APII R&D Testbed Network Project

Purpose: Information
Submitted by: Japan
APII R&D Testbed Network Project
Progress Report - April 2013 to March 2014

April, 2014
Takahiro Sumitomo
National Institute of Information and Communications Technology, Japan

Updates for April 2013 to March 2014

• Introduction and Overview of JGN-X Project
  – JGN-X Project for Future Internet
  – JGN-X updates on Network Environment

• Recent and Upcoming Events related to APII Testbed
  – Demonstration on Supercomputing Conference (Nov. 2013)
  – APAN Future Internet Testbed(FIT) WG Workshop(Jan. 2013)
  – Future Internet Workshop in Bangkok, Thailand(Dec. 2013)
  – Snow Festival Experiment 2014(Feb 2014)
  – Joint SDN Research with ThaiREN/SingAREN
**Future Internet/New Generation Network**

**Outline**

- Realization of “Future Internet technologies (i.e. the New Generation Network (NWGN))” is required, which will provide fundamental solutions to various network problems, such as network security and energy consumption.
- NICT has conducted R&D activities, and operates large-scale testbed networks to establish NWGN technology through proof and evaluation.
- The testbed networks are widely opened to industry, academia and government as a technology assessment environment (testbed), and promote the timely development of new applications and strategic international joint research and cooperation through connections with research institutions in the U.S., Europe, Asia, etc.

### Outline of NWGN

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>2000</td>
<td>Increasing speed and performance</td>
</tr>
<tr>
<td>2010 (Present)</td>
<td>Putting it to practical use</td>
</tr>
<tr>
<td>2015</td>
<td>Establishing New Generation Network Technology</td>
</tr>
<tr>
<td>2020</td>
<td>Operation of New Generation Network (NWGN)</td>
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### Related IP Network Technology

- Related New Generation Network Technology
- JGN
- JGN2
- JGN2plus

### Network Virtualization Concept in NWGN

**Different function**: dedicated bandwidth, delay tolerance, processing speed, security level, etc.

- **Network Service of Highly Security**
  - Local Governments NW
  - Hospital NW
  - Bank NW
  - Privacy NW

- **Network Service of Fine Data / Low-latency / Delay Tolerance**
  - Observing NW
  - Healthcare NW
  - Environmental Monitoring NW

- **Network Service for Computing**
  - Layered Video NW
  - Data Aggregation NW
  - Value Creation NW

- **Internet Service**
  - Web NW
  - IP-TO NW
  - VISP NW

- **Physical network**

- **Network Service of Super-Low-Latency, Time Synchronized Broadband**
  - Seismic detection NW
  - Astro/Geophysical NW
  - Ultra-Realistic NW
  - Disaster Recovery NW

- **Network Service of Computing**
  - Layered Video NW
  - Data Aggregation NW
  - Value Creation NW

- **Network Service for Computing**
  - Web NW
  - IP-TO NW
  - VISP NW

**Physical network**
To virtualize network (to make some completely isolated logical networks (we call "network slices") in non IP technology basis over physical network).

Network virtualization service can provide different network function, performance and quality etc. for different service application as virtualization.

Network Virtualization System image

JGN-X Network including APII Network (till end of 2014)

Realizing multiple New Generation Network Planes on a virtual JGN-X network. Also made it available to interconnect with other Testbeds.

Optical Testbed

Koganei: Otemachi
Otemachi ~ Otemachi

JGNN USA: 10G
Japan ~ Korea: 10G
Japan ~ Hong Kong: 10G
Hong Kong ~ Singapore: 2.4G
Singapore ~ Thailand: 622Mbps

Bandwidth International

USA
Thailand
Singapore
Hong Kong
South Korea

DCN plane
OpenFlow plane
Virtual Node plane

VLAN-based testbed network
Virtual Node plane
OpenFlow plane
DCN plane
Realizing multiple New Generation Network Planes on virtual JGN-X network. Also made it available to interconnect with other Testbeds.

