

(Press release material)

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Nippon Telegraph and Telephone Corporation
National Center for Child Health and Development

A new dimension of the US-Japan telepresence and telemedicine in fetal care management is to be tested by linking research and education networks

-- Transmission and evaluation of medical data including 3-dimensional ultrasound images via ultrahigh-speed research and education network GEMnet2 --

<Overview>

Nippon Telegraph and Telephone Corporation (NTT, headquarters: Chiyoda-ku, Tokyo, president: Norio Wada) and the National Center for Child Health and Development (NCCHD, Setagaya-ku, Tokyo, dean: Junichi Hata, MD, PhD) will test feasibility of transmitting digitalized fetal medical images (including 3-dimensional ultrasound (*1) as well as fetoscopic images) between the US and Japan. The purpose is to implement the telediagnosis and prospective telesurgical treatment of fetal diseases on a global scale in the hope of braking the sharp decline in the Japanese birth rate. These feasibility studies are to be conducted using ultrahigh-speed network technologies through interconnections of the GEMnet2 ultrahigh-speed experimental network (*2) operated by NTT Laboratories with overseas research and education (R&E) networks from March 1, 2006 through March 31, 2007.

Initially, the participating medical institutions will be NCCHD and the Fetal Treatment Center at the University of California at San Francisco (UCSF, San Francisco, California). The Advanced Fetal Care Center at the Children's Hospital Boston (Boston, Massachusetts) is also expected to participate soon.

<Development>

Prior to proceeding to the full study, the basic network performance was evaluated from February through December 2005 using diverse test modalities including the video signal transmission between the UCSF and the NTT Musashino Research and Development Center (R&D Center), and, then, both the connection and data transmission via GEMnet2 between the Musashino R&D Center and NCCHD were examined a couple of times.

Nursing and medical managements of fetomaternal and neonatal patients are becoming increasingly important in Japan due to its rapid decline in the recent birth rate. To address these issues, NTT has determined to encourage a "safe and secure" society through the promotion of large-scale telemedicine network in the fetal care management. It's because serving the global community is one of the paramount goals under "The medium-term strategies of the NTT group."

NTT's ultrahigh-speed network technologies are likely to represent the fruits of futuristic R&D initiatives available for substantial support of the fetuses having congenital defects as well as potentially improvement of the declining Japanese birth rate. For example, these technologies are expected to enable us to accomplish the telediagnosis, telemonitoring and teletreatment of diseased fetuses with overseas advanced medical centers.

<Background of experiments>

Prenatal treatment refers to in utero treatment (medical and/or surgical) of diseased fetuses usually at 16 to 30 weeks to save lives or to secure postnatal long-term quality of life. Although prenatal treatment is increasingly significant, the number of fetal medicine specialists in Japan is still small unlike in European countries, the US and Canada, and pregnant women with diseased fetus are occasionally unable to receive adequate perinatal care and management.

In the field of telemedicine, various communications systems aimed for remote medical treatment have been developed and tested so far. One is conventional video systems connected with dedicated circuits and the other is commercial Internet-based technologies. However, at present, those systems are either very expensive or too vulnerable for critical applications due to the inherent problems including network quality, security of transmitted medical information, and achievements of high-definition images for telediagnosis.

To overcome these current difficulties, NTT has launched a joint investigation with NCCHD to build up a new fetal telemedicine system. Transmission of large-volume data with small delays was made possible by using the GEMnet2 ultrahigh-speed network.

The GEMnet2 is interconnected with such foreign R&E networks as Abilene (a backbone network operated by the Internet2 project in the US) and CENIC/CalREN (a research network linking most universities in the state of California) via the Pacific Wave at the University of Washington (Seattle, Washington), the hub of R&E networks on the West Coast. In February 2005, a test was conducted on the connection between the UCSF (Professor Michel Harrison, a leading expert in fetus surgery) and the NTT R&D Center via GEMnet2 to enable real-time telediagnosis and treatment. This test was specifically aimed to examine the end-to-end performance of the network comprised of multiple R&E networks in collaboration with Sunrise Telecom (San Jose, California), a network measurement equipment vendor and GEMnet2 partner in the US. Furthermore, the transmission of 3-dimensional ultrasound images encoded using MPEG2 Codec developed by NTT ([*3](#)) was also tested along with the potential for providing prenatal treatment via the networks as well.

