Progress Report for “APII IPv6 Testbed” Project

Purpose: Information
Submitted by: Japan
# APEC PROJECT FORMAT

## Progress Report on APEC Projects

<table>
<thead>
<tr>
<th></th>
<th>Operational Account</th>
<th>TILF Special Account</th>
<th>APEC Support Fund</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project number:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Date received by Secretariat:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Name of Committee/Working Group:**
ICT DEVELOPMENT STEERING GROUP, DSG

**Title of Project:**
APII IPv6 R&D Testbed Project

**Proposing APEC Economy:** Japan

**Co-sponsoring APEC Economy (ies):** Korea, China, Thailand

**Project Overseer:**
Dr. Norifumi YAMAGUCHI
Group Leader, Network Testbed Strategic Planning Group, Collaborative Research Department
National Institute of Information and Communications Technology, Japan

**Postal address:**
1-8-1 Otemachi, Chiyoda-ku, Tokyo, 100-0004, Japan
Tel: +81.3.3272.3060
Fax: +81.3.3272.3062
Email: n.yamaguchi@nict.go.jp

**Financial Information**

<table>
<thead>
<tr>
<th></th>
<th>Total cost of proposal (US$):</th>
<th>Amount being sought from APEC Central Fund (US$):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Self funded</td>
<td>None</td>
</tr>
</tbody>
</table>

**Type of Project:**
- seminar/symposium
- short-term training course
- survey or analysis and research
- database/website
- others (Please specify)

**Project start date:** 2002/04/01
**Project end date:** N/A

**Brief description of Project:**

1. Establish APII IPv6 testbed for research and development
2. Incubate researchers and engineers with IPv6 technology
3. Establish an information-sharing system and a technology-transfer program
4. Distribute the latest expertise in IPv6 technology for APEC TEL members, especially DSG
5. Establish unique IPv6 technologies in Asia-Pacific countries
6. Speed up the transition from IPv4 to IPv6

**Signature of Project Overseer:**
(Separate written confirmation acceptable for email submission) Date:

**Signature of Committee Chair/WG Lead Shepherd:**
(Not applicable to Progress Report and Evaluation Report)
(Separate written confirmation acceptable for email submission) Date:
Progress Report on APEC Projects

Status/Progress and Problems

<table>
<thead>
<tr>
<th>Current status of project: On schedule (Yes/No)</th>
<th>Within budget (Yes/No)</th>
</tr>
</thead>
</table>

Objectives

This project aims to speed up the development of a new testbed, the APII IPv6, for IPv6 native networks in the Asia-Pacific region. The project assists researchers and engineers in promoting the transition from the current IPv4 to the IPv6 Internet by using a real testbed infrastructure, by sharing facilities, equipment, and knowledge among the APII IPv6 network operation teams, and by fostering cooperation among their institutions.

Linkages, Methodology, Budget

The APII IPv6 R&D testbed provides a new network and framework for researchers and engineers in the Asia-Pacific region to develop and expand next-generation Internet technology, especially IPv6 technology. It has been already used for several experiments.

The testbed consists of international submarine optical-fibre cable systems (the Japan-Korea and the Japan-China links). The capacities of the systems are 10 Gbps for Korea and 2.5 Gbps for China, and the systems are working together with JGN2plus, APAN, TransPAC2, and TEIN2.

The APII IPv6 R&D Testbed Project is open to researchers and engineers in the Asia-Pacific region. Those who are conducting any form of research to develop next-generation Internet technology are welcome to use the testbed. To present your plans or ideas, please contact the project overseer.

Gender Considerations  N.A.

Progress since last report:

1. Asia Pacific Backbone Topology
2. Recent APII test activities (Snow Festival, SC’08 etc)

Notes:
- All Committee and Working Group projects, irrespective of their source of funding, should be reported to BMC.
- Please mark “N.A.” if any item is not applicable.
  Name of Project should be identical with the name stated in the project proposal.
Progress Report on the APII IPv6 R&D Testbed Project in Japan

April 2009

1. INTRODUCTION AND OVERVIEW

In April 2008, NICT started with the operation of the JGN2plus project. JGN2plus represents an advanced testbed network to support R&D of the New Generation Network (NwGN) promoted by NICT since 2007. The mission of JGN2plus is to provide a platform for new R&D activities and leading-edge experiments in the field of network technology. In order to make research and development activities more efficient, the project is managed by the research center called SPARC (Service Platform Architecture Research Center) which was founded in April 2008 and is located at Otemachi in downtown Tokyo.

