CIREN/TransPAC2 Annual Report
1-January-2008 thru 30-November-2008

James Williams, Principal Investigator, CIREN/TransPAC2 (SCI-0441096)

Summary of Project Year 4 Activity

The CIREN/TransPAC2 project is operating within budget.

Five major initiatives for this year are outlined in detail in separate sections of the Annual Report. They are: Pakistan, DCN deployment, perfSONAR deployment, GENI activities and our summer REU work. Other highlights of Project Year 4 follow immediately.

Circuit RFP is decided in favor of continuing KDDI-A-provisioned circuit. Costs reduced by approximately 10%.

TransPAC2 staff made presentations throughout the year at various events including at Internet2 Joint Techs/APAN meetings, the Internet2 members meetings, at APAN meetings and other meetings as outlined in more detail in the Presentations sections of the AR.

Brent Sweeny was introduced as the TransPAC2 engineer, replacing Chris Robb. Chris Robb has moved out of the TransPAC2 project to take on new responsibilities with Internet2.

George McLaughlin has been hired as a consultant to develop TransPAC2 applications.

TransPAC2 engineers worked with Internet2 and CENIC to arrange for access to the DCN network. This activity is detailed later in the AR.

As sub-group chair of the Internet2 South Asia Special Interest group, Williams traveled to Nepal to hold a SA-SIG meeting and participate in various events.

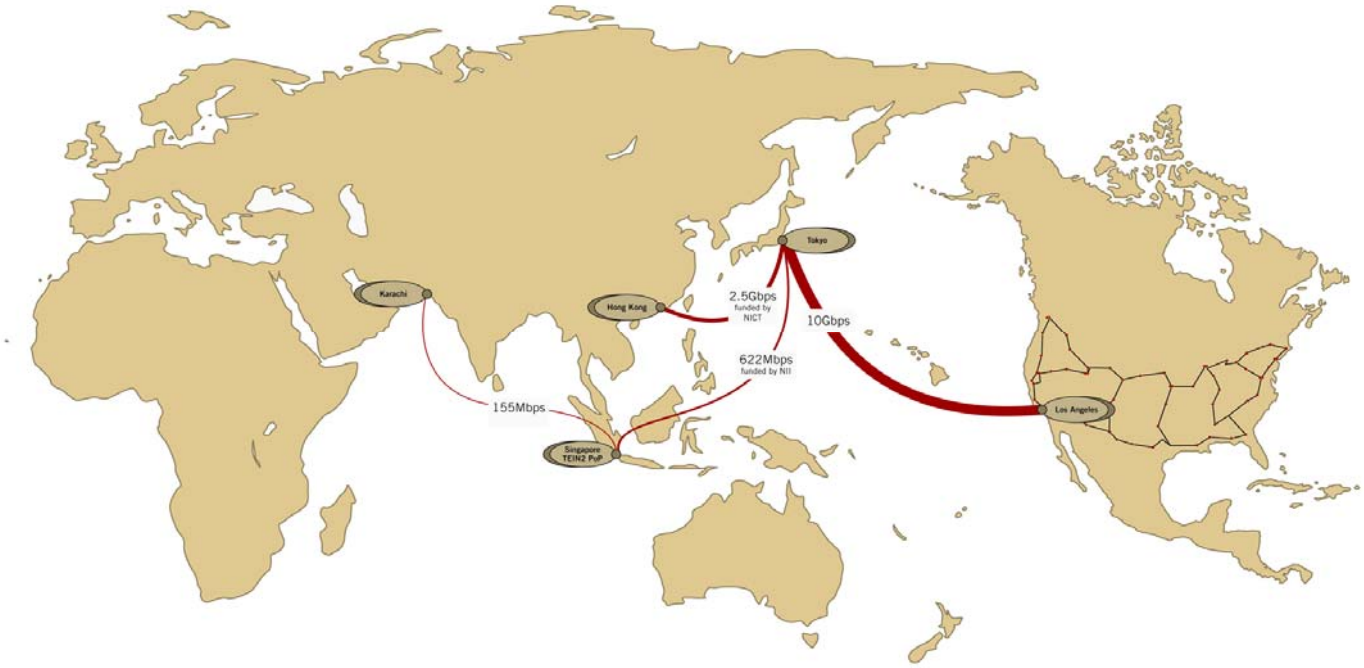

Figure 1: TransPAC2 Core Topology as of December 31, 2008

Significant milestones and accomplishments for Project Year 4

January 2008
Indiana University began preparation for development of a GENI solicitation response.

Williams attended a State Department briefing about the IRNC programs and presented about TransPAC2 and Pakistan.

Work began to prepare for the Chinese American Networking Symposium to be held in Indianapolis.

Williams, Sweeny and Hicks attended the Joint techs – APAN meeting in Hawaii and presented a variety of papers and reports.

