

Towards A service Platform for Virtualization and Federation : a case of JGN2Plus

Shinji Shimojo, Yasuichi Kitamura, Hideaki Otsuki,

Service Platform Architecture Research Centre
National Institute for Information and Communications Technology
Chiyoda-ku Otemachi 1-8-1 KDDI Otemachi Build. 21F, Tokyo, Japan

sshinji@nict.go.jp, kita@nict.go.jp, eiji@nict.go.jp

Abstract

New generation network R&D by clean slate approach is started world wide such as GENI in US, Future Internet activities in FP7 and AKARI in Japan. Following these trends, JGN2plus, a new testbed for an advanced networking and application R&D, has been started from April 2008 by NICT. Fundamental requirement for testbed is that it should be built for a proof of concept of newly developed technology while supporting development of new applications. Therefore, testbed should be consistent with API although we want to keep introducing new technology. A service platform based on a service oriented architecture seems to be one of the candidate for flexible architecture. A service platform provides various advanced services to the applications in the help of network functionality. Most importantly, to support multiple experiments on new network functions, virtualization of network functionalities should be supported in a service platform. Finally, a service platform should be federated to support international experiments. In this paper, we propose a new service platform architecture for an advanced testbed for new generation networking research and development.

1 Introduction

In Japan, first testbed for network R&D was started in 1999 as JGN (Japan Gigabit Network) followed by JGN2 in 2004 and JGN2plus in 2008. However, the purpose and its role of the testbed is slightly changed. In the first two phases, that is, JGN and JGN2, the high speed network is very precious resources and its connectivity is mostly important. Therefore, just a connection to various sites is mostly important to encourage R&D effort and application development. Through the use of the high speed testbed, various applications such as telemedicine, remote observation of, for example, the ultra high voltage microscope, remote education became possible by the range of quality such as DV (Digital Video), HD or even 4K digital cinema. Also other applications requires to exchange a large volume of data such as eVLBI, LHC, etc. However, after ten years, although the connectivity to the

high speed network is still highly appreciated, a new requirements for testbed is rising.

- More dynamic and shared use of high speed network is required because of the limited budget and growth of its application.
 - Security becomes very important even in the R&D network.
 - A new type of ubiquitous applications with a large number of terminal or sensors is coming.
 - Testbed is a field for global open innovation.
- New generation network R&D by clean slate approach is started world wide such as GENI[1] in US, Future Internet activities in FP7[2] and AKARI[3] in Japan which aim to attack these issues. Therefore, a new role is expected for testbed of new generation network R&D as follows:
- Testbed should be built for the proof of concept in more realistic environment.
 - While appreciating existing applications in cyberinfrastructure, we are expecting more applications which utilize advanced functionality from the network.
 - Testbed should be built on existing and operational technology while supporting evolution of technology.
 - Virtualization and federation is a key concept for supporting multiple international experiments.

Therefore, the effort to build testbed network for new generation network is necessary but challenging. Among all above requirements, programmability for all layers is mostly important. To build flexible network testbed, our proposal is to introduce a layer of service platform between network layer and application layer. To support multiple experiments, concept of virtualization should be introduced in multiple layers. Virtualization helps to separate multiple experiments safely and securely. Currently, development of virtualization mechanisms are on going in different layers and projects. Therefore, virtualization mechanisms should be federated to support international experiments. Currently we are developing virtualization mechanisms in our service platform in three layers: Network layer consists of an optical network and

wireless network. On top of the optical network, many separated logical networks are existed. Some of them are packet switched and some of them are circuit switched. For circuit switched network, we are relying on VLAN. We also introduced virtually managed routers based on the state of art technology. In conjunction with high performance storage and CPUs, it could provide IaaS (Infrastructure as a Service) environment to support dynamic allocation of network, storage and computing resources. The middleware Layer consists of control plane for this hybrid network, service elements for advanced networking. In the current implementation, control plane for JGN is DCN[4] and a service platform for performance metrics is a mechanism called perfSONAR[5]. On top of these network layers, we are providing overlay layers based on P2P ubiquitous service platform, PIAX[6] and Planetlab[7]. Among these mechanisms, some of them are already internationally federated. As examples of internationally federated mechanisms, in this paper, we introduce our trial for DCN and perfSONAR.

