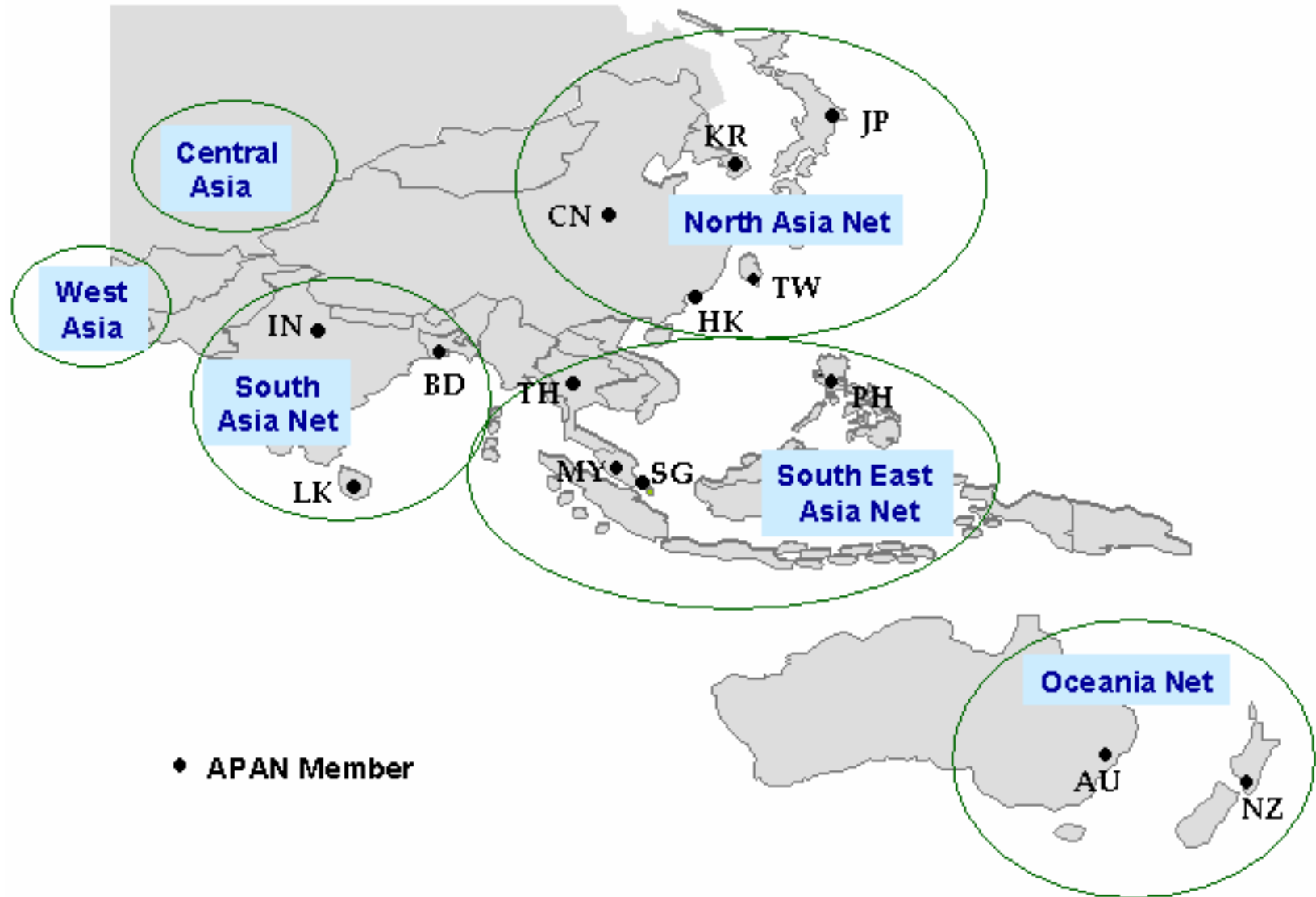


研究開発テストベッド の国際連携

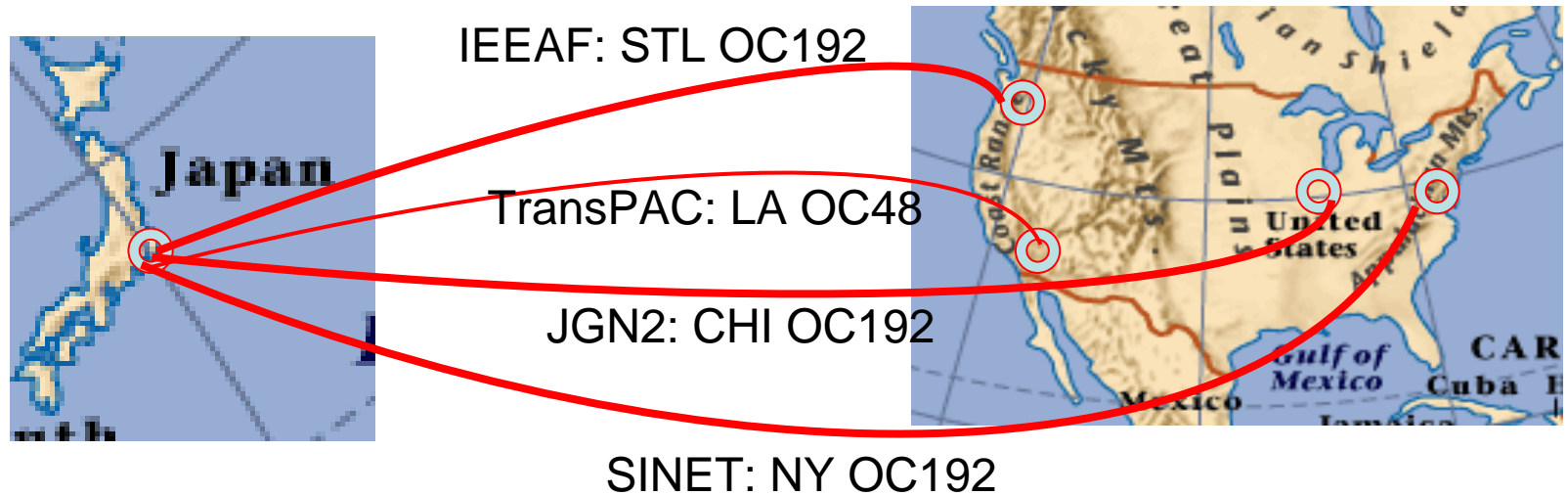
後藤 滋樹

早稲田大学 理工学部

APAN Regional Groups



リンクの国際連携



- TransPAC Layer 3 link and JGN2 link are the main JP-US links.
- SINET Layer 3 link provides the backup service for JP-US.
- IEEAF 8 X GbE links are for GLIF project.

Two Backbone Networks in JP

- JGN II is a testbed network for e-Science projects as well as advanced networking.
- SINET supports the wide community of education as well as research institutes related to universities.
- Both networks are working together for APAN under the competitive environments.

[Legends]

- 20Gbps
- 10Gbps
- 1Gbps
- Optical testbeds
- Access points
- Core network nodes (Available as access points)

<10G>

- Hokuriku Core network node (Kanazawa)
- Ishikawa Create Lab (Tatsunokuchi-machi, Ishikawa Prefecture)

<100M>

- Toyama Institute of Information Systems (Toyama)
- Fukui Information Super Highway AP* (Fukui)

<1G>

- Hokkaido Core network node (Sapporo)

<100M>

- Network Organization for Research and Technology in Hokkaido (Sapporo)

<10G>

- Chugoku Core network node (Okayama)

<1G>

- Teleport Okayama (Okayama)
- Hiroshima University (Higashi Hiroshima)

<100M>

- Tottori University of Environmental Studies (Tottori)
- Techno Arc Shimane (Matsue)
- New Media Plaza Yamaguchi (Yamaguchi)

<10G>

- Kinki Core network node (Osaka)
