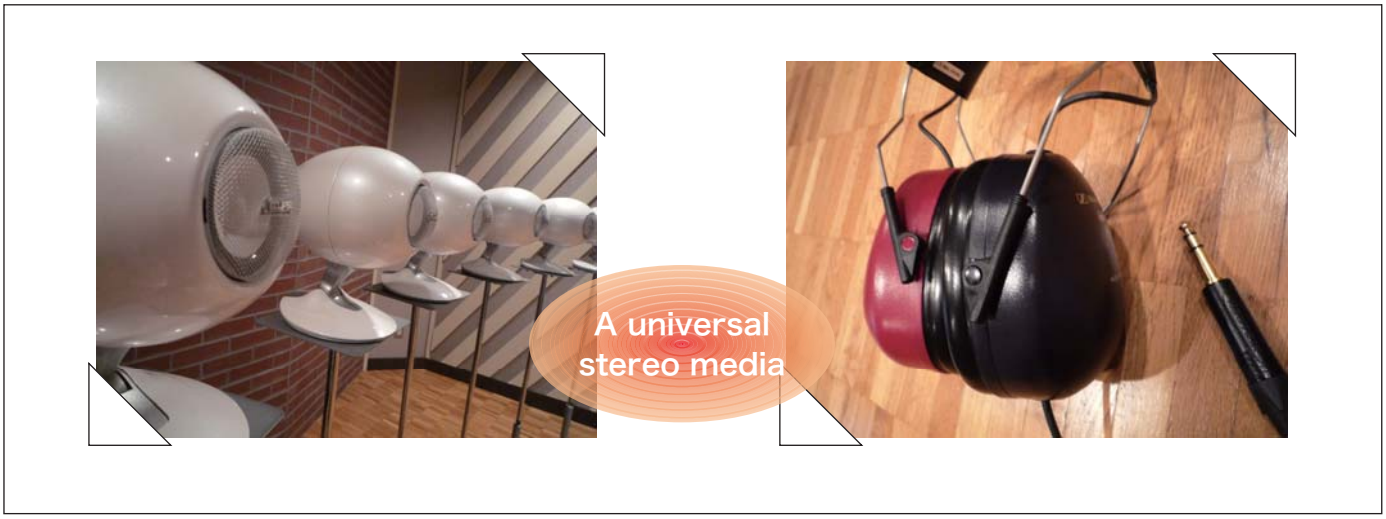


Figure 2●Universal media (stereo) that do not depend on a particular playing method

Acoustic Data Hiding and Watermarking

To manipulate multimedia information so that people do not perceive the changes, we first need to understand how we perceive things. Through complicated processing, the human auditory system (HAS) converts physical air vibrations into sounds that can be perceived for human beings. The HAS has many unique properties. Masking properties*1 are the ones most frequently used for watermarking. Typical masking properties include temporal masking and frequency masking, both of which can be attributed to the mechanism of the cochlea*2 in which the frequency of vibration is analyzed and converted into the firing*3 of the auditory nerves or to the transmission properties of the nerves. Figure 3 schematically illustrates these masking phenomena. The signals that are close to a loud sound with regard to time or frequency are less likely to be perceived. With further research, we may find other HAS properties that are usable for embedding watermarks.

