

Performance Measurement and Monitoring in APAN

APAN-JP NOC

Fall 2005 Internet2 Member Meeting

International Task Force

19 September 2005

Why performance measurement is needed?

— [APAN NOC are supporting numerous overseas demonstrations conducted by Asian network researchers.

— [With further speed-up of backbone network and increase of application bandwidth, network performance is attracting attention.

— [Meeting with growth of our networks, to realize satisfactory network environment for researchers is a major challenge for NOC.

Requirements on End-to-End High Performance Demonstration

— [Bandwidth Challenge at SuperComputing

- No packet loss on the route with venue? Is it confirmed?
- No congestion in networks?

— [Demonstrations at iGrid

- Where is the point of trouble on Wide Area Lower Layer Network ?

— [Uncompressed HDTV

- Picture is distorted; any trouble on end system? Or on network side?

— [e-VLBI

- TCP performance is not sufficient under long-distance latency environment; Please look into it.

Bandwidth Performance

— [iperf server

- 10G iperf machine in Tokyo
- 3 x 1G iperf machines in Tokyo
- 2x 1G iperf machines in fukuoka
- 2 x100M iperf machine in Tokyo

— [BWCTL server

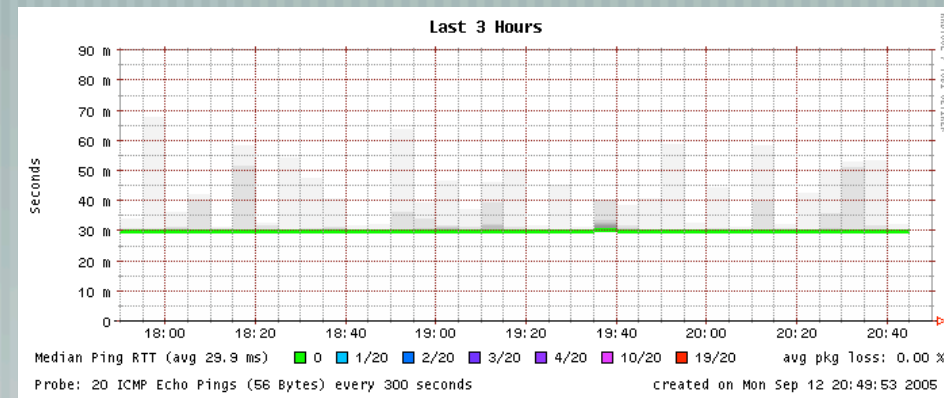
- BWCTL server in Tokyo, kashima, and fukuoka
- <http://www.jp.apan.net/NOC/bwctl/>

Latency Performance

Smokeping

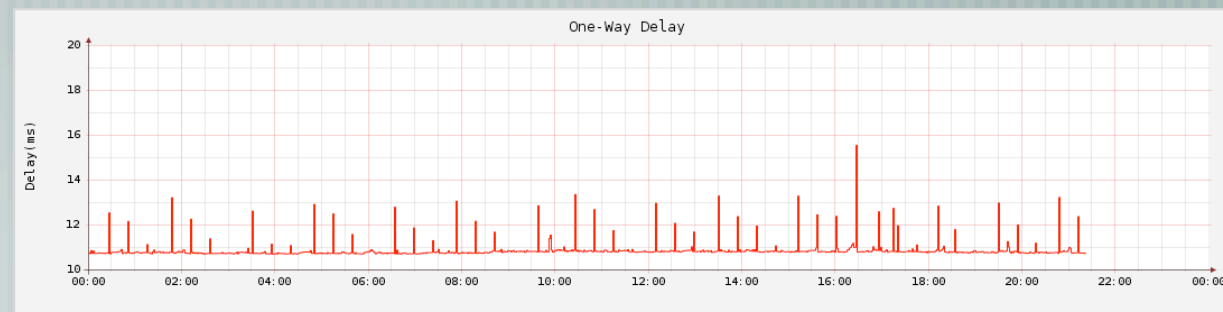
Enable to measure, store and display latency, latency distribution and packet loss.