February 2008
Williams worked with the Advanced Network Management Laboratory to prepare a submission for funding from the Cybertrust solicitation.

GENI proposal submitted to GENI Project Office.

Daniel Doyle (Summer REU) interviewed and hired part-time until summer.

March 2008
Williams (and other IU staff) attended the Second GENI Engineering Conference in Arlington, VA.

Williams met with a variety of people from NSF while in DC.

Prep work for CANS meeting continued.

Sweeny prepared a detailed technical review of TransPAC2 engineering as background for other GRNOC engineers.

Engineering discussions began with Pacific-Wave regarding DCN implementation from US to Japan (and into APAN generally).

April 2008
Williams traveled to Pakistan to present a series of lectures about international networking and the proposed Pakistan-US network connection. A complete description of the trip and the talks given at various universities is available at http://pakistan.indiana.edu.

Williams, Sweeny, Peck and Hicks attended the Spring Internet2 meeting in Arlington, VA and presented a variety of papers and reports.

May 2008
Williams attended the NSF Cybersecurity Summit in Washington, DC.

June 2008
Williams traveled to NYC to meet with new KDDI-America President to discuss the TransPAC2 and KDDI-A relationship.

Hicks and Sweeny host an engineer from SINET for several weeks.

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July 2008
Williams, Hicks, Peck and Sweeny attended the Internet2 Joint Techs meeting in Lincoln, Nebraska. . Sweeny participated on a DCN panel there. Sweeny was also a member of a group which met in Lincoln after Joint Techs tasked with redesigning the Internet2 ipv6 hands-on workshops.

Williams presented a talk at the Bloomington Chamber of Commerce about international networking at IU and specifically to Pakistan.

August 2008
As Sub-Group Chair, Williams traveled to Nepal for meeting of the Internet2 South Asia Special Interest Group and a variety of other meetings and presentations.

Pakistan connection (Karachi-Singapore) comes up.

Hicks and Sweeny attended 26th APAN meeting in Queenstown, New Zealand and made a number of presentations. During this meeting a joint TransPAC2/Internet2 perfSONAR workshop was held. Sweeny met with the chief APAN engineer to work out more technical details and schedule of the Internet2-TransPAC2-APAN DCN implementation.

September2008
Williams traveled to DC for a series of meetings at the NSF.

George McLaughlin hired as applications consultant for TransPAC2.

Hicks traveled to Ann Arbor for a perfSONAR developers workshop and DICE meeting.

Engineering implementation begins for the DCN implementation over TransPAC2.

October 2008
Indiana University awarded a GENI grant for development of the GENI Meta Operations Center (GMOC)

Williams, Sweeny, Peck and Hicks attended the Fall Internet2 meeting in New Orleans and participated and presented on a number of topics. During this meeting a DVTS tele-medical video demonstration was held between the conference venue, Indiana University, and Stanford University. The video demonstration was part of TransPAC2's ongoing support of tele-medicine within APAN and provided an opportunity for US physicians to both participate in and experience a DVTS session.

DCN implementation over TransPAC2 is completed.

Sweeny helped setup the SC08 supercomputing conference network in Austin, Texas.

The CANS 2008 conference was held in Indianapolis.

Williams traveled to DC for a series of meetings at the NSF.

Pakistan connection officially announced.

November 2008
Williams gave a remote presentation for the HONET meeting in Malaysia.

Sweeny and Hicks worked on the routing and measurement teams respectively in support of the SC08 supercomputing conference in Austin, Texas.

DCN tests are conducted over the APAN and TransPAC2 networks.

DCN is used successfully across the APAN, TransPAC2, and Internet2 domains into the SC08 show as part of a NICT/JGN2 LIGO demonstration.

December 2008
To be completed in the next AR.

Meetings and Presentations

January 2008

Williams, Sweeny and Hicks attended the Joint techs – APAN meeting in Hawaii and presented a variety of papers and reports. Presentations are available on the APAN web site (http://www.apapn.net) and the TransPAC2 web site (http://www.transpac2.net)

Presentations by TransPAC2 at the Joint Techs/APAN meeting in Hawaii:

- Sweeny: Gigapop Geeks BOF http://events.internet2.edu/2008/jt-hawaii/sessionDetails.cfm?session=3584&event=278
- Sweeny: BGP path-hinting http://events.internet2.edu/2008/jt-hawaii/sessionDetails.cfm?session=3608&event=278
- Sweeny: presentations on TransPAC2 engineering, including new DCN functions for APAN and path-hinting, at APAN meeting

Williams State Department briefing about TransPAC2 and Pakistan.

http://www.transpac2.net/presentations/2008/State%20Dept%20TP2%20Briefing.ppt

April 2008

See http://pakistan.indiana.edu for a complete list of Williams talks and presentations in Pakistan.