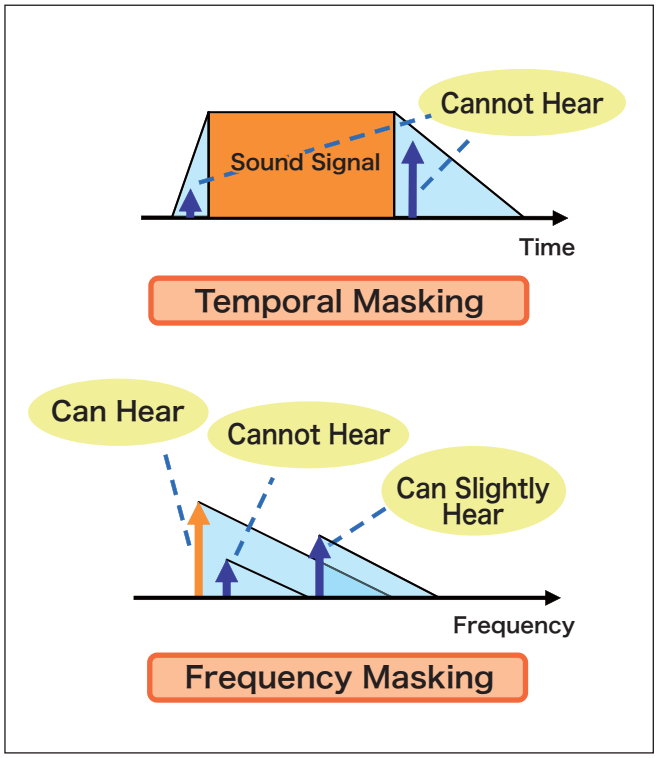


Figure 3●Conceptual diagram of temporal masking and frequency masking

Future Perspective

Data hiding and watermarking can provide additional, hidden communication channels. As with ordinary communication lines, this platform is not useful until valuable services are built upon it. At first, copyright protection services gained attention because of the indivisible relationship between the content and the embedded information, but data hiding and watermarking techniques have much greater potential if you go back to their original functions. We hope that more useful services and various applications for our lives will be developed in the future.

Glossary

*1 Masking Phenomenon
The phenomenon in which sounds that can be heard in a normal situation become difficult to hear due to the presence of other sounds.

*2 Cochlea
Situated in the inner ear, the cochlea contains a cochlear duct, one of the sensory organs of the human auditory system (HAS). In mammals, the cochlear duct is shaped like a snail.

*3 Firing
The condition in which the membrane potential of a nerve cell becomes positive, spiking in response to a stimulus.

Single-celled Organism Tetrahymena Control Two Different Genomic Information

—Understanding and application of their regulatory mechanism—

Masaaki Iwamoto

Expert Researcher, Bio ICT Laboratory, Advanced ICT Research Institute

After completing a doctoral course of graduate school, worked for University of Hawaii at Manoa as a research fellow. Joined in NICT in 2004 as a Guest Researcher. Has been engaged in the research in the molecular mechanism of the regulation of genomic information in cells. Ph. D. (Science)

To apply the systems of living organisms, first understand the living organisms themselves

More and more technologies that mimic the characteristics of living organisms are being developed in various fields, including information communication. Living organisms are great models for developing new technologies due to their autonomy, robustness, adaptability to the environment, information processing capability, and self-repairing and self-renewal capabilities. Living organisms have acquired those characteristics in the process of evolution, and have modified and improved them through the struggle for survival. Among those characteristics are countless eccentric and novel systems that we could never imagine. To extract something useful from those systems efficiently, we must first thoroughly understand the living organisms.

The object of my experiment is a single-celled organism, called Tetrahymena (*Tetrahymena thermophila*) (see Figure 1). Japanese people call something that is very simple a single cell, but I believe this is a wrong usage of the words. In reality, many single-cell organisms have very complicated cell structures and functions. That should be no surprise since they manage to conduct with just a single cell the very same activities that we humans need 60 trillion cells to conduct. Unlike the cells of an animal, which are always in a stable environment inside a body, single-celled organisms live in a drastically-changing environment. Those having won the struggle for survival in such a harsh environment are particularly robust and able to adjust very well to their environment. They have reached the very top of the cell evolutionary process.

Tetrahymena Uses and Passes down Genomic Information in a Special Way

The genomic information of a living organism is contained in the cellular nucleus as nucleotide sequences of DNA. A set of DNA is called a genome. Comparing a cell to a computer, the cellular nucleus is a hard disc*1 and the genome is information. The more the information in a hard disc is used, the more it is damaged. That means the DNA sequences are damaged. A cell can repair the damage, but if too many areas are incorrectly repaired or become irreparable, the cell, much like a computer, can no longer work properly. This is the aging of a cell, and some cells may become out of control and cancerous. To avoid further damaging genomic formation, it is better not to use the information, but this is impossible for a living cell.