<http://tools.jp.apan.net/smokeping.cgi>



One-Way Latency

Original tool developed by NICT Japan



<http://pe2.koganei.wide.ad.jp/cgi-bin/owd-stat>

<http://qpe.jp.apan.net/cgi-bin/owd-stat>

Usage Data

MRTG

Basic tool that monitor the traffic load on network links

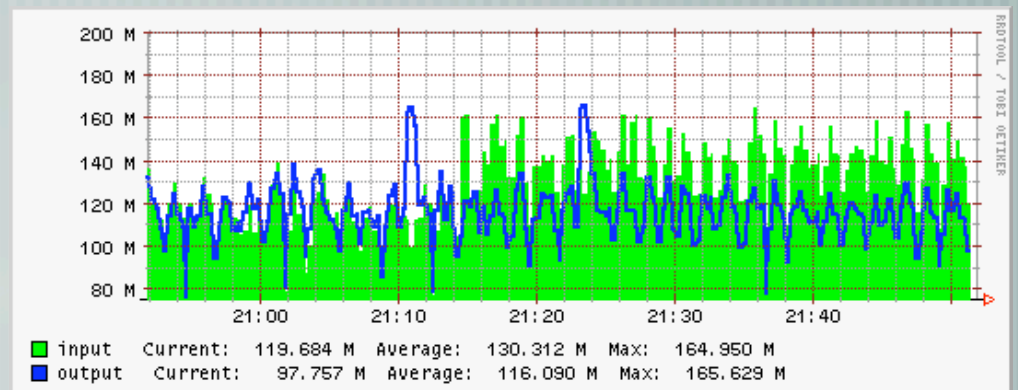
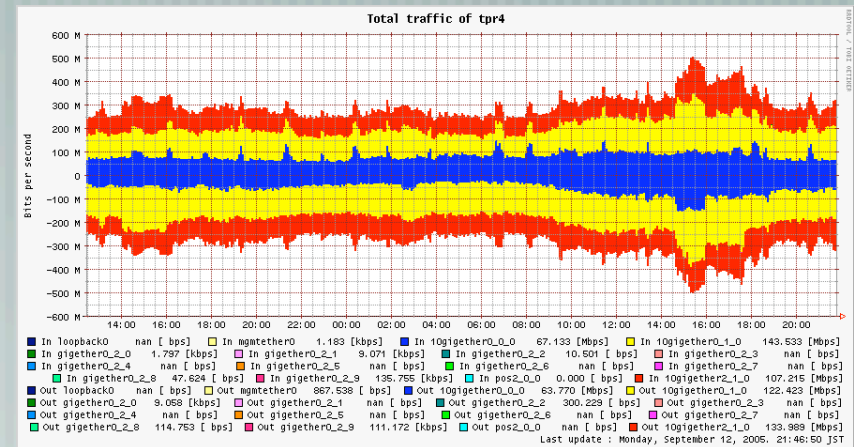
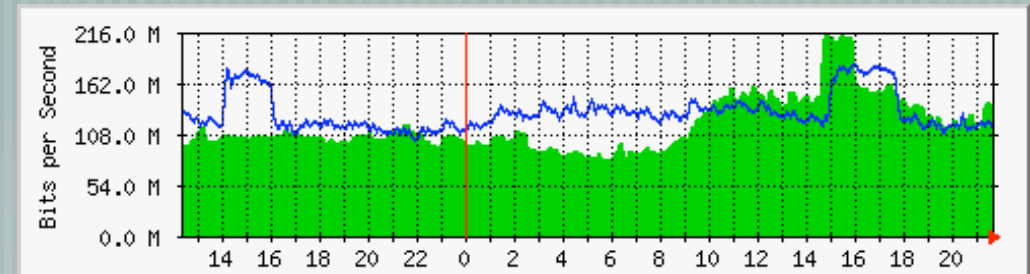
RRDtool + Cricket

Advanced tools that enable to flexibly correct traffic data and make graphs

APAN Tokyo XP providing raw rrd data

RRDtool + SNAPP

Hi-resolution data (every 10 seconds) of interface and environmental statistics using the SNAPP developed by Indiana Univ.