The JGN2plus project has its own research theme called “Research and Development on Operations and Management for New Generation Network”. This theme is further subdivided into six research topics as depicted in Fig. 1.

![Fig.1 Research projects supported by SPARC](image-url)
Research topic 5 is concerned with international collaboration which involves also the management of all activities between Japan and Korea under the Asia-Pacific Information Communication Infrastructure (APII).

Figure 2 on the next page gives an overview of the network used by SPARC for its international collaborations.

\[\text{Fig. 2 Network for international collaborations}\]

### 2. APII TESTBED ACTIVITIES

#### 2.1 Background

The APII project's Record of Discussion (RoD) was exchanged at the director general meeting in Seoul in 1997, and a 2 Mbps Japan-Korea ATM link (APII JP-KR link) was established in 1998. This link was temporarily upgraded in preparation for some events and experiments, one of which was the first Digital Video Transport System (DVTS) experiment for the Super Computing conference in 1998. At the APAN Osaka meeting in 1999, a temporary 45 Mbps bandwidth was used for a high-quality remote conference between Japan and Korea using DVTS. In 2000, the APII JP-KR link was then permanently upgraded to 8 Mbps. One of the link’s purposes has been to provide connectivity for the Asia-Pacific region. The link was therefore used for Asia-Pacific collaboration on research activities even after Korea started its direct connection to USA. As a result, the link between Japan and Korea was soon used at the maximum of its capacity. In 2001, the bandwidth was saturated and experimental technology with Quality of Service (QoS) had to be introduced to reserve bandwidth for high-priority communications.
2.2 APII and related links

2.2.1 APII Japan-Korea (JP-KR) link

The city Fukuoka is located on the north side of Japan's southwestern island Kyushu and lies opposite across the Sea of Japan to the city Busan on the south side of the Korean peninsula. Because they are geographically separated by only about 250 km, these two cities historically have had a close economic and cultural relationship. The distance between them is short enough that an optical fiber cable without a repeater facility can be used. Therefore, the Korea Japan Cable Network (KJCN) fiber system was established between them. First, the APII JP-KR link with a 1 Gbps bandwidth for the KJCN was introduced in the Japan-Korea APII testbed in 2003. The APII JP-KR link speed was then upgraded from 1 Gbps to 2.5 Gbps in 2005 and from 2.5 Gbps to 10 Gbps at the end of 2006.

2.2.2 APII Japan-China (JP-CN) link

A 2.5 Gbps link between Tokyo and Hong Kong was established in April 2005. NICT is being connected to the China Education and Research Network (CERNET) and Chinese Science and Technology Network (CSTNET) with separate channels at 1 Gbps respectively. NICT has exchanged a Memorandum of Understandings (MoU) with Tsinghua University, China as well as the Computer Network Information Center (CNIC) of the Chinese Academy of Sciences (CAS) to establish joint research activities utilizing these links.

In 2008, in the course of upgrading the network configuration in Hong Kong, the Chinese University of Hong Kong (CUHK) and the Hong Kong Internet Exchange (HKIX) point were directly connected to the JP-CN link, too. Price of Wales Hospital of CUHK is well known for its endoscopy training center and HKIX is famous to be one of the biggest Internet exchange points in the Asian area. The JP-CN link is used not only to access China but also other Asian areas.

![Fig.3 APII links (JP-KR 10 Gbps link and JP-CN 2.5 Gbps link)](image-url)
2.2.3 Research and Education Network (R&E Network)

Besides activities related directly to APII, the National Science Foundation (NSF) in the USA started the International Research Network Connections (IRNC) in 2004 and adopted then five network projects such as Gloriad, Transpac etc. In addition, the third generation Trans-Eurasian Information Network (TEIN3) started its operation recently. Figure 4 gives an overview of the R&E Network in the Asia Pacific area including the bandwidth data of a few representative links. It can be seen that the East Asian, South-East Asian and Oceania area have a good interconnectivity with links of at least 155 Mbps.