In addition, in March 2005, the GEMnet2 connection between NCCHD and the NTT R&D Center was completed along with the testing a MPEG2 3-dimensional scanner encoder (to confirm basic quality in local transmission tests).

Based on these outcomes combined with prospective approvals of the medical ethics committee of both NCCHD and UCSF, experimental fetal telediagnoses will be implemented involving remote prenatal treatment via the transmission of 3-dimensional ultrasound data and fetoscopic images. The telediagnoses are to be conducted through international collaboration between the US and Japan over R&E networks.

<Details of experiments>

-Main participants

NTT, NCCHD (Tokyo), UCSF (San Francisco), Children's Hospital Boston (Boston), Sunrise Telecom (San Jose)

-Main experiments

Evaluation of medical image transmission

- (1) Evaluation of transmission of 3-dimensional ultrasound scanner videos and endoscopic images encoded using MPEG2 Codec

(2) Evaluation of transmission of high-definition videos by HDTV

Evaluation of network technology qualities

(3) Examination and evaluation of network technologies to secure the quality and the confidentiality of medical information

<Significance of experiments>

These experiments are very significant. If successfully conducted, they will serve to establish fetal telediagnoses and treatment technologies which will potentially reverse Japanese declining birth rate. In the viewpoint of network technologies, the real problems faced when implementing critical applications over Internet-based networks can be studied through cooperation with academic organizations, R&E networks, and device vendors.

<Future outlook>

NTT is promoting group-wide efforts to build up fully functioning network environments that provide ubiquitous broadband services where customers can "connect to anything, anywhere, and any time" in a "safe and secure" manner " which is supposed faster and more convenient."

Based on the positive experimental results and armed with world-leading, next-generation, ultrahigh-speed network technologies, NTT will be able to promote further network quality and security, as well as to drive forward its R&D and coordination activities from a more global perspective than ever before. The latter is to be achieved by further strengthening NTT's cooperation with overseas R&D networks allowing an expansion of telemedicine systems. In this regard, connection with DANTE (a research network backbone linking EU member countries) is expected to open up new possibilities for collaboration with European medical centers.

NCCHD has been planning to build networks among medical centers intensively involved in advanced prenatal diagnosis and treatment. To acquire information about advanced prenatal medicine in the US, the NCCHD is founding a wide range of fields of fetal telemedicine along with promoting research works based on the cutting-edge network technologies.

<Glossary>

*1 3-dimensional ultrasound scanner

A next generation ultrasound scanner having the capability of displaying realtime 3D images by utilizing advanced digital signal processing technologies. This system allows doctors to explore images in any plane to reveal the smallest details with clarity, providing very powerful means to diagnose prenatal babies with defects.

*2 GEMnet2 (Global Enhanced Multifunctional Network) 2

A new experimental network built by the NTT Laboratories that connects its R&D (research and development) centers in Musashino, Yokosuka, and Atsugi accomplishing ultrahigh-speed data transmission rates of tens of Gbit/s. The GEMnet2 was made possible by upgrading the prior GEMnet research network which had been operating since 1998 in order to examine global information sharing services on actual networks, and also by applying WDM (Wave Division Multiplexing) and wavelength routing technologies. In addition to its utilization for research and development within the NTT research centers, the GEMnet2 enables joint research with research institutions in Japan and abroad through links with external research and education (R&E) networks. The GEMnet2 is inter-connected with two R&E networks (Super SINET and JGN2) in Japan, as well as with several R&E networks in various

worldwide countries via the US.

***3 MPEG2 Codec**

A device encode/decode SDTV(Standard Definition Television) video signal into MPEG2 streams in realtime. Compact NEL (NTT Electronics) devices with small delays are used for this experiment.

*** General description of NCCHD**

The NCCHD (Tokyo) was founded in 2002 by the Ministry of Health, Labor, and Welfare as the fifth national medical center in Japan. The care provided by the NCCHD (medical/surgical/mental/gynecologic and obstetric/genetic) is supposed to support a patient throughout his/her entire developmental (including reproductive) cycle that consists of pre-fertilization, embryonal/fetal, perinatal, neonatal, pediatric, adolescent and paternal/maternal stages of life.

- [Network Configuration of Remote Fetal Treatment](#)

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