JGN-X (Japan Backbone)

JGN-X (International Backbone)

JGN-X International & Domestic Circuits

(planned for 2015 Q1)

US-JP line: Tokyo-Los Angeles, 10Gbps
HK-JP line: Tokyo-Hong Kong, 10Gbps
HK-SG line: Hong Kong – Singapore 2.4Gbps
SG-TH line: Singapore –Thailand 1Gbps

Upgrade!!
JGN-X International circuit update (done)

- 100G Logical SW
- 100G SDN Routing SW
- 100G HW Router
- RISE OpenFlow SW
- VNODE
- 10G Legacy SW
- GG
- DPI
- 10G Logical SW
- Virtual Storage Service

Recent and Upcoming Events related to APII Testbed

- APII Workshop 2013 (Aug. 2013)
- APAN Future Internet Testbed (FIT) WG Workshop (Jan. 2014)
- Demonstration on Supercomputing Conference (Nov. 2013)
- Snow Festival Experiment 2014 (Feb. 2014)
- Future Internet Workshop in Bangkok, Thailand (Dec. 2013)
- Joint SDN Research with NECTEC/Uninet
Date: Aug 23th 2013
(held in the final day of 36th APAN meeting)
Place: Daejeon, Korea

Presentation of 10 Research updates had been made from Attendees from Asia-Pacific countries joined the discussion as well
We appreciate the great effort and hospitality of NIA members!!]

Next APII Workshop is planned in Oct. 2014 (Osaka, Japan)

<table>
<thead>
<tr>
<th>Topic</th>
<th>Title</th>
<th>Organization</th>
<th>Speaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testbed Update</td>
<td>APII-KR Update</td>
<td>NIA</td>
<td>Mr. Sanggyun KIM</td>
</tr>
<tr>
<td></td>
<td>APII-JP Update</td>
<td>NICT</td>
<td>Prof. Kazumasa Kobayashi</td>
</tr>
<tr>
<td>SDN</td>
<td>Experimenting Open Networking with OF@TEIN</td>
<td>GIST</td>
<td>Dr. Jongwon KIM</td>
</tr>
<tr>
<td></td>
<td>Towards SDN-enhanced High-Performance Computing and Visualization</td>
<td>Osaka Univ.</td>
<td>Dr. Susumu Date</td>
</tr>
<tr>
<td>Mobile TB</td>
<td>Mobile Communication Platform using Open Source Software</td>
<td>Kyunghee Univ.</td>
<td>Sungwon Lee</td>
</tr>
<tr>
<td></td>
<td>Green Wireless LAN System</td>
<td>Tottori Univ.</td>
<td>Assoc. Prof. Motoyuki Ohmori</td>
</tr>
<tr>
<td>Application</td>
<td>Next Generation Web Technology for Future Media Platform</td>
<td>KAIST</td>
<td>Dr. Junghyun CHOI</td>
</tr>
<tr>
<td></td>
<td>The effectiveness and impact of JGN-X network in the field of astronomy</td>
<td>NAOJ</td>
<td>Dr. Masafumi Oe</td>
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<tr>
<td></td>
<td>Service Changing between R&amp;D and experiment over KOREN</td>
<td>NIA</td>
<td>Dr. IlKwon CHO</td>
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<tr>
<td></td>
<td>A Participatory Platform for Cyber-Physical Sensing based on Service-Controlled Networking</td>
<td>NICT</td>
<td>Dr. Koji Zettsu, Mr. Takashi Kimata</td>
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</tbody>
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Presentation materials are available from: http://www.koren.kr/koren/eng/dat_list.html?cate=7&menu=1
APAN37 FIT WG (Jan. 22th, 2014 Indonesia)