Flow Data (1)

Port Traffic Measurement

Netflow + Flowtools
+RRDtool

Utilize traffic grapher to provide public views of APAN traffic on common application ports

<http://vabo1.jp.apan.net/flow/>



Asia-Pacific Advanced Network

Port Traffic Measurement

These port traffic graphs are generated from the netflow data of tpr2, core route at APAN TokyoXP, collected by Observatory. These indicate the number of bit, packet and flow per second for every port well-known in security. Click the graph, then the detail graphs are presented.

port	protocol	Service	Octets	packets	flows
20	tcp	ftp-data			
21	tcp	ftp			
22	tcp	ssh			
23	tcp	telnet			
25	tcp	smtp			
53	tcp	dns			

Flow Data (2)

Top10 Flow

Netflow + Flowtools + RRDtool + SNAPP

<http://vabo3.jp.apan.net/sobs/html/web/index.html>

APAN Network Monitoring System with Scheduler

Schedule
[Add](#)
[Modify](#)
[Delete](#)
[Search](#)
[Show](#)

Link
[Add](#)
[Modify](#)
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[Show](#)

Monitoring
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[Show Top10](#)

Top10 Flow

Requested Data
 Start Time : 2005-09-15 13:40 JST
 End Time : 2005-09-15 13:45 JST
 Link : TransPAC2

Usage Traffic

IN Cur: 136.60 M[bps] Ave: 139.74 M[bps]
 Max: 159.26 M[bps] OUT Cur: 128.72 M[bps]
 Ave: 133.28 M[bps] Max: 156.23 M[bps]

Latest Top3 flow
 2005-09-15 13:44

in				
Rank	SrcIP	DstIP	Traffic(Mbps)	scheduled
1	128.8/16	192.51.41/24	53.72	
2	128.220/16	143.248/16	9.45	
3	128.117/16	147.46/16	7.66	

out				
Rank	SrcIP	DstIP	Traffic(Mbps)	scheduled
1	192.51.41/24	128.8/16	53.16	
2	203.178.128/17	192.87/16	2.14	
3	158.203/16	132.239/16	1.66	

Top10 Flow
 2005-09-15 13:44

in-top10				
Rank	SrcIP	DstIP	Traffic(Mbps)	scheduled
1	128.8/16	192.51.41/24	53.72	
2	128.220/16	143.248/16	9.45	
3	128.117/16	147.46/16	7.66	
4	195.194/15	210.90.176/21	3.23	
5	156.56/16	203.178.128/17	3.16	

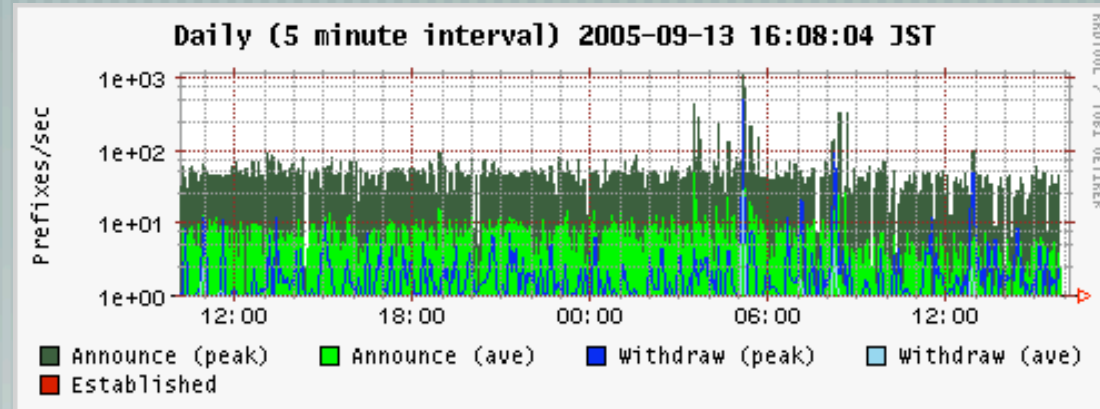
out-top10				
Rank	SrcIP	DstIP	Traffic(Mbps)	scheduled
1	192.51.41/24	128.8/16	53.16	
2	203.178.128/17	192.87/16	2.14	
3	158.203/16	132.239/16	1.66	
4	143.248/16	128.205/16	1.65	
5	162.42/16	129.105/16	1.31	