- NICT Keihanna Human Info- Communication Research Center (Seika-cho, Kyoto)

<1G>

- Kyoto University (Kyoto)
- Osaka University (Ibaraki)

<100M>

- NICT Kansai Advanced Research Center (Kobe)
- Biwako Information Highway AP* (Ohtsu)
- Nara Prefectural Institute of Industrial Technology (Nara)
- Wakayama University (Wakayama)
- Hyogo Prefecture Nishiharima Office (Kamigori-cho, Hyogo Prefecture)

<1G>

- Shinetsu Core network node (Nagano)

<100M>

- Niigata University (Niigata)
- Matsumoto Information Creative Center (Matsumoto, Nagano Prefecture)

<10G>

- Tohoku Core network node (Sendai)

<1G>

- Tohoku University (Sendai)
- NICT Iwate IT Open Laboratory (Takizawa-mura, Iwate Prefecture)

<100M>

- Hachinohe Institute of Technology (Hachinohe, Aomori Prefecture)
- Akita Regional IX* (Akita)
- Keio University Tsuruoka Town Campus (Tsuruoka, Yamagata Prefecture)
- The University of Aizu (Aizu Wakamatsu)

<10G>

- Kyushu Core network node (Fukuoka)

NICT Kita Kyushu IT Open Laboratory (Kita Kyushu, Fukuoka)

- Kyushu University (Fukuoka)

<100M>

- NetCom Saga (Saga)
- Nagasaki University (Nagasaki)
- Kumamoto Prefectural Government (Kumamoto)
- Toyonokuni Hyper Network AP* (Oita)
- Miyazaki University (Miyazaki)
- Kagoshima University (Kagoshima)

NICT Kita Kyushu IT Open Laboratory

Kanazawa

Sendai

Nagano

Osaka

Okayama

Nagoya

NICT Tsukuba Research Center

<1G>

- Shikoku Core network node (Kochi)