Presentations by TransPAC2 at the Internet2 Member Meeting in Arlington:

- Sweeny: TransPAC2 update for APAN group; update on path-hinting at RENOG

June 2008

Williams KDDI-America presentation in NYC.
http://www.transpac2.net/presentations/2008/KDDI%20talk.ppt

July 2008

Williams and Sweeny presented at the Nebraska Joint Techs meeting:

- Sweeny: Gigapop Geeks BOF (ipv6 deployment) http://events.internet2.edu/2008/jt-lincoln/sessionDetails.cfm?session=10000089&event=281
- Sweeny: DCN implementation panel discussion http://events.internet2.edu/2008/jt-lincoln/sessionDetails.cfm?session=10000083&event=281
- Williams: Inter-Agency Communication and International Projects http://events.internet2.edu/2008/jt-lincoln/sessionDetails.cfm?session=10000134&event=281

Williams talk at the Bloomington Chamber of Commerce:
http://www.transpac2.net/presentations/2008/Bloomington%20talk.ppt

August 2008

See http://southasia.indiana.edu for a list of presentations in the last year (some by Williams) focused around South Asia.

October 2008

The Chinese American Networking Symposium was held in Indianapolis.
See: http://www.indiana.edu/~uits/cans2008/
Program: http://www.indiana.edu/~uits/cans2008/program.html

Presentations by TransPAC2 at the Internet2 Member Meeting in New Orleans:

- Sweeny: TransPAC2 update for APAN group

November 2008

Williams remote presentation for the HONET meeting in Malaysia.
http://www.transpac2.net/presentations/2008/Internet2%20and%20NRENs%20in%20South%20East%20Asia.ppt

Sweeny routing presentations in support of the SC08 supercomputing conference in Austin, Texas.
http://www.transpac2.net/presentations/2008/SC08-Routing-PresentationV2.ppt

US-Pakistan Connectivity

In January 2007, in preparation for the United States-Pakistan First Joint Committee on Science and Technology (Feb 13-14, 2007) Williams prepared a briefing on internal networking in Pakistan and the possibilities of a US-Pakistan network connection. Among the recommendations of the FJC report was "introduction of high speed connectivity between the two countries". With the assistance of Internet2, a cooperative project between TransPAC2 (US-IRNC initiative) and PERN2 (Pakistan-HEC initiative) was begun to develop this high speed connectivity.

A funding request was submitted to the NSF and funds allocated for US half of the project. A similar funding process was undertaken in Pakistan and the Pakistan-HEC approved and allocated funding for the Pakistan half of the project.

Technically the connection will be from Singapore to Karachi where it will connect to the PERN2 network (see preceding Figure 1). The connection will share the EU TEIN2 POP in Singapore. Pakistan and the US will split costs of the "wet" segment between Singapore-Karachi. Pakistan will be responsible for all networking costs within Pakistan.

Williams visited Pakistan in early April. He met with officials from the Pakistan Higher Education Commission (HEC). He visited a number of universities in Islamabad and in the area around Islamabad. He led a seminar and training program on high performance networking for the HEC. He also met with officials from the HEC and the Pakistan Telecommunications Company Limited to discuss details of the US-Pakistan network connection. This connection will be made from the TransPAC2 point of presence in Singapore to Karachi, Pakistan where it will connect to the PERN/PERN2 network.

The connection became active on 14-August. There was considerable work to be done on routing issues (see the Network Engineering section) and some of that work continues.

In addition to the web site: http://pakistan.indiana.edu we have prepared a "flashsheet" to hand out that quickly shows the topology of the network and how to use the connection. This handout is located at: http://tinyurl.com/4vf25g.

This project was made possible by close cooperation between the HEC in Pakistan, the TEIN2 project of the European Commission and the US National Science Foundation. Official publicity for the launch of the Pakistan network can be found at:

NSF: http://nsf.gov/news/news_summ.jsp?cntn_id=112503&org=NSF&from=news

Indiana University: http://uitspress.iu.edu/news/page/normal/9124.html

European Commission:
http://europa.eu/rapid/pressReleasesAction.do?reference=IP/08/1590&format=HTML&aged=0&language=EN&guiLanguage=de

Since the network is physically operational, the next step in this project is to encourage new US-Pakistan science collaborations. To that end, George McLaughlin, the new TransPAC2 Applications Development Advocate (TP2-ADA) has been in conversation with Pakistan regarding extension of the Bio-Mirror network to Pakistan. These discussions are ongoing. See: http://www.bio-mirror.net/. Other applications will be investigated as the situation in Pakistan permits.

IRNC related GENI activities

This is a new section devoted to GENI activities that have an IRNC connection.