Routing Data

BGP Instability

Showing instability of BGP updates using BGP routing daemon "MRTd"

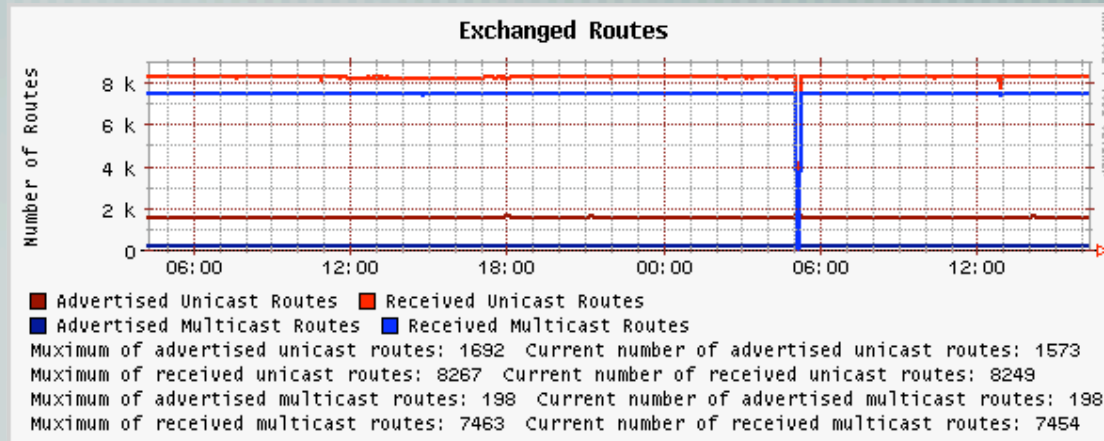
<http://mrtg.koganei.itrc.net/cgi-bin/rrdrc.cgi>