<100M>

- Kagawa Creation of New Industries Support Center (Takamatsu)
- The University of Tokushima (Tokushima)
- Ehime University (Matsuyama)
- Kochi University of Technology (Tosayamada-cho, Kochi Prefecture)

<1G>

- Tokai Core network node (Nagoya)

<100M>

- Nagoya University (Nagoya)
- University of Shizuoka (Shizuoka)
- Softopia Japan (Ogaki, Gifu Prefecture)
- Mie Prefectural College of Nursing (Tsu)

<10G>

- KANTO Core network node A (Chiyoda Ward, Tokyo)
- KANTO Core network node B (Chiyoda Ward, Tokyo)
- NICT Koganei Head Quarter (Koganei, Tokyo)
- NICT Tsukuba JGN Research Center (Tsukuba, Ibaraki Prefecture)

- The University of Tokyo (Bunkyo Ward, Tokyo)
- NICT Kashima Space Research Center (Kashima, Ibaraki Prefecture)

<1G>

- Yokosuka Telecom Research Park (Yokosuka, Kanagawa Prefecture)




<100M>

- Utsunomiya University (Utsunomiya)
- Gunma Industrial Technology Center (Maebashi)
- Reitaku University (Kashiwa, Chiba Prefecture)
- NICT Honjo Multi-Media Open Laboratory (Honjo, Saitama Prefecture)
- Yamanashi Prefectural Open Center for R&D (Tamaho-cho, Yamanashi Prefecture)



SINET / Super SINET

Composition Figure (Japan Map)

-  Super SINET 10Gbps
-  International line Approximately 5Gbps
-  Domestic Circuit 30~100Mbps