Tetrahymena, however, pulls it off. They duplicate the genome (information), store the two sets separately in two types of cellular nuclei (hard discs) (see Figure 1), use one for living activities, and save the other as an unused backup. The genome that is used is stored in the macronucleus (MAC), and the DNA sequences are re-edited so that the genomic information can be efficiently taken out in large amounts. This information is then amplified several dozen to several hundred times (see Figure 2). The macronuclear genome that is used in daily life will be disposed of at the end of a generation. On the other hand, the genome contained in the micronucleus (MIC) is highly compressed and used only in an emergency (specifically, when no nutrition is available), not in daily life. When the time comes, they produce offspring through cross-fertilization*2 with a cell of the opposite sex. The micronuclear genome is used to form the new cellular nucleus of the offspring.

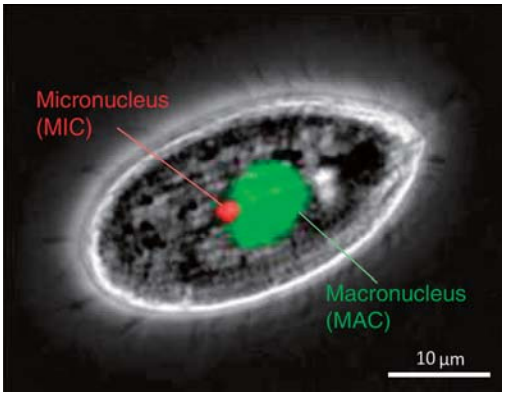


Figure 1●Single-celled organism *Tetrahymena thermophila*
They have two distinct nuclei, MAC and MIC, in their cytoplasm.

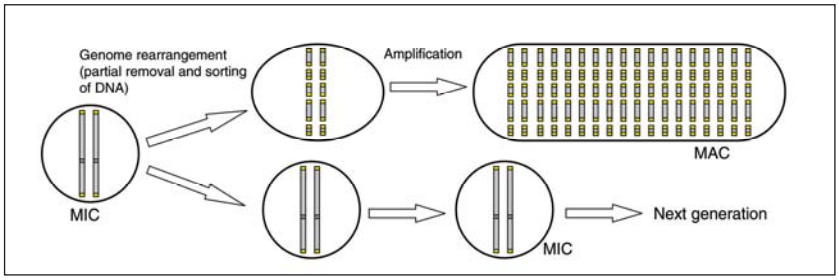


Figure 2●MAC genome differentiates from MIC genome
The ends of each DNA colored in yellow indicate telomere sequence*3.

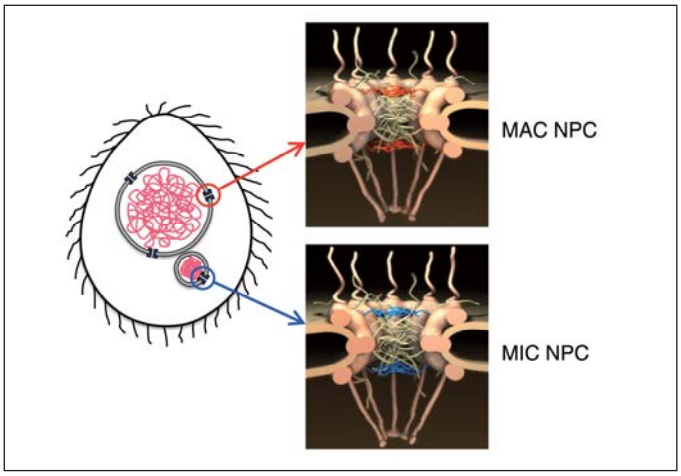


Figure 3●Nuclear pore complex and Nup98 of *Tetrahymena*
Both MAC and MIC are surrounded by double membrane structure called 'nuclear envelope' (gray in left illustration). In the models of the nuclear pore complex in right, upper and lower sides are cytoplasm and nucleus, respectively. Nup98 is indicated by orange in the macronuclear NPC and by blue in the micronuclear NPC.