Williams attended the second GENI Engineering Meeting in Washington, DC. Although there was some detailed discussion of some GENI engineering areas, this was still a fairly introductory meeting. There was an International luncheon that Williams attended. There was a very large group at this meeting from Japan and a presentation about the Japanese Akira Project. There is also interest in GENI activities from Korea and Europe. Over the next year, TransPAC2 will try to coordinate some of this international interest in GENI. Regarding Indiana University specific efforts:

Indiana University has been awarded a GENI grant to develop a GENI Meta Network Operations Center (GMOC).

From the GENI Press Release:

> [**GMOC**]. "Global Research NOC at Indiana University – GENI Meta Operations Center". PI is Jon-Paul Herron at Indiana Univ. The scope of work on this project is to facilitate the sharing of operational and experimental information among GENI experimental components. This effort has both technical development and operational requirements. Technically, the GENI Meta Operations Center (GMOC) would require a well-defined protocol to help generalize the operational details of GENI prototypes and for the providers of prototypes to send those details to an operational data repository.
>
> These requirements suggest a modular approach, with a generalized protocol rather than a restricted set of hardware and software that GENI prototype participants would be required to run. In other words, it would be largely up to the GENI Spiral 1 project investigators to decide what data to share and how to collect this data from their prototype infrastructure. The GMOC would provide the standardized format for this data and the systems required to share, monitor, display, and act on this data. In addition, the GMOC could be used to help provide a repository for data collections passing into and out of GENI prototypes for the purpose of discovering and isolating prototypes that have caused problems. This might require additional instrumentation at the connection points and substrate elements between prototypes. This would be accomplished with the help of the other prototypes that are part of GENI Spiral 1.
>
> The GMOC will work with these other projects to develop the operational data formats, processes, and systems needed for a consistent and useful suite of GENI infrastructures. During the project, participants will investigate how a Meta Operations Center might interact with various prototype participants to accomplish operations functions.

We expect the close interaction between the GENI project efforts described above and the ongoingTransPAC2 NOC efforts to assist the TransPAC2 NOC (and all IRNC NOCs) in developing tools to interact with and participate in the GENI activities.

Summer REU activities

This is a new section describing the activities of the summer TransPAC2 REU.

Daniel Doyle worked for TransPAC2 as an undergraduate summer student. With assistance and consulting support from Indiana University staff and Interent2 measurement experts, he developed a very useful tool and has documented it in a report attached at the end of the Q3 2008 Quarterly Report. This tool is available to the public and can be found at: http://traceroute.grnoc.iu.edu/

DCN Activities

A significant engineering goal for the TransPAC2 project in 2008 was to provide dynamic layer2 (Ethernet-like) circuit-provisioning and -switching capabilities through the TransPAC2 network, enabling the APAN community to participate in the Internet2-ESnet-European “DCN” dynamic circuit project and to extend its functions and reach through the APAN region. Accordingly, TransPAC2 has been in close discussions with Internet2 regarding connectivity to the DCN network and has worked through the year to achieve this goal. Physical connectivity to DCN was finally achieved when Internet2 extended a 10 Gigabit DCN connection to the PacficWave exchange point in Los Angeles, which we can reach through our existing 10GE connection to PacificWave there (see the Los Angeles topology drawing for details). We were also able to extend the layer2 tagging across the SONET link to Tokyo using MPLS L2VPN technology and connect seamlessly to native Ethernet resources in the APAN region.

In spite of a number of technical challenges—discussed in more detail below in the Engineering Summary--TransPAC2 was able to accomplish this goal with no additional cost to the project and to provide DCN connectivity through the network so that APAN partners could use it to bring content successfully to Supercomputing 08 in November. This was a huge success and the APAN participants are very happy with the results.

perfSONAR Activities

The TransPAC2 project is fully integrated into the Internet2 perfSONAR (PS-PS) infrastructure. John Hicks joined the PS-PS development team and attends the development conference calls and attended the face-to-face meeting in Ann Arbor in September 2008. All currently available PS-PS services are deployed on TransPAC2 in Los Angeles and Tokyo. A PS-PS powered weather map describing the TransPAC2 and JGN2 topology was used at SC08 in the AIST, NICT, and SCInet booths (See below). TransPAC2, Internet2, and DANTE held a perfSONAR workshop this year at the 26th APAN meeting in Queenstown New Zealand. The workshop covered a high level overview of the project down to detailed installation instruction geared toward the APAN community. TransPAC2 provides perfSONAR support to other organizations including CSTNET, KOREN, and KAREN.