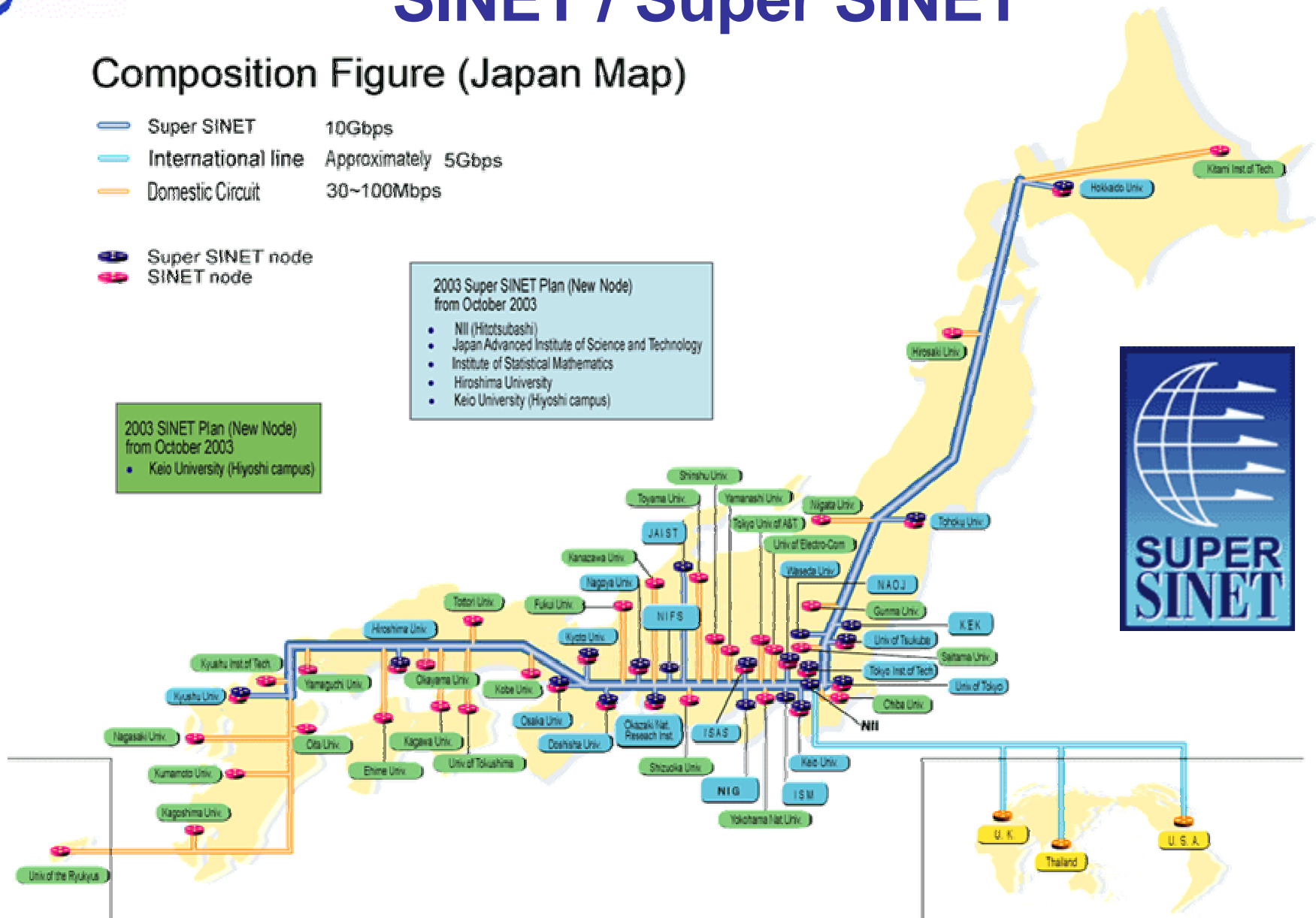
-  Super SINET node
-  SINET node

2003 SINET Plan (New Node)
from October 2003

- Keio University (Hiyoshi campus)

2003 Super SINET Plan (New Node)
from October 2003

- NII (Hitotsubashi)
- Japan Advanced Institute of Science and Technology
- Institute of Statistical Mathematics
- Hiroshima University
- Keio University (Hiyoshi campus)



日米間のリンクの連携

- The links have their own objectives as well as the policies, defined by the budget.

APAN-JP is using 3 JP-US links as the following preferences: TransPAC, JGN2 and SINET.

- Integrated network environments will be discussed by the engineers, followed by the understandings of the administrators to meet the users' requirements .
- HOPI will be adopted for the smooth developments to Lambda Networks.

国際連携によるプロジェクトの例

SC2004 Bandwidth Challenge

- Three groups got the awards, and one group assisted the award
