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<https://hdl.handle.net/2324/8530>

出版情報 : 2005, pp.1-8, 2005. Proceedings of International Workshop on Applied Information
Technology || 2005 || p1-8

バージョン :

権利関係 :



International Collaborations on Next Generation Internet in Asia

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Abstract

Currently, Japan and Korea progress vary active International Collaborations about N-GI (Next Generation Internet) project between countries, named "Core Program Project of N-GI". In this paper, the project's history and current detailed activities are introduced. And technical issues from these activities are explained. Finally future plan about International Collaborations among Asian Counties over Asian NGI extended from this project will be shown.

1 Introduction

Around 2001, the plan of the direct optical fiber between Japan and Korea has started and Internet research group which consists from both countries has started the project of which mission is to use this optical fiber as the Next Generation Internet's physical layer of Japan and Korea. It takes much time and so many efforts from various people, university's professors, company engineers, political officials and etc. And finally the Next Generation Internet (NGI) between Japan and Korea using this optical fiber has established in 2003. After the establishment, fortunately Japanese government supported future oriented applications using this NGI then various international case studies such as remote lecture between universities, remote class between junior high

schools, remote educations between hospitals and etc were accomplished using future oriented applications using Digital Video Transfer System (DVTS) on this Next Generation Internet. Currently still many active projects between Japan and Korea are progressing using this NGI. In this paper, applications of the NGI and the technical issues for the best usage of International NGI will be shown and discussed in detail based on these real activities.

In current Asia, there are another NGI, for example, China, Thailand and Singapore also have very high speed Internet to the other countries. Based on the technologies and many know hows from the matter of Japan and Korea, the extension to these countries is also started. The experimentations from Japan to China and Thailand has been already accomplished and many other problem issues which never happen between Japan and Korea are found. In this paper, these new trial and issues for implementation of international collaboration of NGI in Asia will also be introduced.

2 The Optical Fiber and the NGI Project between JP and KR

Our current active collaboration about NGI between Japan and Korea has been initiated by establishment of Optical fiber (Fig 1) con-

nects these two countries. This optical fiber is called as KJCN (Korea Japan Cable Network) and leded domestic company's union and not by governments.

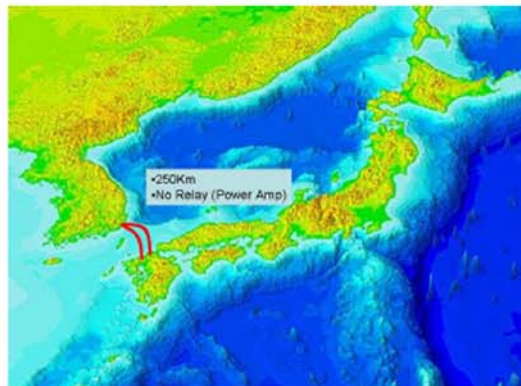


Figure 1: KJCN (Korea Japan Cable Network)

This KJCN connects Fukuoka city of Japan and Busan city of Korea without power supply unit. Then because the running cost should be low, cheap price for the International link is expected. This is typical example that Japan and Korea is very near geographically. This KJCN is owned by KEPCO (Kyushu Electric Power Cooperation), NTT Communications, JT (Japan Telecom) and KT (Korean Telecom). KEPCO is Kyushu, Japan area's domestic company and has kindly provided its link to Academic site for academic purpose in 2001. But what KEPCO gave us is just "Optical Fiber" then we must change it to "Internet".

In order to get very high speed Internet, we must promote what we can do if we could use it, even we never experience it. It likes "Chicken and Egg" problem. Furthermore, we have established semi-official project about N-GI between Japan and Korea to discuss with government to get funds. The project name is "Genkai/Hyunhae" (GH) Project[1]. In our GH Project, we have list upped these research themes for NGI in 2002,