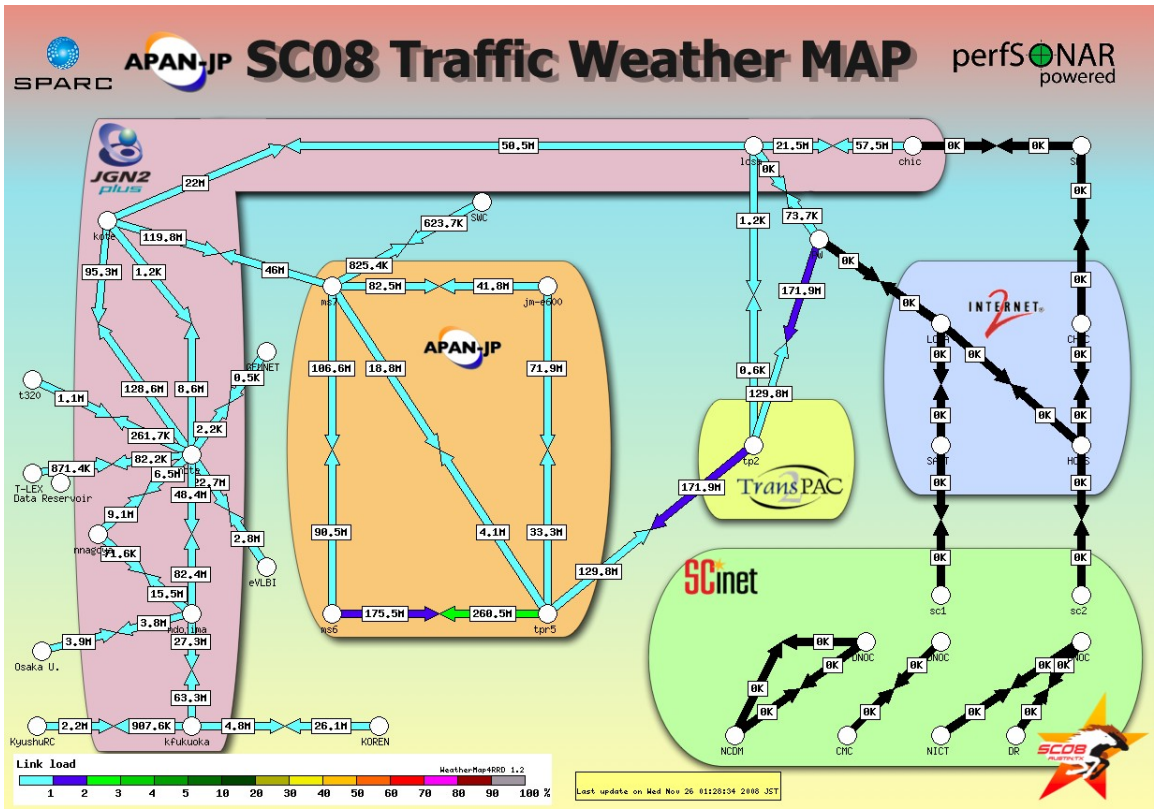


Figure 2: PerfSONAR weather map

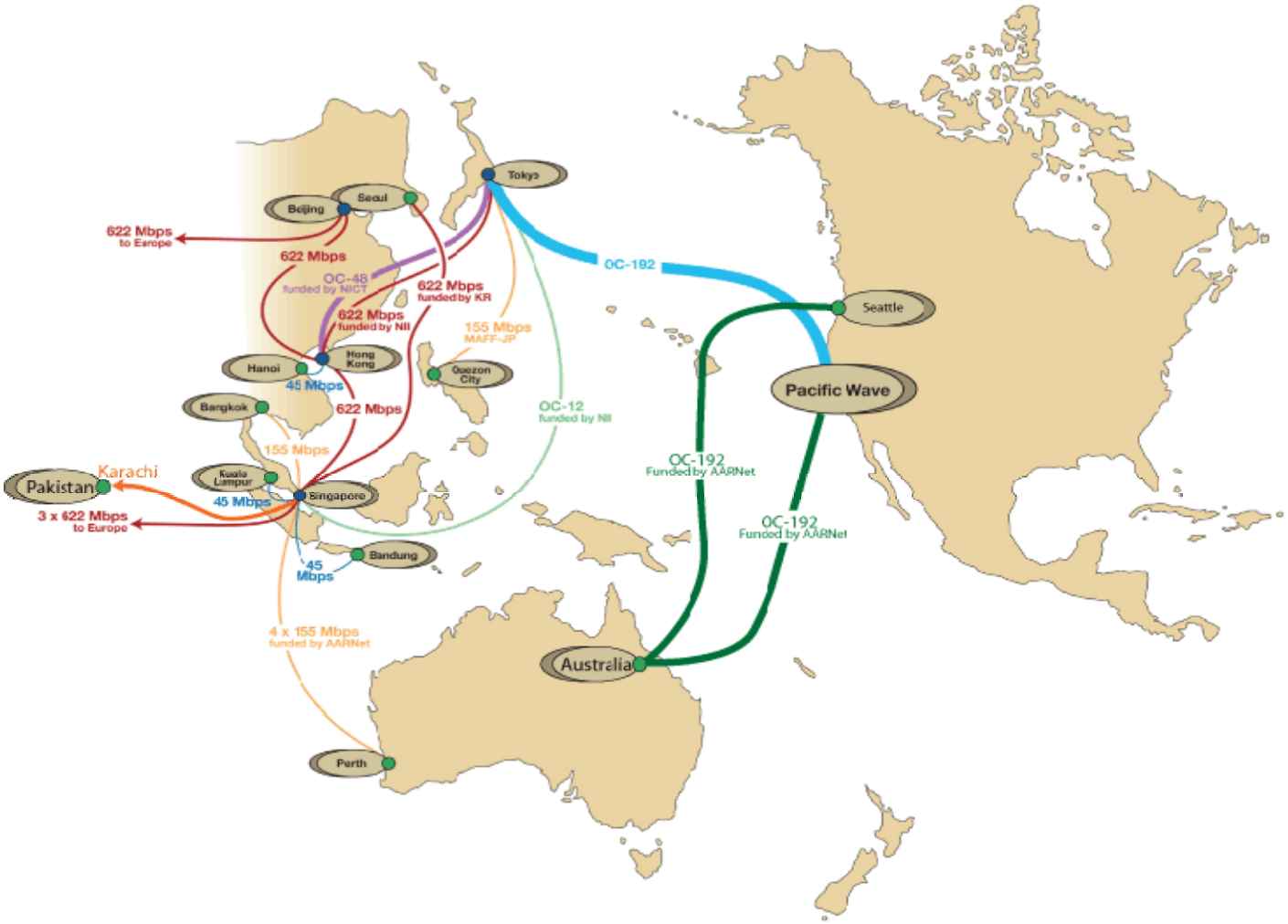


Figure 3: TEIN2 Topology with TransPAC2 circuits

Engineering Summary over Project Year 4

Trans-Pacific network topology: A new 2-year contract for circuit services between Los Angeles and Tokyo was awarded in January 2008 to KDDI, extending the previous circuit agreement for two more years; therefore the fundamental USA-Japan network topology is unchanged from 2007. Backup agreements with JGN2 and SINET have remained in place and have performed as expected. These relationships were especially important as circuit disruptions at different times during the year affected the TransPAC2 and the JGN2 circuits, so these mutual backup arrangements provided for continued connectivity between the US and Asia with minimal impact to the community.

Unfortunately, it was not possible to change the current concatenated SONET OC192 circuit into a channelized or Ethernet one, which would have allowed TransPAC2 to more easily interact with DCN (see below for our workaround). This is something we will investigate in the next round of circuit negotiations.

The additional Pakistan capability is discussed at length elsewhere; the accompanying diagram shows the new connection in the context of other regional R&E connections provided by TransPAC2, APAN/NICT/NII, TEIN, and AARnet. The TransPAC2 engineer provided technical assistance to help move it forward and, after connection, to help get the routing policies to function as desired.

TransPAC2 topology in Los Angeles: Just as USA-Japan network topology is fundamentally unchanged from 2007, the TransPAC2-Los Angeles topology, including the equipment in the TransPAC2 node in Los Angeles, is the same as last year but with the addition of DCN capability. We have made the Los Angeles node more robust by adding a redundant route-engine on the TransPAC2 router, an additional hot-spare 10GE interface on our core Ethernet switch, and upgrading code on the router and switches. (See the diagram below showing TransPAC2 topology in Los Angeles.)