 - (1) Univ. of Tokyo: Third Generation Data Reservoir
Award: Single Stream, Longest Path, Standard MTU TCP Throughput
Description: 7.2 Gb/s around the world
 - (2) Kyushu Univ., KISDI & CERNET: Showing Bandwidth of CJK (China, Japan, Korea)
 - (3) JAXA: Effective Rapid Remote File System For Supercomputer Users Who Are Not Network Expert
- UIC assisted by JGN2 Kyushu: National Center For Data Mining SC04 Bandwidth Challenge

Third Generation Data Reservoir

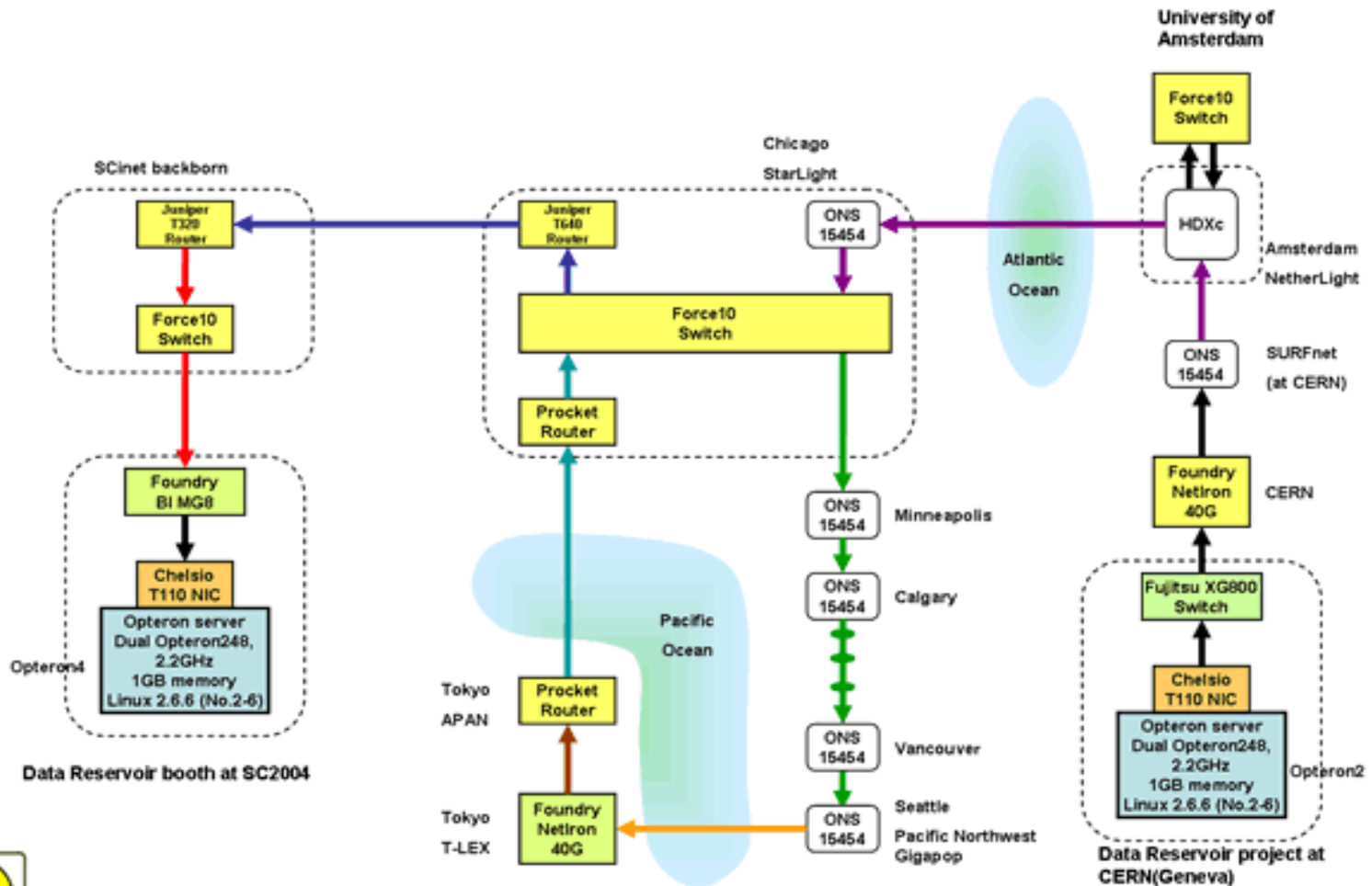
- **Disk to disk data transfer speed**
 - Full utilization of 10Gbps for iSCSI disk transfer
 - High-speed disk to disk data transfer
- **TCP network speed record** (single and multiple stream)
- 10Gbps NIC
- Parallel TCP optimization for LFN (Long Fat Pipe Network)
 - FPGA (Field Programmable Gate Array) based hardware approach
 - Software approach
- Dual ported FPGA based intelligent NIC
 - Developed by Univ. of Tokyo