<table>
<thead>
<tr>
<th>No</th>
<th>Title of the presentation</th>
<th>By</th>
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<tbody>
<tr>
<td>1</td>
<td>Designing Container-Based Testbed for Information-Centric Networking</td>
<td>Hiroshi Asaeda (NICT)</td>
</tr>
<tr>
<td>2</td>
<td>An ICN Testbed on APAN</td>
<td>Sunyoung Han (KonKok University), ICN project</td>
</tr>
<tr>
<td>3</td>
<td>Design and Implementation of Keyword Centric Network</td>
<td>Motoyuki OHMORI (Tottori University)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Session 2</th>
<th>Chair: Jennifer Schopf</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>WE-Bridge for an inter-domain SDN testbed among CERENT-CSTNET-Interen2-SerfNet</td>
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<tr>
<td>5</td>
<td>International Networking at Indiana University</td>
</tr>
<tr>
<td>6</td>
<td>Federation of Future Internet Testbeds - first experiences from bilateral collaboration between Europe and Japan on SDN</td>
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</tbody>
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Planned

APRICOT-APAN2015 in Fukuoka, Japan

- Date: March 1st -5th, 2015
- Venue: FICC, Fukuoka, Japan
- Planned by:
  - Asia & Pacific Internet Association (APIA)
  - Asia-Pacific Advanced Network Limited (APAN)

Detail will be provided soon...
Demonstration in SC13 with global relationship

At SC13 (Supercomputing Conference 2013), NICT performed (1) Demo of RISE 3.0, (2) International dynamic connection using SDN, (3) Application demo of large data, (4) Data mobility service over international organizations with using NSI.

Future Internet Workshop in Bangkok

- Date: Dec. 3rd 2013 (co-hosted: TEIN4 launch event)
- Hosted by: ThaiREN (NECTEC/Uninet), TEIN*CC
- Venue: Amari Watergate Hotel (Bangkok, Thailand)
- 9 presentations are made by researchers from Thailand and Japan
- In Dec 4th, OpenFlow training session has also held in Bangkok

We are discussing with ThaiREN for plan of next Future Internet Workshop
Program:
Future Internet Workshop in Bangkok

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Remark</th>
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</thead>
<tbody>
<tr>
<td>13:00–13:30</td>
<td>Speech from Executive Director of NECTEC, Speech from Director of UniNet, and Speech from NICT (IP)</td>
<td>Dr. Pansak Siriruchatapong, Executive Director of NECTEC Prof. Kanchana Kanchanasut Takahiro Sumitomo, NICT</td>
</tr>
<tr>
<td>13:30–14:00</td>
<td>Named Data Network in Vehicular Net</td>
<td>Giovanni Pau, LiP6, UPMC, France</td>
</tr>
<tr>
<td>14:00–14:20</td>
<td>Advanced Research and Technology for Future Internet (TBD)</td>
<td>Dr. Kazumasa Kobayashi/ NICT / Kurashiki University of Science and The Arts</td>
</tr>
<tr>
<td>14:20–14:40</td>
<td>Information Centric Network Testbed on TEIN4</td>
<td>Prof. Sunyoung Han, Konkuk University, Korea</td>
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<td>14:40–15:00</td>
<td>Tea Break</td>
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<td>15:00–15:20</td>
<td>OOO(O3) Project</td>
<td>Kazuaki OBANA, NTT Network Innovation Laboratories</td>
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<tr>
<td>15:20–15:40</td>
<td>Service Platform for Internet of Things</td>
<td>Dr. Panita Pongpaibool, NECTEC</td>
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<td>15:40–16:00</td>
<td>OpenFlow/SDN Research, Testbed and Experiments</td>
<td>Shuji Ishii, NICT</td>
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<td>16:00–16:20</td>
<td>Big Data</td>
<td>Assoc Prof. Wichian Premchaisawadi, Siam University</td>
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<td>16:20–16:40</td>
<td>Service Provisioning in Future Internet</td>
<td>Dr. Seiichi Yamamoto, NICT</td>
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<tr>
<td>16:40–16:50</td>
<td>User-Centric Networking in Dynamic Circuit Network (DCN)</td>
<td>Dr. Orawiwattanakul Tananun / NICT</td>
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<td></td>
<td>Closing remark</td>
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JGN-X Experiment in Snow Festival 2014