BGP summary view

Showing the number of exchanging BGP routes for peers

<http://tools.jp.apan.net/nr/>

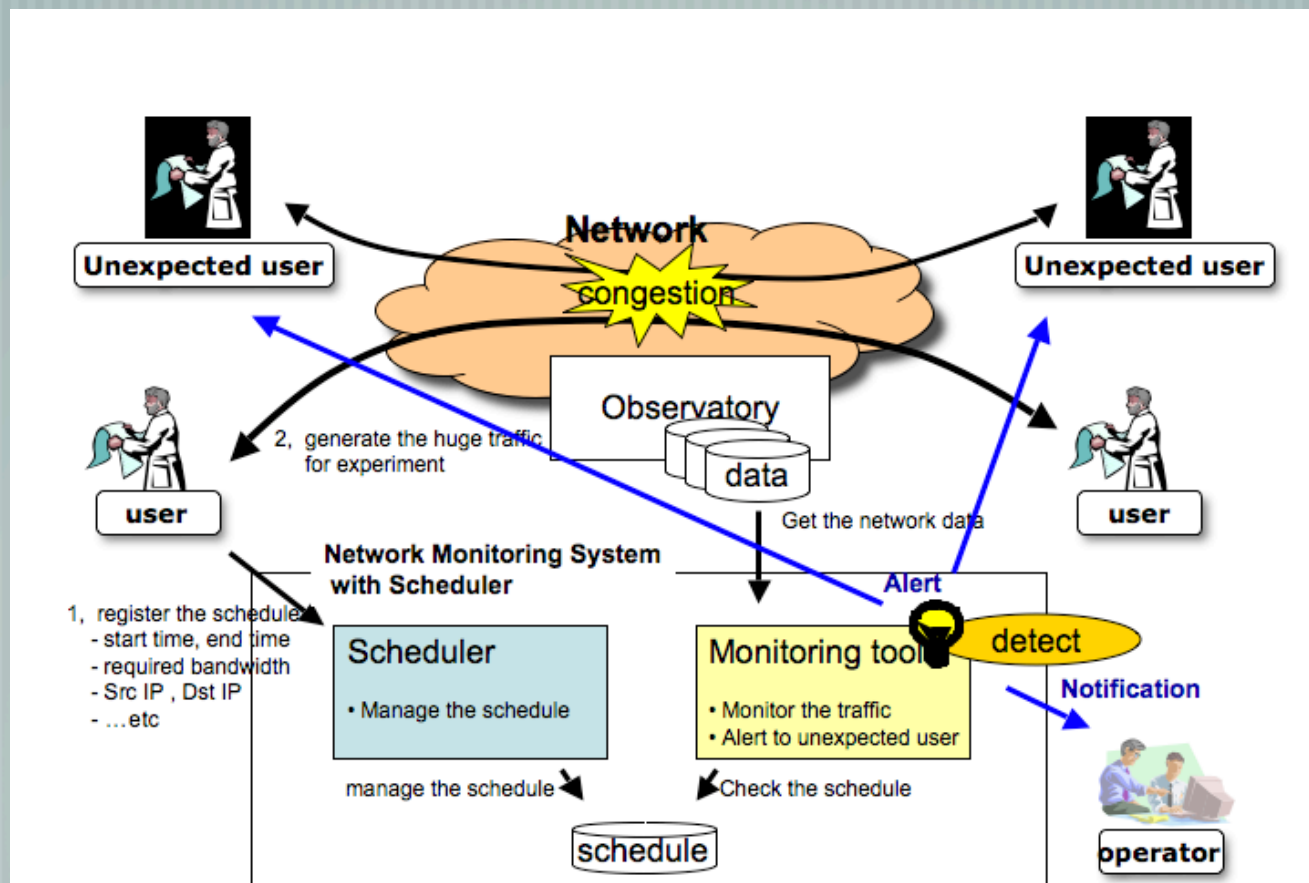


Monitoring System with Scheduler

- Now Developing -

Netflow + Flowtools + RRDtool + SNAPP

- Network resource management
- Monitoring “unexpected” traffic during important demonstrations and experiments
- <http://www.apan.net/meetings/taipei2005/presentation/noc/taka.pdf>



Collaboration Projects for Performance Measurement (1)

piPEs (BWCTL)

APAN BWCTL servers on the Performance Measurement Points (PMPs) of piPEs

<http://e2epi.internet2.edu/pipes/pmp/pmp-dir.html>

<http://www.jp.apan.net/NOC/bwctl/pmp.html>



APAN bwctl servers with web100

Here is a list of bwctl servers in APAN. These bwctl servers are working on Linux with web100 kernel enhanced line rate and MTU is 9KB. The maximum TCP window size is 64MB running HighSpeed TCP.

- 1) bwctl.jp.apan.net**
located in Tokyo XP and connected to the TransPAC router.
- 2) genkai-bwctl.jp.apan.net**
located in Fukuoka, on the edge to Korea.
- 3) vlbi-bwctl.jp.apan.net**
located in Kashima at the foot of 34m radio telescope.

Currently, those servers are used for on-demand tests from end points. The server in Tokyo (bwctl.jp.apan.net) authenticates. If you want to do a test with the other servers, please contact the address listed at the bottom.

In addition to bwctl, those servers collect TCP statistical data every 500 ms through web100 kernel to collect and see your web100 data, visit [here](http://www.web100.org/). Note that recorded data are kept for a day. Your would see streams flow from the server to your host. Use "-s" option with bwctl to do so.