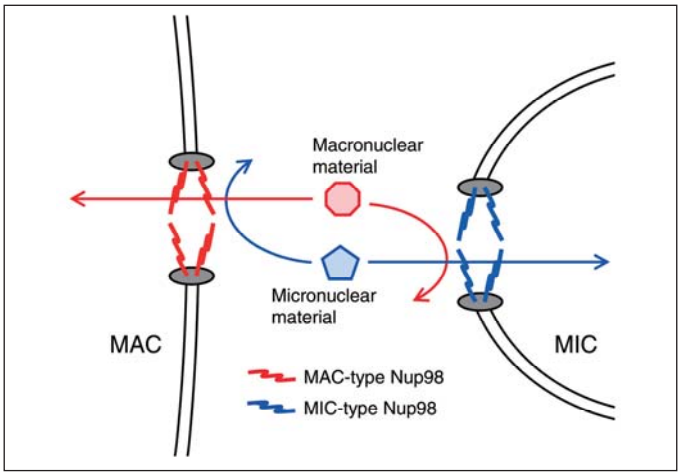


Figure 4●Barrier effect to misdirected nuclear transport by Nup98

Obvious Difference in How Two Types of Genomes are Accessed

Figuratively speaking, the Tetrahymena computer (cell) contains two types of hard discs (cellular nuclei). So how does the operating system access the genome information on a hard disc? We suspect that the molecular basis for the special control over the genomic information by Tetrahymena resides there, and we have investigated the mechanism. The cellular nucleus is separated from the cytoplasm by the nuclear envelope, giving it a partitioned structure (Figure 3). Holes in the nuclear envelope, called nuclear pores, provide access to the nucleus from the cytoplasm. This allows genomic information to be taken from the nucleus and transported to the cytoplasm. If the nuclear pores have the same structure, however, the two types of hard discs could not be distinguished and controlled separately. Based on this theory, we identified the protein components of the nuclear pores and analyzed their functionality.

A nuclear pore is a passage way formed from a structure called the nuclear pore complex (NPC) which consists of about thirty types of proteins (see Figure 3). Comparing the components of the nuclear pore complex of the MAC with those of the MIC, shows that one of the protein components exposed on the inside of a pore, nucleoporin 98 (Nup98), is totally different in the MAC and the MIC (see Figure 3). Nup98 is a functional protein, essential to the bi-directional transportation of substances between the cytoplasm and the cellular nucleus. In the case of Tetrahymena, we found that the MAC's Nup98, which exists in the nuclear pore of the MAC, prevents substances intended for the MIC from being transported into the MAC, and vice versa (see Figure 4). Our research showed that this system ensures that the substances involved in the control over each genome are transported correctly. Tetrahymena takes advantage of the structural difference in the access paths to the nucleus to skillfully control the genomic information on the two types of hard discs.

Conclusion

According to fossilized amber from a couple of hundred million years ago, some ciliate such as Tetrahymena and Paramecium, had almost the same shapes as they do now. Their origin may date back another several hundred million years. That means ciliate developed very early on a system to use a great amount of genomic information and establish a backup. This was surprising and made me think that the system's robustness and flexibility were good enough to make them evolutionary winners. This clever system for distinguishing two sets of genomic information is not only intriguing biologically, but figuring out the mechanism may lead to new applications in cell engineering. For example, if we make an artificial cell or micro-machine that incorporates a DNA computer, we may be able to equip the machine with more than one hard disc, each containing different information, so that it becomes a multi-function machine that can switch discs and information. We also may be able to equip the machine with a system that automatically creates a new hard disc from the backup when the original disc is damaged.

