News Release

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Internet Initiative Japan Inc.
Internet Multifeed Co.
NTT Communications Corporation
Nippon Telegraph and Telephone Corporation

Joint experiments on basic operation of Photonic IX dealing with interoperability of next generation Internet employing photonic networking

Internet Initiative Japan Inc. (IIJ; Head Office: Chiyoda-ku, Tokyo; President: Koichi Suzuki), Internet Multifeed Co. (MFEED; Head Office: Chiyoda-ku, Tokyo; President: Koichi Suzuki), NTT Communications Corporation (NTT Com; Head Office: Chiyoda-ku, Tokyo; President: Masanobu Suzuki), and Nippon Telegraph and Telephone Corporation (NTT; Head Office: Chiyoda-ku, Tokyo; President: Norio Wada) are to conduct joint experiments aimed at the next generation interoperable Internet, which takes advantage of photonic networking technologies) (*1) from September 3, 2004 through the end of March 2007. These experiments will confirm the feasibility of Photonic Internet Exchanges (IXes) employing IP Routers and Optical Cross-Connects (OXCs) (*2).

1. Background (Fig. 1)

- The recent wide penetration of high-speed Internet has caused rapid growth in the amount of communication information (traffic). Subsequently, this has raised the issue of a shortage in the circuit capacity. In particular, the increased amount of traffic is concentrated at the IXes of multiple Internet Service Providers (ISPs) posing a significant problem. Based on the trend in the total amount of traffic of the three major IXes (See the reference) in Japan, the total amount of traffic has been increasing two-or-three-fold every year, and at the end of the first half of 2004 the level has reached the 90 Gbit/s traffic (average per month) level. A novel IX architecture is therefore needed in order to cope effectively with the increasing amount of traffic.
- NTT Laboratories have promoted research and development on photonic networking technologies for many years to offer novel network services as well as to achieve capacity enhancement.

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reference：
http://www.soumu.go.jp/s-news/2005/050125_3.html

1. NTT Laboratories, IIJ, NTT Com, and MFEED initiated a series of joint experiments last year toward the actualization of a novel IX architecture (Photonic IX (Fig. 2)) where IP Routers and OXCs interwork collaboratively by combining photonic networking technologies including OXC and Generalized Multi-Protocol Label Switching (GMPLS) (*3), which NTT Laboratories have fostered on their own terms, and various know-how regarding network configuration, which IIJ, NTT Com, and MFEED have fostered as advanced providers.

2. Outline of joint experiments
   (1) Test of interworking between GMPLS-enabled OXC and IP Routers
   (2) Test of Photonic IX reliability enhancement
   (3) Test of Photonic IX operating techniques

3. Achievements to Date

We conducted joint studies toward the actualization of the Photonic IX as a novel architecture that can effectively handle the ever-increasing amount of traffic. The Photonic IX is characterized by its architecture, which allows for interworking between IP Routers and Layer-2 switches, both of which the ISP and IX have operated so far, and GMPLS-enabled OXCs, which NTT newly developed. If the amount of traffic between ISP IP Routers increases at the IX, IP Routers will use multiple output interfaces simultaneously and will potentially need fine-granular switching within the interface bandwidth (i.e., IP routing) and coarse granular switching at the interface unit. In such cases, it is possible to cope effectively with the increasing amounts of traffic by achieving interworking between IP routing and optical path (*4) level switching using the OXC.

For this joint experiment, NTT Laboratories developed the “optical path bandwidth control technology,” and applied it to GMPLS-enabled OXCs, which allow for interworking with IP routing in order to handle a large amount of traffic. The optical path bandwidth control technology optimally adjusts the capacity of the optical path onto which the traffic is accommodated according to the increase or decrease in the traffic flow. This technology allows for cost-effective accommodation of optical paths between ISPs, where coarse granular optical paths are used. This technology also provides failure recovery by switching the failed optical path to its backup path. So far, we confirmed that the optical path bandwidth control technology operates effectively based on examination in an IX-simulated experimental configuration assuming traffic changes including bursty Internet traffic characteristics and sudden traffic changes with failures.

4. Further Activities

In addition to the investigation to date, we are provisionally considering some technical subjects such as the IP Router/OXC interworking philosophy, reliability enhancement to check the feasibility, and we are finalizing a proposal for the design concept of the Photonic IX.

Furthermore, we are conducting research to achieve real operation as well as long-period operation tests under field environment conditions.

NTT group will put this result to account when considering a next-generation network described in the “NTT Group's Medium-Term Management Strategy”, which was released in November 2004.

5. Roles of Each Organization and Their Objectives

(1) IIJ

IIJ, which has exuberant operational-experience and expertise in advanced Internet design technologies, provides IP network operation technologies and investigates issues and requirements from the ISP viewpoint for the effective usage of IXes.

(2) MFEED

As the commercial IX named “JPNAP” operator handling the largest traffic amount in Japan, MFEED provides operational IX technologies and investigates issues and requirements for the next generation. MFEED will explore the feasibility of IX infrastructure services by analyzing the results of this joint experiment.

(3) NTT Com

NTT Com is a telecom operator and an ISP that has expertise in advanced network design technologies. Based on such background, NTT provides operational technologies for the transmission network and conducts its investigation from the viewpoint of a network operator.

(4) NTT

NTT has technical actualization capabilities and provides know-how related to photonic networking such as OXC and GMPLS. NTT also investigates the requirements for photonic networking and will promote investigations related to realization technologies that allow for sophisticated functionality and cost-effectiveness.

Through these joint experiments, these four organizations will evaluate the Photonic IX from the viewpoint of interoperability among ISPs, and will try to derive solutions for network control schemes for inter-layer interworking as well as clarify the functional requirements for IP Routers and Layer-2 switches to achieve interworking with GMPLS-enabled OXCs.

< Glossary >

(*1) Photonic networking technologies

Photonic networking consists of the Wavelength Division Multiplexing (WDM) technologies, wavelength routing technology and networking technology. The first one transports massive amounts of information by parallel transmission of different wavelengths in a single optical fiber. The second one switches optical paths by wavelength. The third one is networking technology, which operates the photonic network flexibly and effectively.

(*2) Optical Cross-Connect (OXC)

An OXC is a component of the photonic network. It is connected to WDM equipment and switches Gigabit-class high-speed optical signals. It is possible to switch Gigabit-class high-speed optical signals flexibly by applying networking technologies such as GMPLS.

(*3) GMPLS (Generalized Multi-Protocol Label Switching)

GMPLS is the extension of MPLS (Multi-Protocol Label Switching) and is a protocol suite that enables the same control mechanism to be applied to different network layers. GMPLS has drawn attention as a network protocol that is applicable to photonic networks and has been standardized in The Internet Engineering Task Force (IETF), which is a standardization body that develops standards for the design and operation of the Internet.

(*4) Optical path

An optical path is a unit of information transfer for the Gigabit-class high-speed optical signals and is used as the transmission pipe established between the transmission end and receive end, i.e., ingress and egress. It is possible to switch optical paths by using GMPLS-enabled OXCs.

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