1. Digital TV/Video Project

2. Research & Development on Scalable Conferencing System over Asia-Pacific Region
3. Remote Education and Remote Collaboration Support System
4. Access Grid
5. Virtual Museum
6. Advanced Contents Distribution Interoperability System
7. Research & Development on International Global IX
8. Building Very Long-haul Gigabit Ethernet/Lambda Network
9. Research on Generic Reliable Multicast Support Networks
10. Network Performance Measurement on the super broadband none-repeating network
11. Transporting High Energy Physics Experiment Data over High Speed Network
12. Aerodynamic design optimization using genetic algorithm in high throughput Grid computing environment
13. Large-scale molecular dynamics simulation of biopolymers in Grid environment
14. IT Week
15. Middle School
16. Music Performance
17. Alternative School Exchange
18. Ubiquitous (Wireline/wireless) Computing
19. Real-time broadcast of endoscopic surgery between Seoul and Fukuoka

Finally, both Japanese and Korean government have decided to support our GH project as Japan and Korea NGI project and made budget for very high speed Internet between

Japan and Korea using KJCN. The service of very high speed Internet between Japan and Korea of which speed was 1Gbps has been started from the beginning of 2003.

3 The NGI and its Applications between JP and KR

After this new NGI between Japan and Korea has been established, we can get another several foundations from government. And the foundations was mainly for the applications then we could experienced many new challenging applications over this high speed Internet.

The first foundation was called as "e! project" and supported by MPHPT (Ministry of Telecommunications), Japan. e! project focused on future world or society which will be changed by advanced ICT. Especially we have focused on how ICT will change human relationships or exchanges between Japan and Korea in future. Then many kinds of advanced humane related applications have been accomplished by this e! project. Followins are main topis of our e! project.

1. Remote lectures between Japanese and Korean Graduated School.
2. Remote class for Japanese freshmen from Korean
3. Foreign Exchange of Junior High School of Japanese and Korean
4. Culture Exchange between Japan and Korea [2]
5. Remote medical educations between Japanese and Korean Hospitals

We have many demonstrations and case studies by this e! project. Especially we have defined one week as "IT Week" and accomplished many events during the week. Most case studied used high quality video conference tool, name of DVTS which can transmit Digital Video as is over Internet. DVTS uses

30Mbps for its transmission then it can be run over only very high speed Internet[3].

Followings are some pictures of each topics. Fig 2 shows about "Remote lectures between Japanese and Korean Graduated School". This Remote lecture has accomplished as the regular class not the just events. Japanese graduated students had presentations about R-FC or Internet Draft which are described about Internet Standard and after his presentation all of students discussed about the Internet Standard.



Figure 2: Remote Lectures of Graduated School

Fig 3 shows about Remote class for Japanese freshmen. This class is a little bit unique class of Kyushu University. Several freshmen (B1) students are delivered to Professors' laboratories and they can experience current advanced technologies from the professor directly. The students who are allocated to author's laboratory can enjoy conversation with foreigner using the most advanced Internet conference tools.

Fig 4 shows Remote Medical Experimentations. Transmission of high quality moving-image is essential for telemedicine, which needs standardization of medical techniques and healthcare beyond geographical borders. The aim of this study is to establish a broad-banded medical network between hospitals in Korea and Japan using High Quality Conference tool-



Figure 3: Remote class for Japanese freshmen

s over Internet protocol. The medical doctors have established an international medical network with high-quality video transmission over Internet protocol, which reliable and useful for education. This will be a promising tool in remote medicine for the two countries and for world wide telemedical communication in the future.



Figure 4: Remote Medical Educations

Fig 5 show Foreign Exchange of Junior High School. Each students of Japanese and Korean Junior High School have enjoyed with many kind of foreigner exchanges, for example conversation by English or many funny games over Internet. Also the automatic language transla-

tion chat system has been developed for them and tried to use.



Figure 5: Foreign Exchange of Junior High School

The second foundation is supported by JSPS (Japan Society for the Promotion of Science) and KOSEF (Korea Science and Engineering Foundation). This project is called "Core University Project" and Kyushu University, Japan and Chungnam National University, Korea are Core Universities of each countries. These two Japanese and Korean Universities have leadership about NGI researches between Japan and Korea.

This project's official title is "Development and Operation of the NGI (Next Generation Internet) Technologies". So called NGI is researched in all over the world, US, Europe and Asia. We research these technologies and applications for NGI in cooperation between Japan and Korea. We aim that our research activities become one of bases of researches and developments of Internet technologies in Asia.