The research unveiled the mechanism of how the ciliate correctly transports substances from two types of cellular nuclei. In recognition of this breakthrough achievement in protozoology research, we received the Award of the Japan Society of Protozoology in 2010.

Glossary

∗1 Cellular Nucleus Hard Disc
The genomic information contained in a cellular nucleus as a hard disc is read-only, and new information cannot be written to the DNA sequences.

∗2 Cross-fertilization
Cross-fertilization of a single-celled organism is called "mating." In mating, the cells of two organism of opposite sex attach and exchange genomic information. After mating, a cell is born with a new genotype that is a mixture of the genomic information from the two parent cells, and a new generation begins.

∗3 Telomere
This is a special area of sequences that protect the DNA. The macronucleus (MAC), where fragmented DNA exists, contains lots of telomeres. The telomere sequences were first discovered in Tetrahymena, and the research led to the Nobel Prize in Medicine in 2009.

Prize Winners

Prize Winner ● Koumei Sugiura / Expert Researcher, Spoken Language Communication Laboratory, Universal Communication Research Institute
Naoto Iwahashi / Expert Researcher, Spoken Language Communication Laboratory, Universal Communication Research Institute

Joint Prize Winners:
Muhammad Attamimi (The University of Electro-Communications)
Akira Mizutani (The University of Electro-Communications)
Tomoaki Nakamura (The University of Electro-Communications)
Takayuki Nagai (The University of Electro-Communications)
Hiroyuki Okada (Tamagawa University)
Takashi Omori (Tamagawa University)

◎Date: 2011/5/3, 2011/5/5

◎Name of Prize:
RoboCup Research Award, The Japanese Society for Artificial Intelligence Award, Champion in RoboCup Japan Open@Home League

◎Details of Prize:
In recognition of excellent results from research into "Learning Novel Objects Using Out-of-Vocabulary Word Segmentation and Object Extraction for Home Assistant Robots"

◎Name of Awarding Organization:
Japanese Committee of RoboCup, The Japanese Society for Artificial Intelligence

◎Comments by the Winner:

It is a true honor for us to receive the RoboCup Research Award for our article on the dialogue technology of a robot that can learn unregistered words. We also took first prize in the home robot section in RoboCup Japan Open and won high recognition with the Japanese Society for Artificial Intelligence Award. We especially extend our appreciation to Yutaka Kidawara, Director General of the Universal Communication Research Institute, and Hideki Kasioka, Director of the Spoken Language Communication Laboratory, who gave us valuable guidance and support for our research and development efforts, and the other members of the laboratory staff. The recognition gives us huge encouragement, and we are determined to aim for even higher goals in our research and development efforts.


From left: Naoto Iwahashi, Koumei Sugiura

Prize Winner ● Chiori Hori / Senior Researcher, Spoken Language Communication Laboratory, Universal Communication Research Institute

Joint Prize Winners:
Satoshi Nakamura
(Former Director General of NICT Keihanna Research Laboratories / currently with the Nara Institute of Science and Technology)
Jun Matsumoto
(Former NICT Invited Advisor)

◎Date: 2011/5/17

◎Name of Prize:
The ITU Association of Japan Award, International Cooperation Prize

◎Details of Prize:
In recognition of efforts in international communication activities and contributions to the international development of information communications and broadcasting.

◎Name of Awarding Organization:
The ITU Association of Japan

◎Comments by the Winner:

A countless number of languages are used around in the world. Overcoming the barrier of languages has been a long-held dream of mankind. In cooperation with other institutes around the world, we proposed a framework for speech translation by connecting through networks the speech recognition, voice synthesis, and translation modules that are widely dispersed in the world. At ITU-T, we worked on the international standardization of communications protocols between modules and the data format. I would like to express my deep gratitude to the researchers who have shared the same dream and have been working for over twenty years on speech translation projects, as well as all the supporters who have supported the researchers.