"bwctl" is developed in Internet2 and available at <http://e2epi.internet2.edu/bwctl/>. Information on "web100" is available at <http://www.web100.org/>. "iperf", used from bwctl, is available at <http://dast.nlanr.net/Projects/iperf/>.

E-mail: bwctl-request@jp.apan.net

[APAN_JP_NOC](#)



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Performance Measurement Point Directory

This page contains a list of piPEs Performance Measurement Points (PMPs) that are available from various institutions around the world. You can find your own PMP(s) and determines the tests available, the operating parameters, and the policy on who can use them. You can find more information from their Information Page.

If you desire to install and run one or more PMPs the information below will tell you about potential peers with whom you can collaborate to research disciplines that want to better understand routes that are commonly used by their community.


To have your PMP(s) listed on this page, create a PMP Information page using the [blank PMP form](#) (see the [Abilene page](#) as an example). E-mail: measurement-domain-registrar@internet2.edu

NEWEST PMP (04/06/05)!	Location	Information Page
NORDUnet	Sweden	NORDUnet PMP Info
Institution / Network		
APAN	Japan	APAN PMP Info
DANTE/GEANT	Europe	GEANT PMP Info
ESnet	US Nationwide	ESnet PMP Info
Hawai'i GigaPoP/University of Hawai'i	Honolulu, HA	Hawai'i PMP Info
Internet2 / Abilene	US Nationwide	Abilene PMP Info
KISTI/KREONet2	Korea	KISTI PMP Info
MIT / Haystack Observatory	Westford, MA	Haystack PMP Info

Collaboration Projects for Performance Measurement (2)

NLANR (AMP Project)

<http://watt.nlanr.net/active/amp-apantyo/international/body.html>



"amp-apantyo international results"

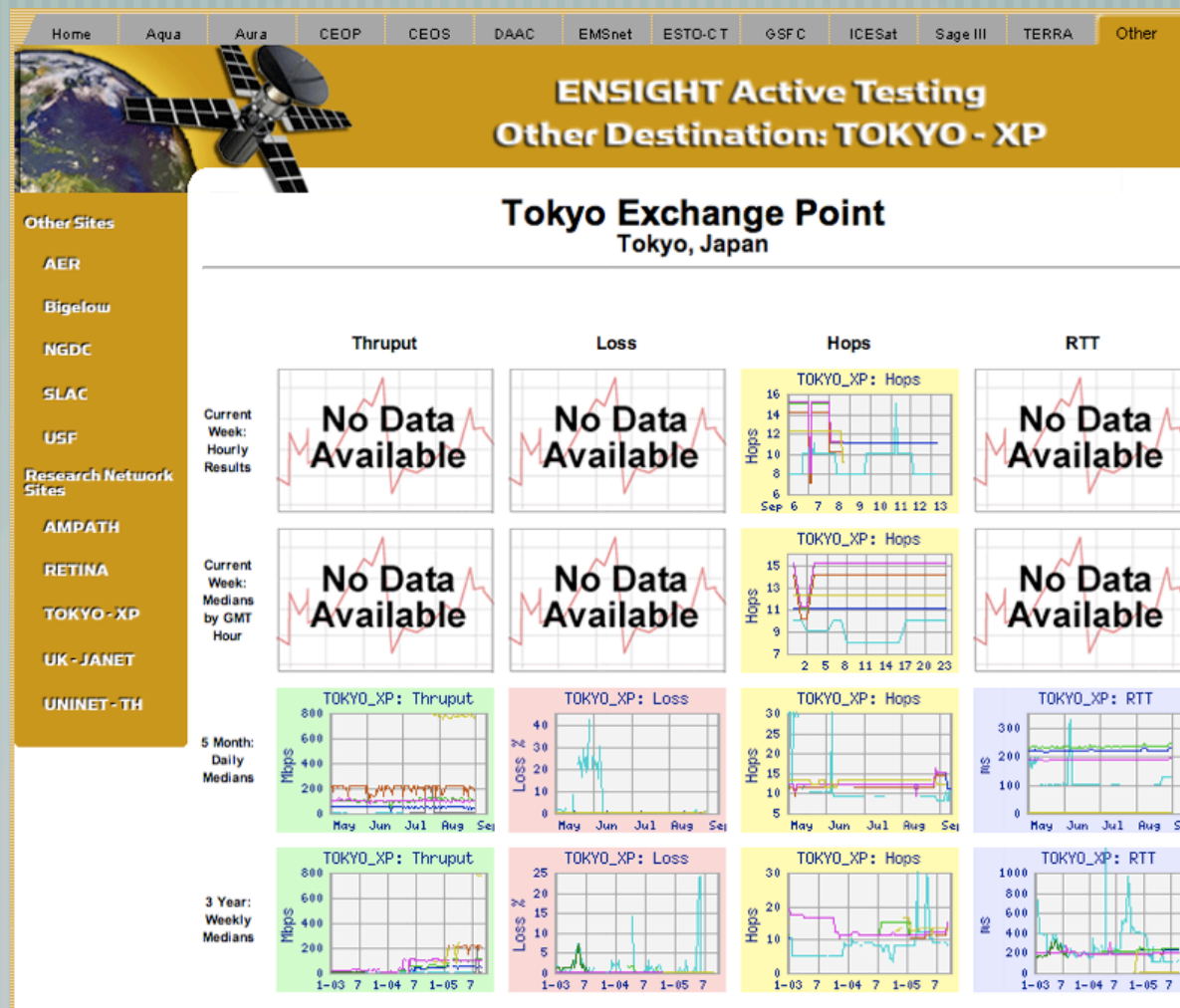
[\[NLANR\]](#) [\[AMP\]](#) [\[Monitors\]](#) [\[route summary\]](#)[\[summary graph\]](#) [\[site info\]](#)