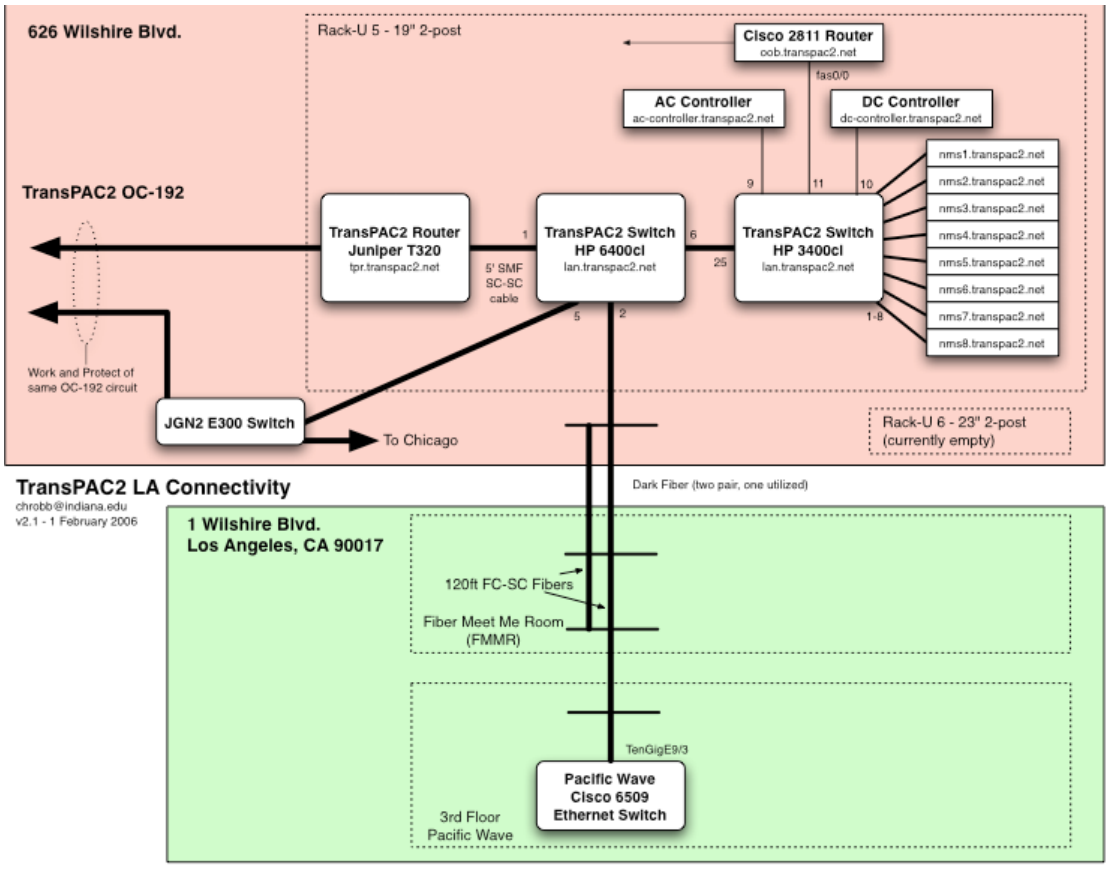


Figure 4: Los Angeles Node Topology

Dynamic Circuits Network (DCN): The most significant engineering addition has been the DCN capability, the implementation of which is discussed at greater length below. It was able to be accomplished at no additional cost to the project. As explained above, this allows TransPAC2 to extend the dynamic circuit-switching capabilities of the jointly-developed Internet2-ESnet-Canarie-DANTE dynamic circuit network to our APAN partners, functionally extending the Internet2 DCN network into many parts of the Asian research community. This capability was used successfully by JGN2/NICT and others at the November 2008 Supercomputing conference to bring LIGO data over this layer2 network from Tokyo and elsewhere to a correlator on the SC08 show floor. See below [Figure 5, "Global Dynamic Circuit Network"] for a map showing some of the regions accessible through DCN, including APAN.

A summary of the tasks related to the TransPAC2 DCN implementation includes these considerations:

- We worked with Internet2 to make sure physical connectivity would be established from I2 to the PacWave exchange point in Los Angeles where we also connect and that TransPAC should have access to it. This connection was established in the first half of the year and we worked with PacWave to ensure we would share access to DCN on it.
- Since the SONET circuit between the USA and Tokyo is not channelized, one of the most difficult tasks was to identify and implement a technology that could accept layer2-tagged frames from the DCN Ethernet network, carry the tagged information across the SONET network, and deliver them on the other end again as tagged Ethernet frames, as if it was Ethernet all the way—without disrupting the production routed traffic occupying most of the same OC192. Our goal was to identify the most straightforward and simple technology that would accomplish this. In the second quarter we narrowed the technology choices down to two and Sweeny and Tanaka from APAN each investigated them and presented a plan at the APAN meeting in August. Tanaka tested them further in a Juniper lab Tokyo and Sweeny eliminated a simpler JunOS option. These discussions and tests continued in August with Tanaka, Sweeny, and a Juniper engineer meeting to discuss technical options, finally selecting MPLS L2VPN as the most appropriate technology for our needs. (See a diagram [Figure 6, "APAN-TransPAC-Internet2 DCN"] below showing logically how the vlans enter, traverse, and exit the SONET link.)
- Concurrently, in July-September APAN engineers identified Japanese users who could fruitfully first use DCN to collaborate with colleagues in the US and worked to confirm DCN capability through their region to those users. APAN and TransPAC2 also worked to implement their own IDCs (inter-domain controller, the server which communicates with domain controllers in other domains. Each administrative domain e.g. Internet2, TransPAC, APAN, NYSERNET, etc each have their own IDC) to negotiate DCN characteristics and configure the path through our domain.
- In October, the TransPAC and APAN engineers reconfigured the TransPAC OC192 to enable carrying layer2-over-SONET framing. When this was completed, there was a complete layer2 path from Internet2 across TransPAC to the users of the APAN region.
- Since all of the above technology choices require CCC on the Juniper core routers to encapsulate the layer2 frames across the SONET network between the US and Japan, and since CCC requires 802.1q VLAN-ids to be less than 512 and PacWave VLAN-ids are all greater than 512, we must provide VLAN translation. The current TransPAC switch cannot do this, so TransPAC worked during the 2nd and 3rd quarters with CENIC to provide VLAN translation for all PacWave VLANs coming to the TransPAC router in Los Angeles.
- The TransPAC2 DCN control-plane technology has initially been simple statically-configured VLANs. IDCs will be added in Los Angeles and Tokyo to provide true inter-domain dynamic control for the TransPAC and APAN domains.
- TransPAC has requested that Internet2 designate a set of "static" VLANs (dynamically configured over DCN but fixed across the TransPAC routed circuit) for use in the TransPAC DCN trial. When the TransPAC IDC is complete the static VLANs will no longer be needed in the switched portions of the TransPAC-APAN networks, though the nature of the L2VPN configuration requires a block of static VLANs across that part of the network which can be dynamically used by the IDCs, and TransPAC can use the IDC to dynamically allocate, assign, and program VLANs as needed.
- Sweeny presented engineering updates on TransPAC DCN implementation progress, capabilities, and plans at the APAN meeting in August.
- APAN and TransPAC engineers tested the DCN capability end-to-end through the APAN, TransPAC, and Internet2 networks in October and November to ensure proper function including jumbo frames and acceptably high levels of throughput.

