enable application programs to be downloaded safely to smart cards via the Internet and other networks whenever they are needed. In the future, NICE will enable the downloading of application programs to GlobalPlatform™ cards in order to promote expansion into various fields.

For further information, please contact
NTT Information Sharing Laboratory Group
Musashino-shi, 180-8585, Japan
E-mail: koho@mail.rdc.ntt.co.jp

Joint Experiment on Broadband Network for Intelligent Social Infrastructure in the 21st Century —Application of World's Fastest (43-Gbit/s) Testbed System Capable of Transmitting a DVD Movie in One Second

Keio University, NTT East, and NTT have begun using the world's fastest (43-Gbit/s) testbed system in an actual field environment. After signing an agreement on July 15, 2003 for a joint experiment, they completed preparations for the test and began operating the testbed network on October 24, 2003.

Based on next-generation application research such as the 21st Century COE (center of excellence) project promoted by Keio University called the "Next Generation Media and Intelligent Social Infrastructure" and various other projects, this joint experiment aims to implement a next-generation network using an ultrahigh-speed network that can support the broadband applications that Japanese society will need in the future.

Background

With the spread of the Internet, broadband access networks such as FTTH (fiber to the home) and xDSL (digital subscriber lines) have progressed. We can expect a rapid increase in data traffic and diversification of services in future, and advanced application technology based on high-capacity networks will spread to provide new services such as image system content-streaming delivery, peer-to-peer (P2P) communications, Internet delivery of broadcast programs, and large file transfer. On the other hand, core optical networks that can provide capacity greater than one terabit per second through a fiber have emerged, and networks that can flexibly handle various interface protocols have become necessary.

Keio University, which has developed various large-volume contents and wide-area applications to establish the future intelligent social infrastructure, in conjunction with NTT East and NTT Network Innovation Laboratories will clarify the requirements for high-capacity networks in the broadband era, evaluate the network quality of the long-term application of these networks, and select subjects for testing on the network system. This joint experiment should lead to the creation of new broadband applications that fully utilize the characteristics of the ultrahigh-speed network, and system development will progress aiming at ultrahigh-speed high-capacity backbone networks of the Internet and high-speed information transmission networks between data centers etc. We expect that these will be useful in implementing the intelligent social infrastructure required by Japanese society in the future.

Overview of experiment

A 43-Gbit/s OTN*1 line-terminal multiplexer developed by NTT Network Innovation Laboratories and an optical repeater system capable of transmitting a 43-Gbit/s optical signal were installed between the Yagami and Shonan-Fujisawa Campuses of Keio University. Large-volume content data belonging to the university is transmitted between these campuses using next-generation applications. This will enable us to achieve the envisioned future data-centric communication environment and be able to evaluate and verify the connection reliability, multiprotocol transmissions, network monitoring and control, and the long-term stability of applications. To put this transmission speed in perspective, 43-Gbit/s enables this network to transmit the entire contents of a DVD movie in one second.

- Test period: October 2003 to March 2005
- System configuration of joint experiment (**Fig. 1**)

*1 OTN: An optical transport network using wavelength division multiplexing and optical switching. The network node interface for an OTN is standardized in ITU-T (International Telecommunication Union-Telecommunication Sector) recommendation G.709.

Roles of participants

Keio University is providing the actual field sites for the test, adjusting the large-volume content delivery environment, developing high-definition content delivery applications, and constructing wide-area distributed IP storage. It will participate in the joint evaluation of the practical usability and data transmission quality of the ultrahigh-speed testbed network. Keio will also develop and evaluate a transport protocol for a high-speed and low-latency network. This advanced experiment using Keio's 21st Century COE project will enable participants to study the architecture of the intelligent social infrastructure.

NTT East used its network to integrate an optical transmission line and 43-Gbit/s OTN testbed system into Keio University's backbone network. During the test period, NTT East performs network operation and maintenance on the actual field applications for "end-to-end" 43-Gbit/s transmission, evaluates the applicability of maintenance and remote supervision as a prerequisite to long-term application, and accumulates service quality control and system integration know-how, which will be required for the future data-centric communications environment.