Site Name - Graph	Min (ms)	Mean (ms)	Max (ms)	Stddev (ms)	Loss (%)	Stats from
AARNet	173.00	174.11	176.00	0.35	0.00	2005/9/12
AMPATH-Miami	176.00	184.47	226.00	2.26	0.07	2005/9/12
CICESE Ensenada, Mexico	119.00	120.37	246.00	5.87	0.07	2005/9/12
CNCI Hong Kong	53.00	53.00	53.00	0.00	0.00	2005/9/12
China Computer NW, Beijing	84.00	85.00	86.00	0.04	0.07	2005/9/12
Columbia University	183.00	191.12	308.00	3.63	0.07	2005/9/12
Corp. Univ. Desarrollo de Internet	152.00	155.79	254.00	7.66	0.07	2005/9/12
ELTENET, Hungary	292.00	299.98	300.00	0.37	0.07	2005/9/12
Florida International University	178.00	178.05	190.00	0.67	0.21	2005/9/12
HEANet, Ireland	264.00	271.98	272.00	0.37	0.07	2005/9/12
HUT Finland	292.00	300.26	352.00	2.51	0.07	2005/9/12
KREONet2, KOREA	27.00	27.19	88.00	3.18	74.03	2005/9/12
NUST Institute, Pakistan	424.00	781.93	2256.00	226.77	10.14	2005/9/12
NaukaNetNWU	279.00	318.48	320.00	1.92	0.14	2005/9/12
Norwegian University of Science and Technology, NO	300.00	307.98	308.00	0.37	0.07	2005/9/12
Pittsburg Supercomputing Center	190.00	190.05	195.00	0.36	72.78	2005/9/12
Rice University	149.00	153.70	391.00	20.13	0.14	2005/9/12
SURFnet Amsterdam	265.00	272.96	273.00	0.52	0.07	2005/9/12
San Diego Supercomputer Center	117.00	117.26	221.00	4.80	0.07	2005/9/12
Singapore POP	0.00	0.00	0.00	0.00	100.00	2005/9/12

Collaboration Projects for Performance Measurement (3)