From left, Jun Matsumoto, Chiori Hori, Satoshi Nakamura

Prize Winner ● Shigeru Tsuchiya / Senior Researcher, Space-Time Standards Laboratory, Applied Electromagnetic Research Institute
Kuniyasu Imamura / Research Manager, Space-Time Standards Laboratory, Applied Electromagnetic Research Institute
Hideo Maeno / Senior Researcher, Space-Time Standards Laboratory, Applied Electromagnetic Research Institute

Joint Prize Winners:
Kenro Nozaki
(Formerly with the Telecom Engineering Center / currently with Space Engineering Development Co., Ltd)
Norio Nagahama (48th and 50th Antarctic Expedition Party Member)
Masamichi Umetsu (49th Antarctic Expedition Party Member)
Noboru Wakai (Deceased)

◎Date: 2011/5/19

◎Name of Prize:
Excellent Paper Award

◎Details of Prize:
Propagation Experiments and Method for Predicting LF and Standard Frequency Waves

◎Name of Awarding Organization:
IEICE Communications Society

◎Comments by the Winner:

To verify our method for predicting the reception field intensity of LF over long distances, we planned to demonstrate the method by putting an observation system on a ship. With data acquired from container vessels crossing the Pacific and "Shirase", the Antarctic Observation Vessel, we finally succeeded in developing a calculation method. We would like to thank everyone who has supported us. We will also tell the late Mr. Wakai, who put great efforts into the development of the prediction method, about our achievement.


From left, Shigeru Tsuchiya, Hideo Maeno, Kuniyasu Imamura

Prize Winner ● Junko Matsubayashi / Expert Researcher, Brain ICT Laboratory, Advanced ICT Research Institute

◎Date: 2011/6/3

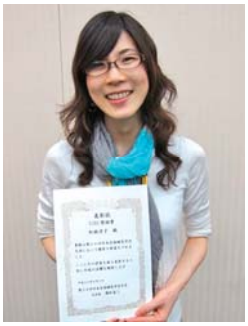
◎Name of Prize:
U35 Incentive Award, 26th Japan Biomagnetism and Bioelectromagmagnetics Society

◎Details of Prize:
In recognition of the presentation of research on the "Impact of Composite Properties of Binocular Rivalry on Brain Activity (written by: Junko Matsubayashi, Yasushi Terazono, Makoto Kato, and Tsutomu Murata)

◎Name of Awarding Organization:
Japan Biomagnetism and Bioelectromagnetics Society

◎Comments by the Winner:

To determine the mechanism of visual perception and consciousness, I have been researching a phenomenon called binocular rivalry using the magnetoencephalography device (MEG) owned by the Brain ICT Laboratory. I am greatly honored to have my research receive high recognition by the Biomagnetism and Bioelectromagnetics Society. I had difficulty in achieving results and it took me a long time to present the research, but the recognition gives me huge encouragement and I will continue to make every effort to advance the research. I would like to express my sincerest appreciation to everyone in the laboratory who has supported me and given me feedback on the research.



Report on Exhibition in Knowledge Capital Trial 2011

–Introduced Visualization Technologies and Multisensory Interaction System–

Kazuhiro Kimura, Managing Director of the Universal Communication Research Institute

NICT participated in Knowledge Capital Trial 2011 held in DOJIMA RIVER FORUM in Osaka City from Friday, August 26 to Sunday, August 28. The event was held so that ordinary citizens would have the opportunity to learn about the research activities of the companies, universities, and research institutes that will be taking part in Knowledge Capital. With a view to bringing forth new intellectual values through the fusion of creativity and technology, the Knowledge Capital facility will be built in "Grand Front Osaka" in Umekita (north of Osaka Station), an advanced development district that will open in the spring of 2013. This was the third and last trial event before the facility is completed. According to the organizer, about 11,600 people visited the event during the three days it was held.