NTT Network Innovation Laboratories provided the world's first 43-Gbit/s OTN testbed system

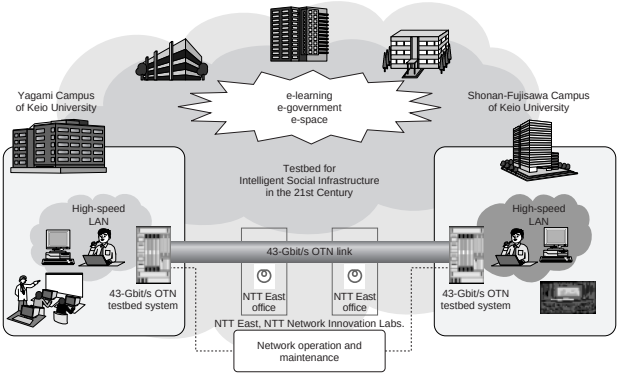

Fig. 1. System configuration of the joint experiment.

employing new international standards for an optical network using wavelength division multiplexing (WDM). The OTN based on a 43-Gbit/s channel, a standard proposed by NTT, enables the experimental system to handle 32 channels of GbE (Gigabit Ethernet) signals at high quality without processing the client signal. Furthermore, by applying a bandwidth-efficient line coding (CS-RZ format*2) proposed by NTT and based on an automatic dispersion compensation function, NTT Network Innovation Laboratories upgraded the tone modulation of the CS-RZ signal for long-distance WDM transmission at over 1 Tbit/s. In this joint experiment, they will conduct a stability test based on long-term actual use of applications, and verify and evaluate the system design during testing.

*2 CS-RZ (carrier suppressed return to zero) is an optical transmission format appropriate for high-capacity long-haul WDM transmission. It enables easy implementation of automatic compensation technology, which is indispensable for handling transmission impairments after transmission at 43 Gbit/s.

For further information, please contact
Science and Core Technology Laboratory Group
Atsugi-shi, 243-0198, Japan
E-mail: st-josen@tamail.rdc.ntt.co.jp

NTT, NEC, Furukawa Electric, and Mitsubishi Electric Succeed in the World's First Interworking of GMPLS and MPLS

NTT, NEC Corporation, The Furukawa Electric Co., Ltd., and Mitsubishi Electric Corporation conducted the world's first successful demonstration of interworking between legacy MPLS (multiprotocol label switching) for IP network control and GMPLS (generalized MPLS) for next-generation photonic network control. This interworking will produce an economical broadband IP network environment and lead to the smooth introduction of the next-generation high-speed flexible backbone network without demanding changes to the existing IP and MPLS network configurations. It will also enable the novel high-speed and flexible network services offered by GMPLS technology to be provided in addition to existing IP and MPLS services. This demonstration was performed at the Photonic Internet Lab (PIL)*1 where these four companies took part in the planning.

This interworking experiment was demonstrated from October 26 to 28, 2003 at an exhibition booth at the international conference MPLS2003 in Washington D.C. In MPLS2003, telecommunication carriers and vendors from around the world debated the novel *de facto* MPLS technology, which is an advanced IP network control technology used to provide IP VPN services.

Background

Due to the explosive increase in the number of Internet users and various new services, traffic volume is doubling every year. This trend will continue because new network applications like VoIP (voice

*1 Photonic Internet Lab (http://www.pilab.org/). PIL, which was founded in September 2002, is promoting research and development of next-generation photonic network technologies. It encourages the submission of proposals from its members to global standardization bodies like ITU-T, IETF, and OIF. It also tests photonic network control programs developed by PIL member companies. This experiment directly supported these goals. At present, PIL consists of seven companies: Fujitsu Ltd., Oki Electric Industry Co., Ltd., and Hitachi Ltd. joined after the four companies mentioned above. PIL activities are supported by the R&D support scheme of the MPHPT (Ministry of Public Management, Home Affairs, Posts and Telecommunications) for funding selected IT activities.