![Fig. 4 Asia Pacific Backbone Topology](image)

2.3 Activities to be updated (since October 2008)

SPARC conducts APII IPv6 R&D Testbed Project experiments in cooperation with APEC economies. The following summarizes a few noteworthy examples.

2.3.1 Snow Festival

The Sapporo Snow Festival is one of Japan’s largest winter events attracting many visitors from Japan and abroad. This year, the event celebrated its 60th anniversary. During the event, Japan and Korea closely collaborated with respect to real-time video transmission over DTV (HD-SDI)
for a TV program broadcasted both in Japan and Korea. The highlight of this broadcasting was the video transmission of the snow Namdaemun (a snow model of the historic gate located in the center of Seoul) from Japan to Korea. The experiment included the following technical details:

- Measurement of how the broadcast system affects the quality of contents;
- Measurement of the video quality and its impact on network latency;  
  (packet loss rate, packet delay time, MTU size, jitter of the available bandwidth),
- Evaluation of the video quality based on the transport protocols (UDP/TCP etc),
- Evaluation of the failure recovery time,
- Broadcasting experiment using the virtualized storage system.

Also experiments with respect to local one-segment broadcasting, a terrestrial digital broadcasting service for mobile devices in Japan which is compatible with Internet video streaming, were carried out using IPv6 technology. Usually, TV broadcasting over the net requires QoS. This service can be implemented in a number of different ways, but during this experiment, the Japanese and Korean team used future internet technologies such as virtualization. The virtualization technology was used to manage the network equipment, the routing information, the network topology and the video storage. Figure 5 shows the so-called “Infrastructure as a Service“ (IaaS) configuration used during the experiment.

Fig. 5 Computer infrastructure used during the Snow festival experiment
(VR: virtual router, VS: virtual storage, VPN-GW: virtual private network gateway)
2.3.2 Super Computing Conference SC’08

As mentioned already in the previous APEC-TEL meeting, SPARC started activities with respect to both the Dynamic Circuit Network (DCN) and the performance Service Oriented Network monitoring Architecture (perfSONAR). The first trial in this respect was done during the Super Computing Conference 2008 in Austin, Texas, USA. DCN demonstration supported real-time correlation calculation of the radio astronomic activity (Very Long Baseline Interferometer, VLBI) to obtain and correlate observation data both from Japan and Finland. On the other hand, perfSONAR provided data about the usage of all the links between Korea, Japan and USA. Both services were very well received by researchers who were presenting their demonstrations at SC’08.

2.3.3 APII Workshop

This year’s APII workshop was held during the 27th APAN meeting in March 2009 in Taiwan. Besides discussing updates and future plans for the APII JP-KR circuit, the workshop featured talks with respect to “Green IT on the Net” as well as “Future Internet”. The workshop was organized by the National Information Society Agency (NIA) of Korea with support from NICT.

2.4 Future Activities

Along with the APII activities, NICT and NIA have been holding monthly teleconference meetings. Through these meetings, we promote on both sides research activities such as network monitoring and measurement via web service in form of perfSONAR and the deployment of interdomain network control layers in form of DCN which enables provisioning of QoS. Further activities include internet protocol-ubiquitous sensor network experiments (IP-USN) and the deployment of a large scale distributed computing environment (Planetlab). These activities, which involve future internet technologies, receive growing attention from the APEC community. Of course, IPv6 deployment plays a major role in these activities too. In other words, NICT will steadily increase the number of research topics related to future internet technologies in its testbed activities henceforth.

3. CONTACTS

For technical questions please contact:
Mr. Yasuichi KITAMURA (Network Testbed Research Promotion Group, NICT)
E-mail: kita@nict.go.jp

For general questions please contact:
Dr. Werner KLAUS (International Alliance Group, NICT)
Email: klaus@nict.go.jp