NTT Press Releases

(News Release)

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NTT's network virtualization enhanced to support high performance in global-scale

- World-wide remote HD video content editorial upon a dynamically provisioned virtual network to be showcased in SC11 -

Nippon Telegraph and Telephone Corporation (NTT, Chiyoda Ward, Tokyo, President and CEO: Satoshi Miura) has developed a technology to dynamically provision a global-scale virtual network that can provide sufficient quality and reliability for advanced future applications. A virtual network can span over the globe by stitching together the circuits provided by network domains in the world. QoS will be managed by control mechanisms such as measurement-based optimal path selection, path redundancy and path switchover.
At the upcoming SC11[*1] held in Seattle (USA), 12-18 November, we plan to demonstrate the composition of the single wide-area virtual network that span over Asia, Europe and US. As a use case, we also demonstrate TV program editorial in cooperation of remote studios based in Osaka, London and Seattle.

Background

Emerging technologies of network-based rich applications such as telemedicine, cloud service, grid computing and high-density video streaming are expected to shift our lifestyle to another stage. However, the Internet, in spite of its global reachability, may not be capable to support experiments and deployment of these future applications since they have severe requirements in transmission quality such as huge bandwidth capacity, low latency, jitter and packet loss rate.
In the past several years, NTT laboratories had been working on IP-optical networking technologies such as operation of multiple virtual network topologies upon a shared physical infrastructure, and dynamic optimization of them in response to traffic demand fluctuations.

Achievements

Recently, notable functionality that provides interface to request dedicated circuits on-demand to the users[*2] is being developed among the national R&E testbeds in the world. As an enhancement of our network virtualization technology, we enabled to quickly form a global-scale network by connecting the circuits that are provisioned in multiple domains through the on-demand circuit request interface. Since the set of circuits are organized as a single managed network with multiple path alternatives, it can provide sufficient quality and reliability to applications by control mechanisms such as optimal path selection regarding the QoS requirements, path-level redundancy and dynamic switchover based on prediction of performance degradation.
In order to verify our achievements, we plan to conduct an experiment to actually compose a global scale virtual network that connects Osaka, London and Seattle. In the experiment, the virtual network will be formed by circuits provided by testbeds in Japan, Europe and US[*3]. Upon the virtual network, we examine the path selection for HDTV transmission based on the actual performance measurements. This experiment will be showcased at the upcoming SC11 (Seattle, USA, 12-18 November).

Technical Features

(1) Quick provisioning of global-scale virtual network

Virtual network is formed by set of circuits those connect IP router pairs. In other words, a circuit between an IP router pair is set up along the switches in the physical network, but when we look at it in the IP layer, this is a single link between an IP router pair. Therefore, set of them will form an IP network. Circuits between remotely distributed IP routers are established by triggering the on-demand circuit setup functionality supported by each network domain. As soon as the circuit is set up, IP routers are configure ured in order to associate the circuit to logical router of the VN. In this manner, a global-scale virtual IP network topology will be composed upon multiple network domains (Figure 1).

(2) Optimal path selection based on performance measurements

Future wide-area applications may have wide range of QoS requirements. However, since the datapath in the global-scale virtual network may span over multiple domains with various transport technologies, there may be difference in the transmission performance between the path alternatives. We have developed a function to select the set of domains that the path traverses, taking into consideration the user requested QoS parameters and the transmission performance that is measured in each domain (Figure 2).

(3) Software implementation of the virtual network operation

We have developed a prototype operation software that provides a simple GUI to application users. Users can view the topology in a graphical network map, and can edit the circuits to be established through simple mouse-pointer operation. It also provides a function to calculate the optimal virtual network topology according to the estimated traffic matrix. Operation of the virtual network can be done without being aware of the technological details that only the network operators are familiar to, because users can handle the network components with simple abstracted information such as nodes and edges. Through this software, users can manage the QoS of the virtual network stably by such as topology/route optimization path-level redundancy.

Future Plans

We will be working on further research issues needed for practical deployment of our achievements, expecting that the deployment of our technologies can foster development of future applications and novel network services that are leveraged by the global-scale virtual networks.

Footnotes

*1 SC11

SC is the international conference for high performance computing, networking, storage and analysis. SC11 will be held in Seattle, Washington (USA), November 12-18, 2011. Our demonstration will be shown in the exhibition booth of NICT (National Institute of Information and Communications Technology).
http://sc11.supercomputing.org/

*2 Interface to request dedicated circuits on-demand to the users

After the efforts in national R&E networks in the world to develop functionality to dynamically setup circuits on-demand of the users' requests, developers of these technologies are now in cooperation in order to establish a standardized architecture in OGF NSI working group. NSI, the Network Service Interface is expected to be the generic, common architecture that will be widely used in the near future.

*3 Circuits provided by testbeds

Circuits will be provided by JGN-X in Japan operated by NICT, GEMnet2 in Japan by NTT laboratories, GEANT in Europe by DANTE, Internet2 ION in the US. Since some of the testbeds support DCN (Dynamic Circuit Network) instead of NSI, we process a protocol conversion between NSI and DCN.

Attachment·Reference

- Figure 1: Quick provisioning of global-scale virtual network
- Figure 2: Optimal path selection based on performance measurements

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