A Future Internet Testbed in Korea

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Abstract - Future Internet is a new concept Internet to solve inherent problems of the existing Internet and ultimately aims to provide new services such as mobility, security, scalability and manageability by replacing the present Internet. These new services can be expected to be available by Virtualization, Programmability and Federation which have not been realized on the present Internet. Already many developed countries are performing Future Internet research and constructing Future Internet testbeds, a foundation of the research. In order to keep pace with them, Future Internet's testbed deployment in Korea is necessary to create new Internet technology, a variety of services, and interconnection of resources internationally. Therefore the requirement of Korea Future Internet testbed is increasing. In order to satisfy the need, Korea Future Internet testbed is deployed between Daejeon(Korea) and GENI(USA).

Keywords: Future Internet, KREONET1, GENI, Federation, openflow

1 Introduction

Future Internet is a new concept Internet to solve inherent problems of the existing Internet and ultimately aims to provide new services such as mobility, security, scalability and manageability by replacing the present Internet. These new services can be expected to be available by three core technology (Virtualization, Programmability and Federation) which have not been realized on the present Internet. Additionally not only network resources in countries will be used independently, but also they will be shared together for international co-operation in the Future Internet.

Currently although research about Future Internet testbed is in an early stage, developed countries such as USA, Europe and Japan are progressing Future Internet testbed projects with the investment of human resources and budget. Among them, GENI (Global Environment for Network Innovation), FIRE (Future Internet Research and Experimentation), CORE (Collaborative Overlay Research Environment) are the leading and representative projects.

Already Future Internet testbeds in USA, Europe and Japan are being constructed and interconnected one another based on their representative national research and development networks. In order to keep pace with them, it is necessary for Korea to deploy Future Internet testbeds and to federate internationally for future science research. In doing so, Korea is expected to be the advanced country in the Future Internet areas and can lead the next generation network technology. Among them, the most important task is to deploy international Future Internet testbed and in particular federate with GENI, which is the leading project in USA. For those, Korea Institute of Science and Technology Information (KISTI) has participated in GENI project since a few years ago and was selected as the official international research partner in October, 2009. Thus, KISTI obtained a chance to promote joint technology development with Indiana university, one of the GENI project's participants, until 2012. (http://www.geni.net/?p=1480)

In this paper, we explained international Future Internet projects' trend in section 2. Then we described deployment of Future Internet testbed between Korea and GENI(USA) in section3, and openflow test through the testbed in section 4. Finally, we summarized the deployment of the Future Internet in Korea.

2 The Future Internet Trend

Developed countries around the world, as well as USA are investing a lot of budget for the Future Internet research. In this chapter, we would like to describe trend of the Future Internet.

2.1 USA

NSF (National Science Foundation) has been investing 700MS since 2004 through GENI and FIND projects to deploy the Future Internet testbed. Particularly GENI is implementing Programmability, Virtualization, Resource Sharing, Federation, Slice-based experiment and Clean-state in order to solve problems of the existing Internet. Thus, GENI aims to construct a totally differentiated testbed from
existing TCP/IP networks by new technology. For building practical testbeds, GENI uses Internet2 and NLR (National Lambda Rail) as the Future Internet testbed. And now GENI is in Sprial 3 and is constructing meso-scale infrastructure.

2.2 Europe

Europe is performing the Future Internet research program by FP7 (7th Framework Programme) and FIRE (Future Internet Research and Experimentation) projects based on Future Internet service and optical network technology. All of projects are also developing federation technology to use each nation's network resources jointly. In order to build useful testbeds, Europe uses GEANT 1, 2 and 3, PanLan and OneLab as a testbed. Additionally Europe is investing 650M€ to build the Future Internet testbeds on FIRE project and expanding the testbeds to construct large-scale experiment environment across Europe. And also Europe is trying to provide a variety of experiment environment similar to GENI.

2.3 Japan

Japan is performing AKARI project which is led by NICT (National Institute of Information and Communications Technology) and is focusing on ubiquitous, mobility and service convergence. For those Japan uses JGN2plus as the Future Internet testbed. On the other hand, Japan is developing the CORE testbed to perform research of the Future Internet and is trying to expand the CORE project toward national research network. Major research areas are federation, network architecture, mobile communications and bio/nano technology. In the meantime Japan has focused on technology related to IPv6, but recently Japan is concentrating on federation and virtualization research fields.