- **1GbE**
- **10GbE**
- **100GbE**

- 4KHD compressed transmission over SDN multipath (multipoint up to 1Gb/s)
- 8K+4K uncompressed transmission (Tokyo-Osaka, 36Gbps or more)
- 100GbE
- 8K monitor
- 8K Camera
- Video transmitter
- HD Camera
- HD monitor
- 10GbE
- 100GbE

- 4K/8K uncompressed transmission over IP network (>36Gbps)
- Multipath transmission experiment of HD/4K compressed video streaming between Sapporo-Okinawa over SDN testbed RISE on JGN-X (<1Gbps)
- World’s first trial of long-distance 8K video streaming transfer on long-distance IP network
Experiment on Snow Festival 2014
Cooperating organizations (unsorted)

<table>
<thead>
<tr>
<th>Organizations</th>
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<tbody>
<tr>
<td>Asahi Broadcasting Corporation(ABC)</td>
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<tr>
<td>Sky+A Inc.</td>
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<td>GAORA Inc.</td>
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<tr>
<td>Hokkaido Television Broadcasting Co., Ltd. (HTB)</td>
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<td>NTT Corporation</td>
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<td>NTT Communications Corporation</td>
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<td>NTT IT Corporation</td>
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<tr>
<td>Hokkaido Telecommunication Network Co., Inc.(HOTnet)</td>
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<td>KYOWA EXEO CORPORATION</td>
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<td>OBIS, Inc. (OBIS)</td>
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<td>Fatware Inc.</td>
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<td>Information Services International-Dentsu, Ltd. (ISID)</td>
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<td>Cisco Systems G.K</td>
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<td>Juniper Networks, Inc.</td>
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<td>NEC Corporation</td>
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<td>Ixia Communications K.K.</td>
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<td>TOYO Corporation</td>
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<td>PFU LIMITED</td>
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<td>Sharp Corporation</td>
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<td>ASTRODESIGN, Inc.</td>
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<td>Purelogic CO.,LTD</td>
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<td>Trans New Technology, Inc.</td>
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<tr>
<td>Kanagawa Institute of Technology</td>
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<tr>
<td>The University of Tokyo</td>
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<tr>
<td>Nara Institute of Science and Technology</td>
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<tr>
<td>Kurashiki University of Science and The Arts.</td>
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<tr>
<td>Nago City, Okinawa Pref.</td>
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<td>Ginoza Village, Okinawa Pref.</td>
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<tr>
<td>Union-wide Municipal Affairs of Northern Area of Okinawa Prefecture</td>
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<td>Specified NPO NDA</td>
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<tr>
<td>Cyber Kansai Project (CKP)</td>
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</table>

Scenes from experiment in Umekita

Over 100 person visited the demonstration. 8K display by SHARP showed movie of the Snow Festival, and live streaming from Otemachi. People enjoyed interaction with Otemachi via 4K display as well.
OpenFlow/RISE Training (w/ThaiREN)

- During Jan-Mar 2013, NICT invited 2 trainees from NECTEC/Uninet (Thailand) for OpenFlow Training.
- They successfully finished the training course, and developed a few OpenFlow applications for better understandings.
- After the training, ThaiREN started OpenFlow development in its network, and also host OpenFlow tutorials in WUNCA and FI workshop in Bangkok.

Snapshots

OpenFlow application: Flow control

OpenFlow application: Cross-multi-VLANs

OpenFlow/RISE Training (w/SingAREN)

- From May 2013 to July, Derrick LIM from NTU worked in Otemachi/Tokyo for the OpenFlow transport application (loss-less transmission by using buffer)
- A researcher team of Osaka-University in Japan interested in his work, and started applying the function on a SDN application(TDW streaming)
- NICT will continue the training to its partners.

Derrick LIM(NTU)

Loss-less transmission using proposed buffering function
- supply lost data from the buffer

Controller Architecture:
- Store certain flow data into buffer, and re-send when needed
Thank you for your attention!

Network Testbed Research and Development Promotion Center
National Institute of Information and Communications Technology / Japan

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