Japan side Universities and Institutes are composed from Waseda University, Kyushu Sangyo University, Nagasaki University, Saga University, University of Miyazaki, Kyoto University, National Institute of Informatics, The University of Tokyo, Osaka University, Osaka University, Keio University, Kyushu Institute of Technology, Hiroshima University, Hi-

roshima City University, National Institute of Information and Communications Technology, Chikushi Women University, Hokkaido University, Kyushu Institute of Information Science, Nagasaki Institute of Applied Science Cooperative University and Korean side is composed by Korea Advanced Institute of Science and Technology(KAIST), Seoul National University, Korea University, Hanyang University, Kyungpook National University, Kyunghee University, Chonnam National University, Information and Communications University(ICU), Gwangju Institute of Science and Technology(GIST), Sungkyunkwan University, Ewha Woman's University, Konkuk University, Cheju National University, National Cancer Center, Korea Institute of Science and Technology(KIST), Chungbuk National University, Soonchunhyang University, Kyungnam University, Advanced Network Forum(ANF), Pukyung National University, Pusan National University, Chonbuk National University, Sejong University, Gyeongsang National University. This shows almost every major universities and Institutes about Internet join this project.

This Core Program Project has following Working Groups.

1. Research on the Advanced Multimedia Communications and their Applications for e-Learning and distance learning
2. Research and Development of NGI Technologies
3. Research and Development of NGI Technologies for Digital Library
4. Development and clinical use of telemedicine with NGI Technologies
5. Research and Development of Information Security Technologies in Internet
6. Research and Development of VR Technologies for Collaborative Virtual Environments through the Internet

7. Research for Infrastructures and Applications of Grid

Two plenary seminars are held on both countries for one year(Fig 6). Previously two seminars were held at Chungnam National University, one seminar was held at Kyushu University and one seminar was held at Karuizawa to take care for Japanese researchers who don't live in Kyushu area. About 100 researchers attended to every seminars and various information about NGI technologies were exchanged and new collaboration and research themes were found in these seminars. In 2005, one of the plenary seminar will be scheduled in APAN (Asia Pacific Advanced Network)'s plenary meeting. APAN is the most biggest organization about Asia Pacific Advanced Network community. In this seminar, our activities will be introduced to every other Asian countries. This program has been just begun but already accelerated at the same speed of growth of Internet and contributes for future Internet under cooperation of Japan and Korea.



Figure 6: Core Program's Seminar

In this program, some remote lectures of Graduate School of Japan and Korea and contents sharing experimentation between Japanese and Korean TV companies have been already accomplished. In this paper, the demonstration at Korea Medical Conference 2005 is introduced. Korea Medical Conference is one of the biggest conference in Korea and almost all of famous medical doctors

inside Korea gather and attractive conference. During this variable conference, the venue (Hotel), Seoul National University, Ewha University and Kyushu University are connected via very high speed Internet and the panel discussion has been hold using DV (Digital Video) streaming which provides very high quality Audio and Video. The other demonstration which sends the surgery video using HDTV has also shown between the venue and Seoul National University. These demonstrations succeeded and KBS (which TV company is almost the same class of Japanese NHK) broadcasted about these demonstrations(Fig 7). In the broadcasting, the announcer said following.

"Is it possible that I can have operation in my country with being supported by foreigner famous doctor? This dream comes true at last. Korean surgeon and staffs and Japanese skillful surgeon can discuss about the surgery via high quality video using the high speed Internet. This technologies can surely support remote surgery under cooperation with domestic medical staff and feigner many excellent medical doctors."



Figure 7: KBS TV Broadcasting

In this experimentation, the equipment of DV streaming for panel discussion is located and managed by Kyushu University's staff. The team of "Development and clinical use of

telemedicine with NGI Technologies" has remote conference such as this constantly for every week or month. And the team from "Research and Development of NGI Technologies" supports their technical part. This tightly relationship of application area and technology area can success this big event. This success of big event shows that our program surely goes very well with developing the technologies and human relationship.