Third Generation DR



Network used in the experiment

Third Generation DR Network Configuration



- WIDE — APAN/JGN II — IEEAF/Tycow/WIDE — CANARIE — Abilene — SCinet — SURFnet
- Router or L3 switch
 L3 switch used as L2
 L1 or L2 switch

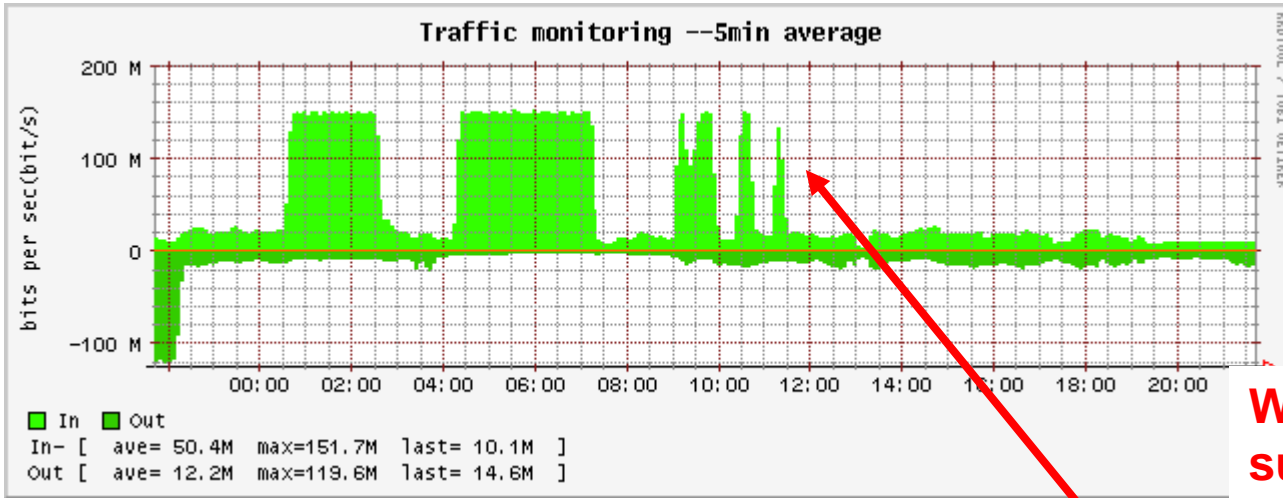


CJK Bandwidth Challenge

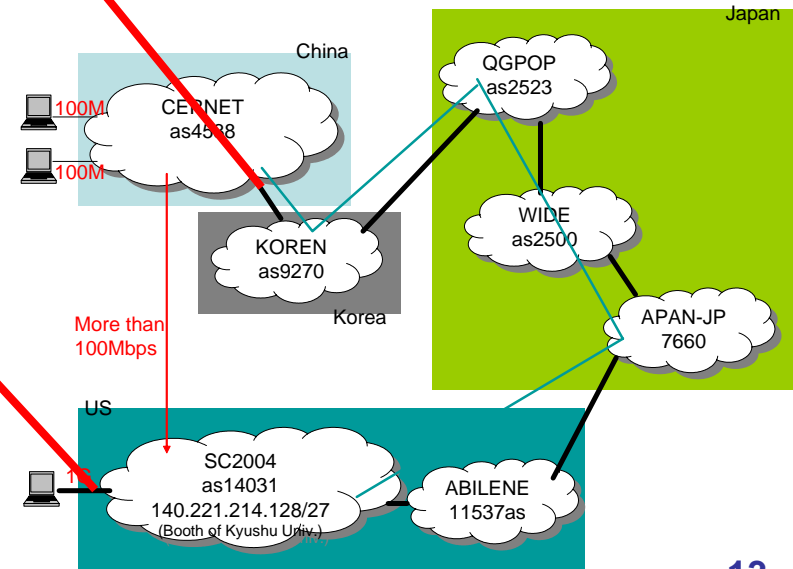
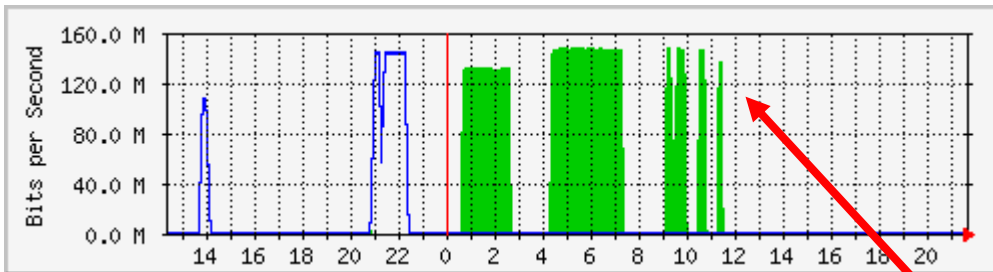
The Network Topology (L1)



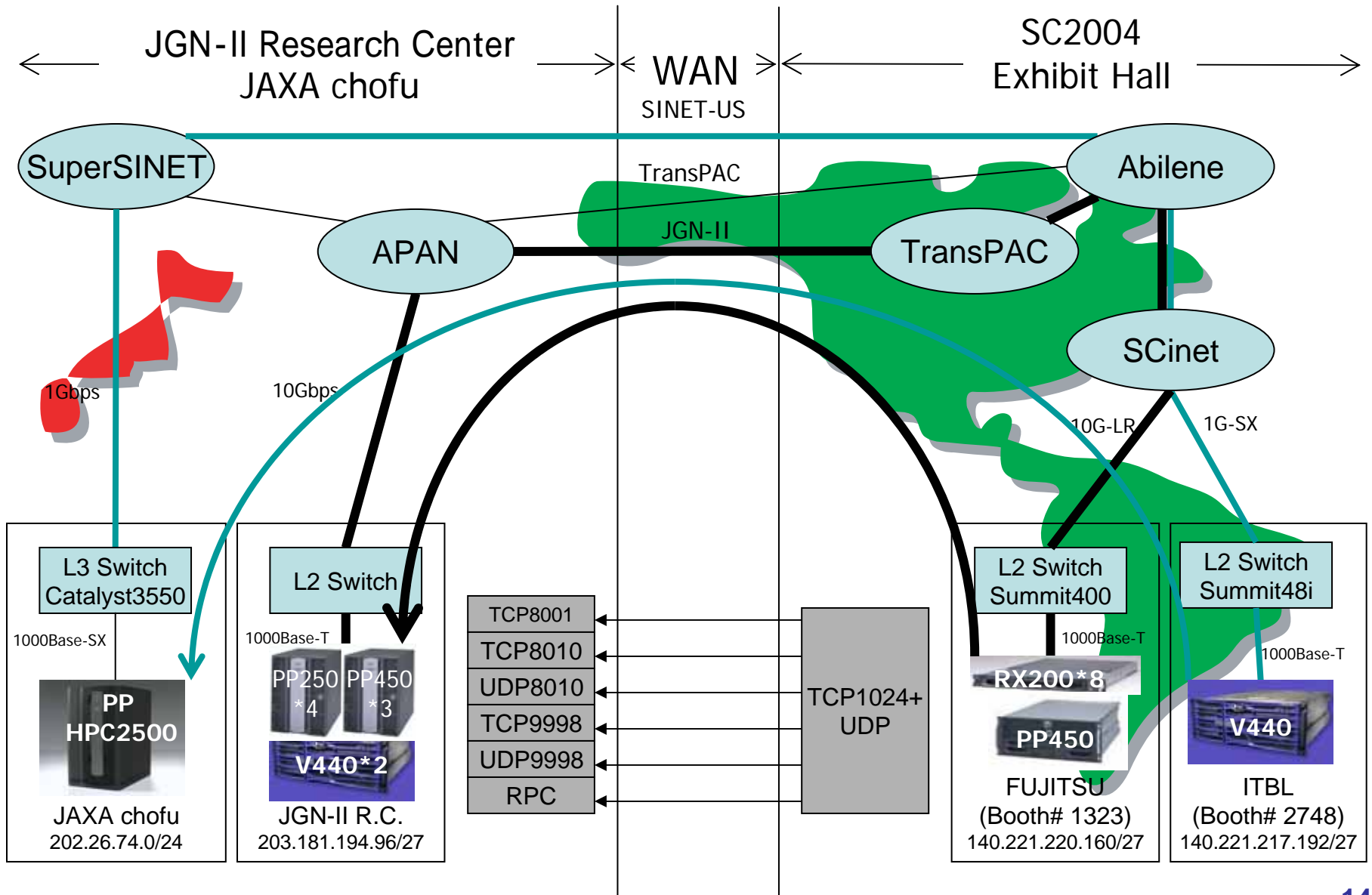
The Result of CJK BWC (9th Nov. 2004)