2.4 China

China is pushing ahead the Future Internet by CNGI (China Next Generation Internet) project. China is devoting to enhance scalability by IPv6 and uses CERNET2/6iX as a testbed.

2.5 Korea

Korea is progressing various projects in KISTI, FIF (Future Internet Forum), FN2020, ETRI and KT. Generally Korea is focusing on completely new structure of Future Internet and improving the structure of existing Internet simultaneously. For example, academic areas such as FIF concentrate on core technology development and standardization such as research plan and architecture design, and research and industrial areas focus on programmable platform development for virtualization. Additionally KISTI and NIA(National Information Society Agency) are deploying the Future Internet testbeds using KREONET and KOREN.

3 Deployment of the Future Internet testbed in Korea and GENI

The Future Internet testbeds can be classified into two categories. One is a small and local-sized testbed in research labs and campus. The other is a large-scale testbed to interconnect local-sized testbeds. From this point of view, the testbed which is deployed between Korea and GENI is backbone network level testbed. Additionally this testbed was deployed by core nodes which can provide virtualization and programmability function, thus Future Internet's researcher in Korea and USA can collaborate with one another using the testbed.

Generally core nodes of the Future Internet testbeds have to satisfy switching and routing functions, as well as have to include flow control functions. Therefore HP Procurve 5412zl switch and FIRST (Future Internet Research for Sustainable Testbed) switch which is developed by ETRI are used in Korea Future Internet testbed.

Figure 1 shows the configuration of the Korea Future testbed. HP Procurve switch is set up in Seattle and FIRST switch is installed in Daejeon. Two nodes were connected by 1Gbps VLAN of SONET/SDH gigabit Ethernet in KREONET. Internationally VLAN which is set up between Seattle and Daejeon is connected with a variety of Future Internet backbone networks in USA, thus Future Internet researchers can use this testbed for their research. Furthermore researchers in Korea also are able to use Future Internet testbed in Daejeon to collaborate with foreign researchers. Especially since core nodes which are deployed the Korea Future Internet testbed are compatible with those of GENI, collaborative research of Korea and USA will be possible.
As we mentioned before, core nodes of Korea Future Internet testbed consist of HP Procurve 5412zl switch and FIRST switch developed by ETRI. In case of FIRST switch, because it supports virtual programmability, users can create appropriate virtual network slice freely for research purposes. In case of a Procurve switch, it is also deployed in GENI testbed and also provides programmability functions.

Although high performance core nodes are necessary for building large-scale testbeds, programmable PC nodes are used to construct medium or small-scale testbeds and they also can be utilized as auxiliary nodes to support large-scale networks. In the Korea Future testbed, small programmable nodes also deployed. Therefore, researchers could choose appropriate nodes according to their research purposes. Figure 3 and 4 shows actually deployed Future Internet nodes of Korea Future Internet testbed.

4 Openflow Test

As Openflow is considered as one of important technology in the Future Internet, we conducted a test in order for Openflow functionality of core nodes. This test was done by FIRST switch and Procurve switch in Daejeon and Seattle on August 4, 2010. The test scenario is as follows.

4.1 Test Scenario

1) Media Server in Daejeon generates streaming traffic to FIRST switch.
2) Check that streaming traffic is normally transmitted to Media Receiver #1 in Seattle.
3) Execute commands which is developed by dpctl in Openflow Controller.
4) Check that transmission of streaming traffic to Media Server #1 in Seattle is stopped.
5) Check that streaming traffic to Media Receiver #2 in Daejeon is transmitted.
4.2 Test Results

Before executing commands, streaming traffic is transmitted to Media Receiver #1 in Seattle. After executing commands, transmission of streaming traffic is stopped to Media Receiver #1, and then traffic began to transmitted to Media Receiver #2 in Daejeon continuously. From this test, we were able to check that openflow function is operated normally in all core nodes.

Figure 6 Traffic received in Media Receiver #1 in Daejeon

Figure 7 Traffic path is changed from Media Receiver #1 to Receiver #2

5 Conclusion

Future Internet is a new Internet to overcome inherent problems on the present Internet. Already many countries such as USA, Europe and Japan are trying to develop Future Internet technology, and several Future Internet projects are being performed to preoccupy new unexplored areas. Thus deploying Future Internet testbeds is very important, because they can be foundation of Future Internet. This Korea Future Internet testbed, built between Korea and GENI, will support experimental environment and satisfy a variety of needs of researcher of USA and Korea. Therefore it will be representative Korea's Future research network.

6 References