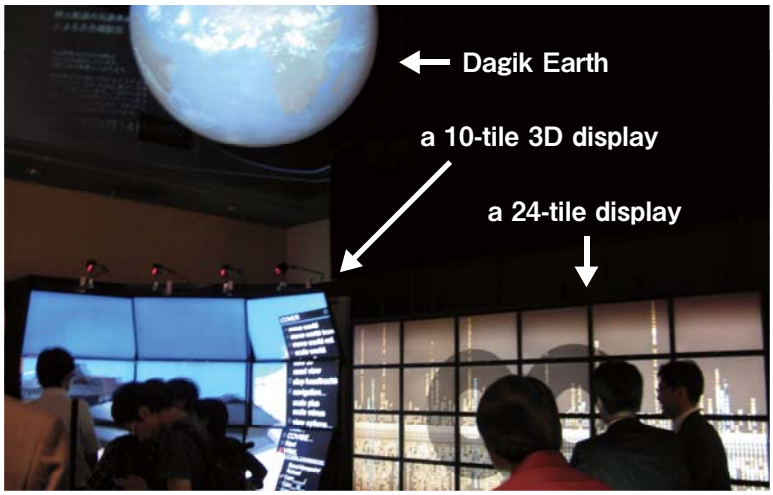


Figure 1●The VisLab Osaka booth

NICT worked together with 23 other organizations, including universities, companies, and institutes to build the VisLab Osaka booth for visualization technologies. We set up a 10-tile 3D display (on the left in Figure 1) in addition to a 24-tile display (on the right in Figure 1), which also was exhibited in previous events. On these displays, we showed visualizations of the calculation results of science and technology created by cooperating groups, as well as artistic images and images reproducing cultural assets and history. As new content, NICT introduced Stream Concordance (image at right in Figure 1), which can analyze various information from Twitter and display it in a list. We also showed images using various visualization devices, including Dagik Earth (at top in Figure 1), which can project, for example, an image of the earth on a spherical screen, a 3D projector, or a head-mount display.

In collaboration with the organizer's program, on the 28th, we transmitted 4K-resolution images from the Enoshima Aquarium to the venue using NICT's ultra-high definition image transmission technology. This is four times the resolution of High Definition. The visitors enjoyed watching 8,000 sardines swimming in a huge water tank in Sagami Bay and dolphins giving a show (Figure 2).

A multisensory interaction system engages the four senses of seeing, hearing, touch, and smell at the same time. During the exhibition under the name of Cyber Museum, we created Ginkunro of Shosoin and let the visitors experience the wonder of touching a very realistic thing that was not actually there (Figure 3).

The exhibition revealed some technological challenges that remain to be resolved, and we received valuable feedback from the visitors. While incorporating those ideas, we will proceed with the preparations for opening the Knowledge Capital facility in the spring of 2013 and further promote R&D activities in cooperation with companies, universities, and artists based in Osaka and nearby cities.

Figure 2●Images transmitted from the Enoshima Aquarium (4K monitor is on the right)

Figure 3●Booth for Multisensory Interaction

Participated in Children's Day for Visiting Kasumigaseki

Children's Day for Visiting Kasumigaseki is an annual event held to give children an opportunity to see and learn about society from different perspectives by spending time with adults doing their jobs. This year, the event took place on Wednesday, August 17 and Thursday, August 18, with 24 government ministries and other organizations giving workplace tours and describing their work.

NICT participates in the event every year under the auspices of the Ministry of Internal Affairs and Communications. Under the theme of "The sky is the limit! Let's play with a smartphone," we presented VoiceTra and AssisTra, which are smartphones applications that support tourism and conversation in different languages through spoken dialogue.

