Unofficial Translation

(Press News Release)

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Telecommunications Advancement Organization of Japan

Nippon Telegraph and Telephone Corporation

The successful demonstration of simultaneous wide-area multipoint transmission of HD streams for the broadband ubiquitous era

- World's first large scale confirmation on JGN of broadband content distribution by end users -

The Telecommunications Advancement Organization of Japan (hereinafter referred to as TAO, Headquarters: Minato-ku Tokyo, Chair: Futoshi Shirai) and Nippon Telegraph and Telephone Corporation (hereinafter referred to as NTT, Headquarters: Chiyoda-ku, Tokyo, President: Norio Wada) have jointly succeeded in demonstrating the realization of multi-origin, multi-program simultaneous content distribution of HD-class IP streams, on May 15, 2003. The experiment was conducted on the Japan Gigabit Network (JGN *1), a research network operated and administered by TAO. More than twenty video receiver sets located at four TAO own research facilities, namely Makuhari Gigabit research center (RC), Kochi traffic research center, and two annexes in Tohoku University and the University of Tokyo, were involved.

The experiment was carried out by TAO Makuhari RC and NTT Network Innovation Laboratories using an IP network constructed by linking MPLS (*2) routers across JGN. One goal was to verify the potential of wide-area multipoint stream distribution, specifically to prove the feasibility of simultaneous multipoint distribution of high volume IP streams generated by end users.

Prior to this trial, the only reports available described the simultaneous distribution of single HD streams to a few sites on Internet2 (*3) based on IP multicast technology. This trial is the world's first to achieve simultaneous distribution involving multiple sources and several tens of destinations. As such, it opens the door to the full-scale distribution of high volume streaming contents from end users which presages the broadband ubiquitous era.

In this experiment, the wide-area simultaneous multi-point distribution of HD class IP streams was implemented on JGN to verify the capability and to extract the issues for further studies with regard to (1) Transmitting technologies to handle extensive multiple areas (Flexcast(*4)) and (2) QoS technologies based on dynamic load balancing that suit MPLS routers; potential problems were elucidated. The following achievements were recorded.

(1) Accomplished simultaneous transmission of HD class (25Mbps) IP stream contents, from three servers, hosted by Makuhari RC, Kochi RC, and Univ. of Tokyo Annex, to more than twenty receivers in four sites (Makuhari RC, Kochi RC, Tohoku Univ. Annex, and Univ. of Tokyo Annex), while minimizing load on networks and servers. This opens the door to the full-scale distribution of high volume streaming contents from end users.

(2) Accomplished equalization of network usage by autonomously switching a path between Makuhari RC and Kochi RC, provided that two independent paths were prepared and the server traffic was increased to produce congestion. This proved the effectiveness of dynamic load balancing technology among MPLS routers for the purpose of maintaining quality, high volume IP stream distribution.

The experiment has confirmed that the problem of image distortion caused by excessive loading of the streaming servers or insufficient bandwidth, which had previously hindered high volume IP streaming from end users, has been successfully resolved, so receivers can enjoy the transferred images whose quality equals that of the original material. This leads to the stream distribution of motion pictures and videos with high quality which will satisfy cultivated audiences, anywhere and anytime.

[Overview of experiment] (refer Appendix)

(1) Configuration of the networks
- Connected Makuhari RC, Kochi RC, Tohoku Univ. Annex, and Univ. of Tokyo Annex by JGN (OC-3, 155Mbps) with MPLS routers. Placed multiple Flexcast relay nodes in each site.
- Placed multiple HD decoder sets in each site; more than twenty decoders in total

(2) Verification of applicability and effectiveness of the transmitting technology that supports extensive multiple areas (Flexcast)
- Placed HD streamer sets in Makuhari RC and Kochi RC, an HD camera in Univ. of Tokyo Annex. UDP video streams from these three sources were transmitted simultaneously by Flexcast.
- Increased the receivers at sites randomly, and confirmed that the multicast distribution trees were built autonomously.
- Confirmed that Flexcast used smaller portion of bandwidth, while the network usage of conventional distribution using multiple unicast flows increased proportional to the number of receivers.

(3) Verification of the QoS technology based on dynamic load balancing using MPLS routers
- Created congestion on communication links by introducing multiple HD streams. MPLS routers switched to a detour path autonomously to equalize NW usage, and, as a result, the quality of the HD streams was maintained.

[Future schedule]

In the future, based on the results of the experiment, we will establish the technology for IP based high-volume wide-area multipoint stream transmission that can be used easily by everyone. We will consider the business and service oriented issues with regard to the application of the technology

(Glossary)

*1 JGN (Japan Gigabit Network)

An open testbed administered and operated by Telecommunications Advancement Organization of Japan (TAO), to conduct research on and development of high-speed networking and high-performance application technologies such as the Next Generation Internet technology. JGN was open to both public and private entities for 5 years from 1999 to 2003, providing a wide range of research opportunities. Details are given on http://www.jgn.tao.go.jp/english/index_E.html

(1) Ultra high-speed optical-fiber networks with links up to 2.4Gbps and 66 access points that cover all prefectures in Japan.
(2) Five Shared Use Research Facilities (Gigabit Laboratories)
(3) Ten Research Centers have been established by TAO to perform its own research. (JGN Project leader: Professor Emeritus Tadao Saito of the University of Tokyo, JGN Project Senior Sub Leader: Professor Tomonori Aoyama of the University of Tokyo)

*2 MPLS (Multi Protocol Label Switching)

MPLS is a packet forwarding framework standardized in IETF, which integrates ATM-like label swapping with network layer routing. In MPLS, the packets are fast-forwarded at each router by the short labels attached by the ingress router; the slow process of consulting IP headers is avoided.

*3 Internet2

Internet2 is a consortium headed by over 200 universities working in partnership with industry and government to develop and deploy advanced IP network applications and technologies. (http://www.internet2.org/)

*4 Flexcast（Flexible Stream Multicast）

Flexcast independently constructs the best transmission route by adapting to the traffic variations as triggered by user requests. This is an autonomous-type large-area multi-point transmission technology that can automatically construct and maintain optimal delivery trees according to changes in the number and the location of transmitters and receivers, and changes in IP network routing. Flexcast is developed by NTT.

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