2 DCN deployment on JGN2Plus

DCN is a switching service that creates short-term circuits between end-users that require dedicated path separately from IP network. The DCN enables users to create point-to-point across multiple domains using control plane software. Now, DCN is partly deployed on the Internet2, ESnet, GEANT, and JGN2plus. Currently, DCN provide a way to set up separate logical network on JGN2plus.

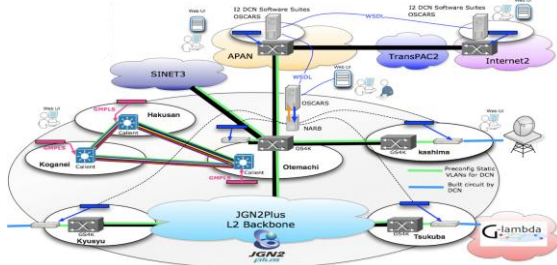


Fig. 1 DCN deployment on JGN2plus

Fig. 1 shows planned DCN network in JGN2plus testbed. We installed Inter Domain Controller (IDC), appeared as OSCARS in this figure, in Otemachi and IDC controls blue boxes in several site such as Kashima, Tsukuba and Kyusyu. These locations depend on application's location, so locations will be moved by experiment environment. E-VLBI application was demonstrated in SC08, as our first multi-domain inter operability trial between Kashima and SC08 booth via APAN, TransPAC2 and Internet2. By using these DCN network, application user is possible to use VLAN path on demand, among JGN2plus, APAN, Internet2 and more DCN site besides on Internet2. On the other hand, We are trying to install this technologies into our optical testbed. The Interoperability working group (IWG) in Kei-hanna info-communication open laboratory develops a

prototype node of GMPLS E-NNI which is interoperable with IETF and ASON model[8]. By using this GMPLS stack (red boxes) which can control optical layer switch, not only VLAN but also optical path can be served by DCN. This will make users can establish dedicated optical path when users need.

2 perfSONAR deployment on JGN2Plus

The other important element of network service is a measurement. The most frustration of current user in the R&E network is that they could not know what going on inside the network. If user can have some function to control the network, they should have some feedback of their control. That is, they should have some information what is going on inside the network. Measurement information gives part of the information inside the network. The performance service oriented network monitoring architecture (perfSONAR) is the framework that enables users or operators to easily refer, collect, and evaluate the monitoring data in a multiple-domain network environment. perfSONAR has been developed by GÉANT2, ESnet, Internet2, and RNP as its core members. perfSONAR is based on the idea of the three layer multiple-domain monitoring system shown in Figure 2.

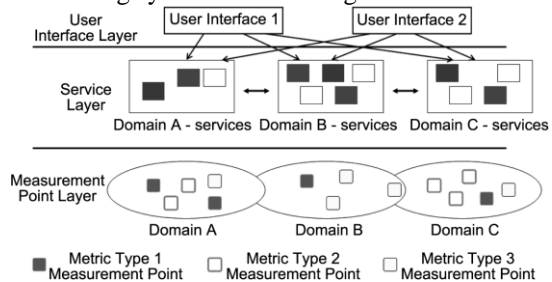


Figure 2 perfSONAR Framework

During the SC'08, perfSONAR infrastructure was deployed as the trial. It was the first time to start the perfSONAR deployment from Asian area and this facility could show the network performance parameter between the SC'08 and the counter part sites of the demonstrations. Figure 3 is the snap shot of the network weather map with using the perfSONAR data of the several networks.

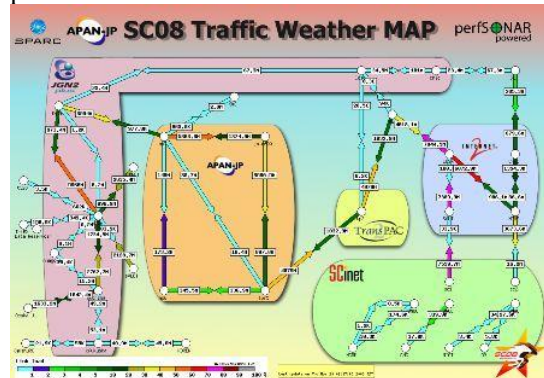


Figure 3 Traffic Weather Map based on perfSONAR

8 Conclusion

JGN2Plus is built as a National and International testbed network for advanced networking R&D. To support advanced international experiments, virtualization mechanisms should be supported. And international federation of these mechanisms is required. This is a very critical and exciting moment because these technologies are developing in parallel. Therefore, exchanging ideas in related projects are mostly welcome.

Acknowledgement

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