We showed that we surely got 140Mbps from China to US.



Remote File System at SC2004



e-VLBI Demonstration

at SC2004 (Pittsburgh)

4 Stations: **MIT Haystack (Westford)**
 GGAO (Maryland)
 Onsala (SE)
 NICT Kashima (JP)

Date: November 8 (Mon) - 10 (Wed) (?)
 ~2+ hours per session

Data Rate: 130, 259, and 518 Mbps (constant rate)
 (Payload 128, 256, and 512 Mbps)

Directions: From all the stations to Haystack
 The result viewed at Pittsburgh

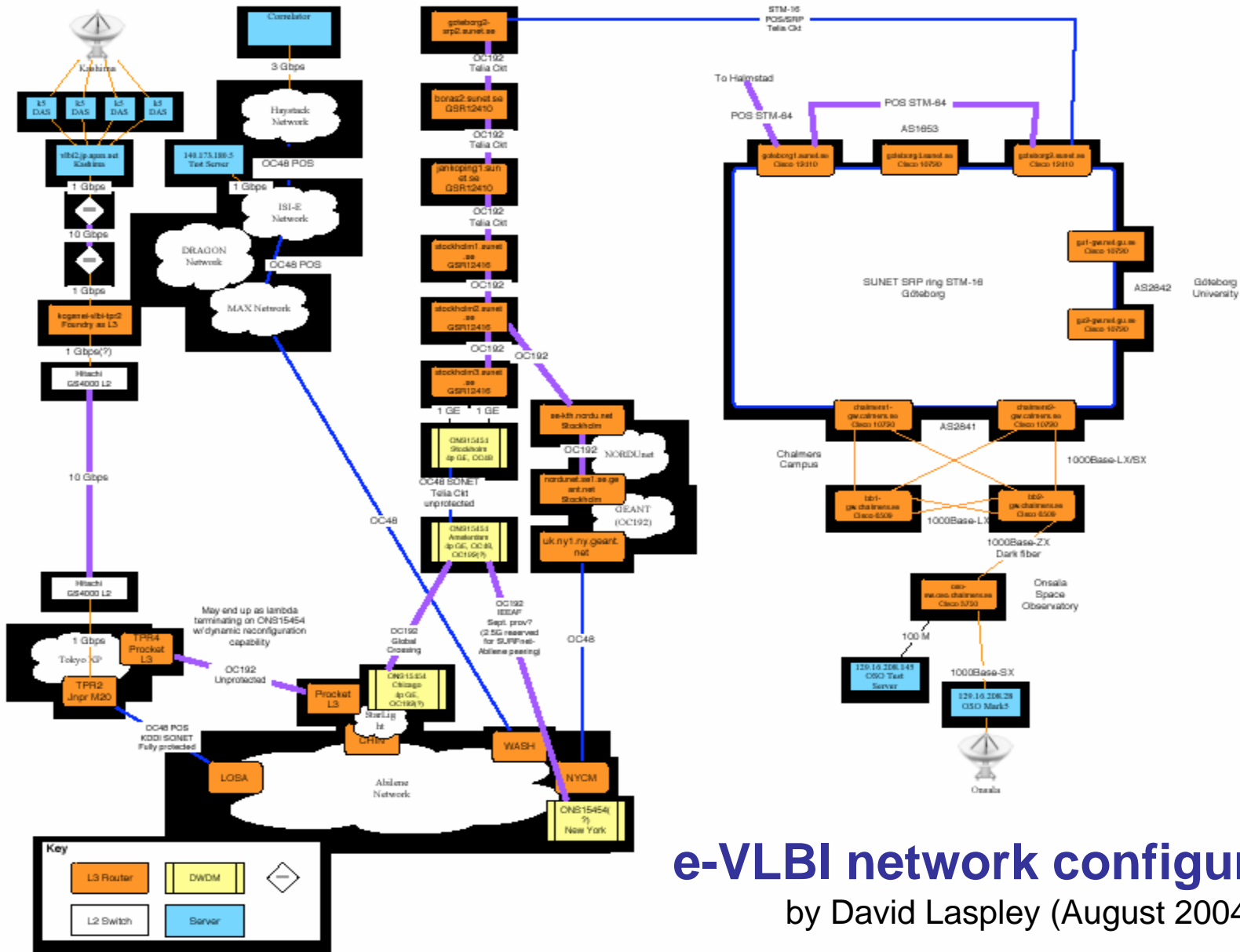
Three formats: Mark5, K5, and VSI-E

Transport: TCP, UDP, and RTP/RTCP

Traffic Requirement:

 Real-time (jitter, delay?)

