November 13, 2002
Nippon Telegraph and Telephone Corporation

NTT streams Super High Definition movies
in the global-scale high-speed network

- Establishment of the broadband (about 300Mbps) IP stream transmission technology
over a long distance network (more than 3000km) of Internet2 -

Nippon Telegraph and Telephone Corporation (NTT; Head Office: Chiyoda-ku, Tokyo; President: Norio Wada) succeeded in the experiment of transmitting Super High Definition (SHD) movies of streaming contents at about 300Mbps between Chicago and Los Angeles, a distance of more than 3000Km.
This experiment has been conducted on October 28th and 29th, by the collaboration of three sites: <Kanagawa> NTT Network Innovation Laboratories; <Chicago> Electronic Visualization Laboratory (EVL) in University of Illinois at Chicago, and Northwestern University StarLight, and <Los Angeles> University of Southern California (USC).
NTT Network Innovation Laboratories managed this public experiment to verify the potential of real time transmission of streaming contents over a long distance network, with not less than 500 participants of the Fall 2002 Internet2(*1) Member Meeting. This was the world's first trial of 3000km transmission of SHD movies(*2). (In the previous experiment, the maximum distance was 5 Km long between Iidabashi and Ginza in Tokyo.) This successful trial won high praise from the relevant parties of the Internet2 Member Meeting and USC, School of Cinema-Television.

This experiment verified the following technologies: 1) Transmission technology of SHD movies, 2) Traffic control technology MXQ(*3), 3) Scalable multicasting technology Flexcast(*4). With the long distance network of Internet2, a plenty of results were derived including followings.

1) The transmission of 300 Mbps streaming contents over a long-distance of 3000Km with 59msec round trip delay was achieved by 64 multiple TCP streams.

2) The traffic control technique was applied to TV conferencing systems in the networks across Internet 2/GEMnet(*5), and participants verified how fairly it can control their video and audio traffic.

3) Real time video streams at the rate of 6Mbps were simultaneously distributed among the three sites located in Japan and U.S. with the distance of more than 6000Km. The maximum round trip delay was 190msec. This result showed that anyone can deliver streams from anywhere at any time using only common PCs.

In all, the experiment confirmed that our technologies successfully resolved the problem of the degradation of image quality by transmission delay and signal attenuation, and that the transferred images preserved its original image quality. The results encouraged that cinema movies can be distributed from anywhere to anywhere at any time, or the high-quality international TV conference are widely serviced in the

Internet.

[Overview of the experiment]

1. The transmission of SHD movies over a long-distance network
   - more than 3000Km, average 300Mbps, 800-900Mbps peak traffic
   - Following movies were transmitted.
     <1>"Galaxy", "Milkyway" (Produced by NCSA, University of Illinois)
     <2>Billy Goat (Produced by KWCC)

2. Fair bandwidth allocation by MXQ in best-effort networks
   - Evaluation of the traffic control applied to TV conference traffic between US and Japan.
   - Evaluation of controllability in the Internet environment.
   - Verification of MXQ implementation onto IP routers

3. Wide area multipoint communication by Flexcast
   - Scalability for simultaneous multipoint content distribution over Internet2 and GEMnet.
   - Measurement of throughput, delay, jitter, and burstiness in transmitting motion digital images of MPEG2 (6Mbps).
   - Performance evaluation of Flexcast processing in terminals and link nodes.
   - Comparison of actual measurement and theoretical analysis using two standard transport protocols (UDP and TCP).

[Future Actions]
In the future, we will further enhance the broadband IP stream transmission technology for fully supporting the transmission of SHD movies over long distance networks. It opens the new area of content delivering business such as SHD digital cinema.
We will also conduct various trials in the Internet to verify and improve the fairness traffic control technology MXQ, and wide area multicasting technology Flexcast.

(Glossary)
*1 Internet2
Internet2 is a consortium led 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/)

*2 Super High Definition (SHD) movies
A technology that is capable of transmitting and displaying super-high definition images that have at least 2000 scanning lines. It fully covers the image quality of 35mm film.

*3 MXQ (MaXimal Queuing)
Traffic Control Technique for IP routers that dynamically prioritizes users' traffic based on their estimated sending rate. It offers fair and comfortable Internet use to a large number of users by controlling the highest rate traffic, which would otherwise cause severe congestion.

*4 Flexcast (Flexible stream Multicast)
Autonomous-type wide area multipoint transmission technology that can automatically construct and maintain optimal path according to changes in the number and the location of transmitters and receivers, and in IP network routing

*5 GEMnet
NTT experimental network connecting Japan and the U.S. over the pacific

*2, 3, 4 are developed by NTT

For further information, contact:
Minako Sawaki, Hirofumi Motai
Planning Division
NTT Science and Core Technology Laboratory Group
Tel: 046-240-5152
E-mail: st-josen@tamail.rdc.ntt.co.jp

[NTT NEWS RELEASE](#)