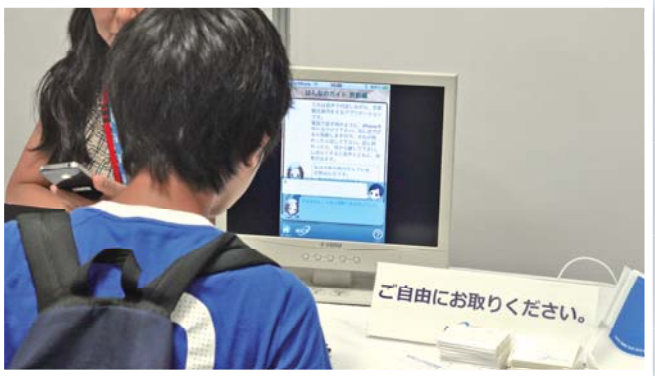
Under the banner of "Spoken Communications that Overcome the Barrier of Languages," VoiceTra can translate spoken dialogue related to tourism in twenty-one languages (speech input and output in six languages) using technologies for quickly translating spoken dialogue into a different language. Trying the application, the children were a bit confused at first since it failed to correctly recognize their speech, but as they got used to it, the problems disappeared. When they experienced having their speech translated into a foreign language, they gave us a big smile.

AssisTra is a sightseeing guidance system with a spoken dialogue interface, "Hanna's Guide – Kyoto," where a cartoon character named "Hanna Kyono" gives the user tourist information about Kyoto through interactive conversations. A user can retrieve various kinds of information helpful for sightseeing in Kyoto, such as tourist spots and restaurants (see pp. 5–6 of the August 2011 Issue of the NICT NEWS).

Perhaps because the smartphones on which the application was installed are so familiar, not only children but also grown-ups enjoyed trying the application.

●NICT's exhibition booth for VoiceTra and AssisTra

●Let's see how well VoiceTra translates your dialogue!



●Kids enjoying listening to tourist information for Kyoto with AssisTra

Summer Holiday Special Event in NICT Exhibit Room

Because the Open House at the headquarters (Koganei) was cancelled this year due to the power shortage during the summer, we held a special event over the summer holiday, inviting elementary school kids in the neighborhood to the exhibit room under the theme of "Let's be a NICT Kid Doctor".

The event took place at two different times: the first from Monday, August 1 to Friday, August 12, and the second from Monday, August 22 to Wednesday, August 31. We had a total of 598 visitors over the 18 days.

We have received many requests from visitors who wish to attend more of such events in the exhibit room. We will plan more events of this kind in the future.

●Experimenting with light transmission through an optical fiber using an optical fiber experimentation kit.

●Watching the video that explains Japan Standard Time to children in an easy-to-understand manner.

●Breaking a code using the scytale cipher method, which involves wrapping a string around a stick.

●Having VoiceTra translate their Japanese speech into a foreign language.

●Writing a letter to be delivered with the postmark of Showa Station in Antarctica.

●Making clouds in a plastic bottle after learning how clouds are formed.

Announcement of NICT's Participation in CEATEC JAPAN 2011

NICT will participate in CEATEC JAPAN 2011, which will be held at Makuhari Messe from Tuesday, October 4, to Saturday, October 8, 2011.

The theme will be "Natural Autostereoscopic Display Technology on a 200-inch Monitor". In addition to showing glasses-free stereoscopic images on a large display, we also make a poster presentation of the Third Mid-term Plan, which started this year.

In the adjacent ICT Suite area, we will have a booth introducing the results of commissioned R&D activities under the Basic Technology Promotion System for Private Sectors, as well as the services that utilize the venture support system to promote business matching.

We hope to see many of you at the NICT booth.
(You will find the NICT booth at 4B28 and 4C21 in Hall 4.)

●Example of Autostereoscopic Display Technology on 200-Inch Monitor

(Note)

If you register prior to the event through the CEATEC JAPAN 2011 web site, admission will be free.
http://www.ceatec.com/2011/ja/index.html

Information for Readers

The subjects of the next issue will range from optical lattice clocks that are accurate to within 1 second over 65 million years, to the technology of brain information communications that allows people to communicate by transmitting information from the brain.

NICT NEWS No.408, SEP 2011 ISSN 1349-3531

Published by
Public Relations Department,
National Institute of Information and Communications Technology
<NICT NEWS URL> http://www.nict.go.jp/data/nict-news/

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