 Packet loss (UDP <~5%)



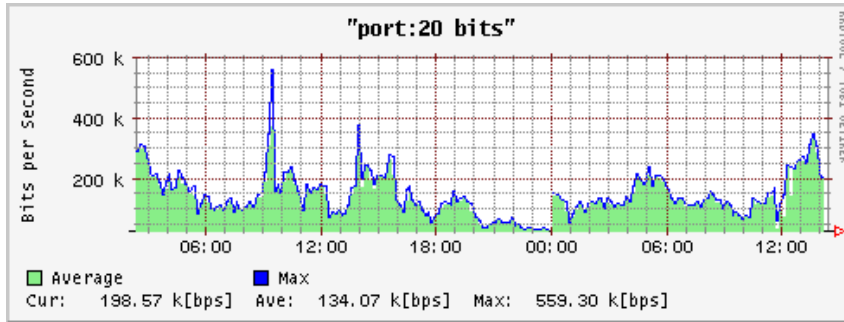
e-VLBI network configuration

by David Laspley (August 2004)

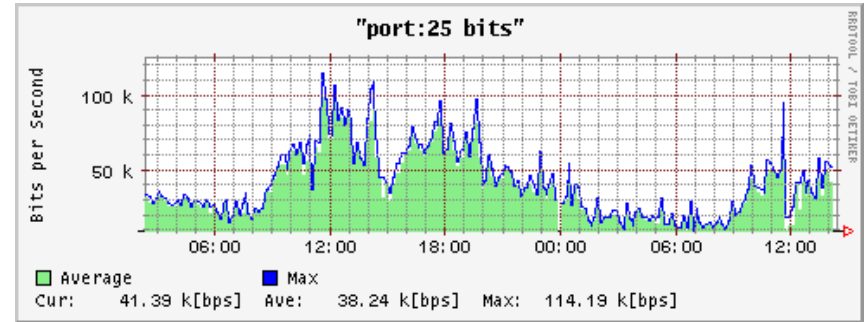
国際連携を支援する測定技術 Observatory

- Abilene Observatory is being adopted for encouraging network researches:
 - Netflow Data (flow-tools, rsync)
 - Throughput Data (iperf & BWCTL)
 - Latency Information (OWAMP)
 - Usage Data (High Resolution SNMP, RRDtool)
 - etc.
- User Interface based on Weather Map
- Raw data will be provided to authorized researchers.

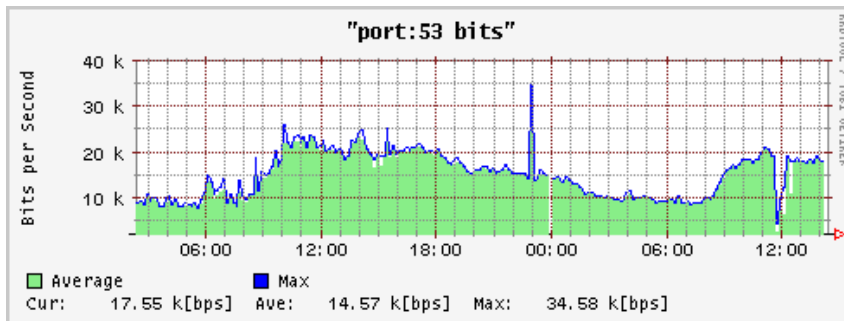
Flow Data with Observatory



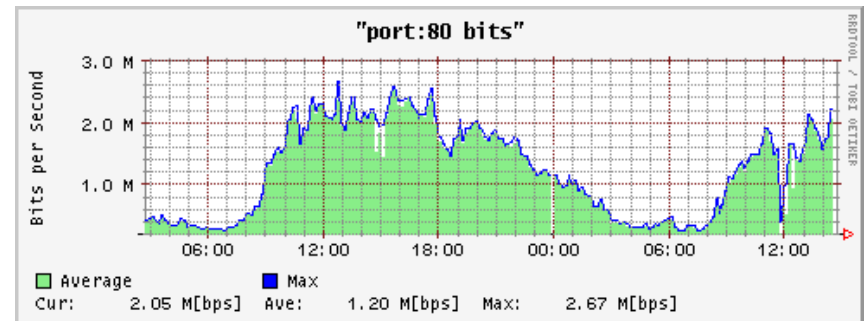
ftp-data



smtp



DNS



http