NASA

http://corn.eos.nasa.gov/Other/TOKYO_XP.shtml



TEIN2 Collaboration

TEIN2

- TEIN2 is a new important project between Asia Pacific and Europe.
- TEIN2 will promote upgrading to high-speed links from existing low-speed links in Asian countries. So measurement activities will be more and more active and important.
- As one single NOC is going to operate, common measurement data is expected to be obtained with common measurement tools.
- TEIN2 will facilitate a performance monitoring scheme among Asian-Pacific countries. Growth and development of TEIN2 is highly anticipated.
- Measurement tools should be deployed at major POPs at first and then gradually at other end points.
- APAN NOC will co-operative work with TEIN2 NOC.

What Measurement Tools are needed for APAN

— [Selection of common data helpful for both end-users and operators

— Throughput, Packet Loss, Latency, Usage, Flow, Routing, Router/Switch situation

— Any other data?

— [Designing the function of how to obtain common data among Inter-domains

— Centralized data management? Or decentralized management among countries?

— What tools are necessary on what machines?

— Tools should be set only at backbone? Or also at nearer points for end-hosts?

— [Designing of the function of how to publish data

— Well publishing data is more difficult than well obtaining data.

— Publishing server should be set centralized or at each POP etc.?

— How should end-users could obtain published data?

How administrate Measurement Tools?

- 2 Possible Schemes -

1, All tools/machines are administrated only by APAN/TEIN2 NOC

- May need more human resources at APAN/TEIN2 NOC
- Difficult to manage remotely-placed servers

2, NOC administrate them in cooperation with NREN in Asian countries

- Tools and their data are administrated by APAN NOC
- NREN may provide site-operation service
- Server hardware support and its OS administration may be provided by NREN organization
- APAN NOC may provide engineering support to them

[For advancement of engineering capabilities of Asian countries, installing/managing of measurement machine(s) at each NREN organization is desirable.

TEIN2 Kick-off Workshop

Measurement and Monitoring training by APAN and TEIN2 NOC

— www.interlab.ait.ac.th/tein2/

— Venue: intERLab/AIT(Thailand)

— Date: 5-10 September 2005

— Trainers

: APAN NOC (Bruce Morgan, AARNet & Yasuichi Kitamura, NICT)

: GEANT NOC (Silvere Pradella)

: TEIN2 NOC (Richard Feng, Wang Jilong and Li Xinman)

— Agenda

Session 1	Introduction to Measurement and Monitoring
	Basic Tools - Traceroutes and pinas
Session 2	SNMP - Using SNMP Tools, Net-SNMP and perl
	MRTG, RRDtool and Smokeping
	NetFlow
Session 3	Using and setting up Nagios
Session 4	iPerf and Performance Monitoring
Session 5	Multicast Beacon and Multicast debugging tools
	Looking Glasses and route-views servers

Toward a Global Measurement infrastructure (1)

- [Establishment of a common platform to measure end-to-end performance or of measurement tools that would allow interoperability

- [Selection of the standard among numerous ways and kinds of data for measurement

- piPEs, NLANR AMP, GEANT2 JRA1... etc.

- GGF, IPPM(IETF)..etc.

- [Easy installation/management of measurement machines

- [Setting of machines that would have tools commonly used among NOCs and nodes to realize Hop-by-Hop measurement

- While hop-by-hop method is available on L3 networks, how should it be possible on L2 networks over inter-domain?

- Any portable Measurement BOX would be convenient?

Toward a Global Measurement infrastructure (2)

— [Measurement Groups and NOCs would collaborate in managing measurement tools and measurement traffics.

- Multiple measurement tools sometimes deal with the same data simultaneously.
- Measurement should be done effectively and efficiently.

— [“Measurement Peering” Agreements should be established.

- Contact points
- Usage permission/limitation
- Authentication method for measuring accounts
- Agreements should be made between NOCs or between a NOC and researcher(s)

— [Measurement data that could also promote security would be needed

- Worm/DoS Real time detection
- Grasping contents of traffics