4 Technical Issues from The Projects

In this section, the technical issues about Network Infrastructure are summarized. These are Layer 2 (High Performance Ethernet) and Layer 3 (Internet Operation).

Mainly we have used DVTS for our experiments. As it has been written before, single DVTS stream consumes about 30Mbps. As current major LAN infrastructures are consists by 100Mbps or 1Gbps Ethernet Switches, it seems that even 30Mbps is a little bit large but it may be easy to use it. But there were so many problems to accomplish the stable DVTS stream between Japan and Korea.

First of all, there are so many kinds of Ethernet Switches in the world now, from very expensive one to very cheap one. This cheap one makes very serious problem for the high bandwidth applications such as DVTS. Then in the beginning of the experimentations, removal all of low-spec Ethernet Switches from the whole network path are focused on and it means that all of Ethernet Switches on the wholenetwork path for the experimentations should be taken care of for success of stable DVTS. At the latter of the experiments, the multiple DVTS streams are used. They consumed about 100Mbps or sometime over 100Mbps. Then the Ethernet Switches of reasonable spec becomes essential for these experimentations.

The second problem is about stable routing. The test bed of Japan and Korea consists of several ASes (Autonomous Systems) and each AS inside this infrastructure lives by its own

policy and under its own network management. The problems are that some ASes inside the test bed become failure and this causes performance problems because the Internet path will be changed to use non-NGI Links which do not have enough band width. Then the observation of the routing is very important during the experiments and back up links using NGI become necessary.

Now we can prepare proper spec Ethernet Switches over our whole network path and the operations skill of main ASes become stable NGI between Japan and Korea then the experiments can be carried out by non technical member such as medical doctors and minimum engineers.

If the experimentation will be extended to use IPv6 and Multicast, the similar attention for Network infrastructure are necessary. And the experiments using un-compressed HD stream between Japan and Korea are scheduled as it is written later. This TIPS about network equipments and Routing Operation Skill are very important.

5 Asian NGI and their Applications

The Core Program project of "Development and Operation of the NGI (Next Generation Internet) Technologies" is keeping active now and especially the WG of "Development and clinical use of telemedicine with NGI Technologies" is one of most active[4]. This group can get another local foundation from Kyushu University and extends their activities to Asian other countries, such as China, Thailand, Singapore, Taiwan and Australia. Actually, Kyushu University hospital has already experimentation with China(Fig 8) and Thailand(Fig 9).

Kyushu University, Japan has been progressed many case studies over NGI with other Asian countries. The difference rather than other foreign universities is that the experimentations are carried on usual campus network not on special Research & Development



Figure 8: Remote Conference with Shanghai First People Hospital, China



Figure 9: Remote Conference with SIRIRAJ Hospital, Thailand

(R & D) line. For example, even Seoul National University, which is the best university in Korea and one of the best Universities in Area use R & D special Internet link for its experimentation. Using dedicated R & D line is easier than compressed campus network line for success the experimentation. But using campus network can feed back many important information to Internet Researchers. From these valuable information, we, Computer Center Engineers can improve our Internet skills. This is real "Development and Operation of the NGI" which is expected by our Core Program Project. Indeed, Kyushu University's computer center skill has been very improved than previous. The beginning of the experimentation, there are so many unknown problems but recently on even campus network, the medical doctors can have practical experimentations like on R & D networks. And these technologies and know how are practically used for building Kyushu University new campus's network.

6 Conclusion

In this paper, International Collaborations about NGI (Next Generation Internet) between Japan and Korea project, named "Core Program Project of NGI" are introduced, technical issues based on this project are explained and Future plan about International Collaborations between Asian Countries over Asian NGI are mentioned. Currently we mainly use DVTS system but HD (High Definition) stream which requires 1.5Gbps is much high quality and recent Internet have enough capacity to carry even such 1.5Gbps HD stream. As Asian Internet grows to global broad band, for example using TEIN2 (Trans-Eurasia Information Network, Fig 10), the tools for Internet such as multimedia based human communication tools should be up graded, too. The author is thinking to deploy these advanced tools on Internet to all over the Asian countries.



Figure 10: Plan of TEIN2

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