- APAN/NICT/JGN2 demonstrated the DCN functionality from Tokyo across all three networks to the SC08 show floor. They were very pleased with the results.
- Sweeny is an active member of the Internet2 DCN Working Group, who are tasked with representing members' technical, functional, operational, and business requirements to the DCN developers and providers.

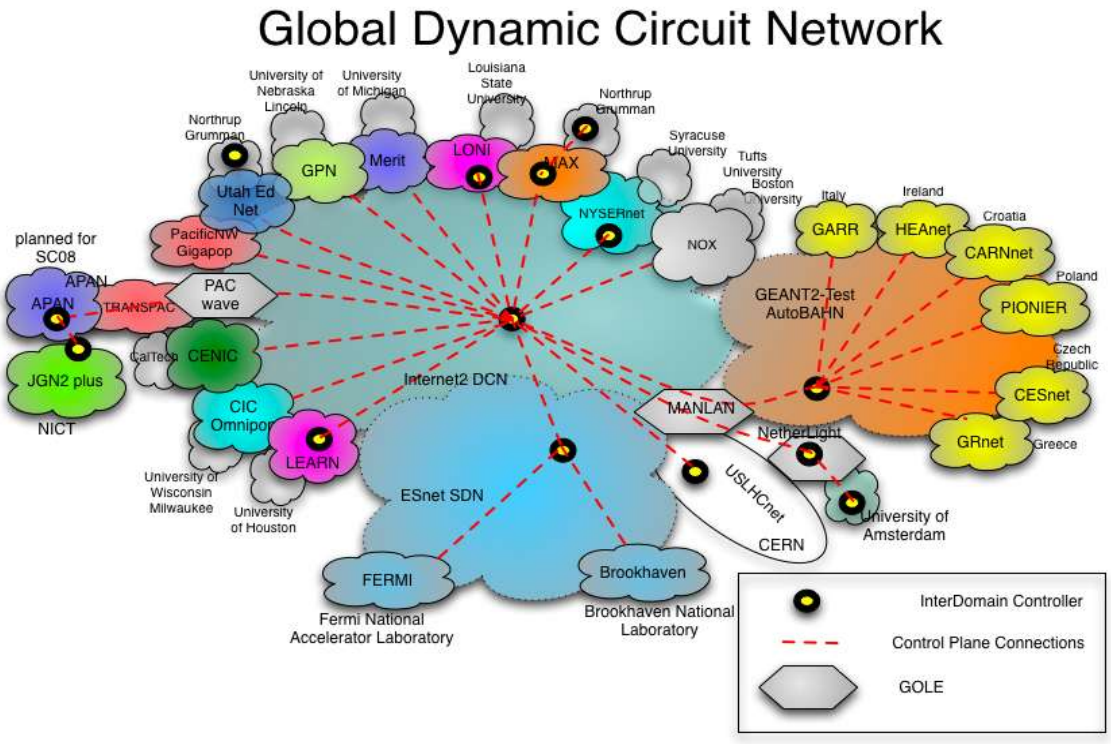


Figure 5: Global Dynamic Circuit Network (Internet2 view)

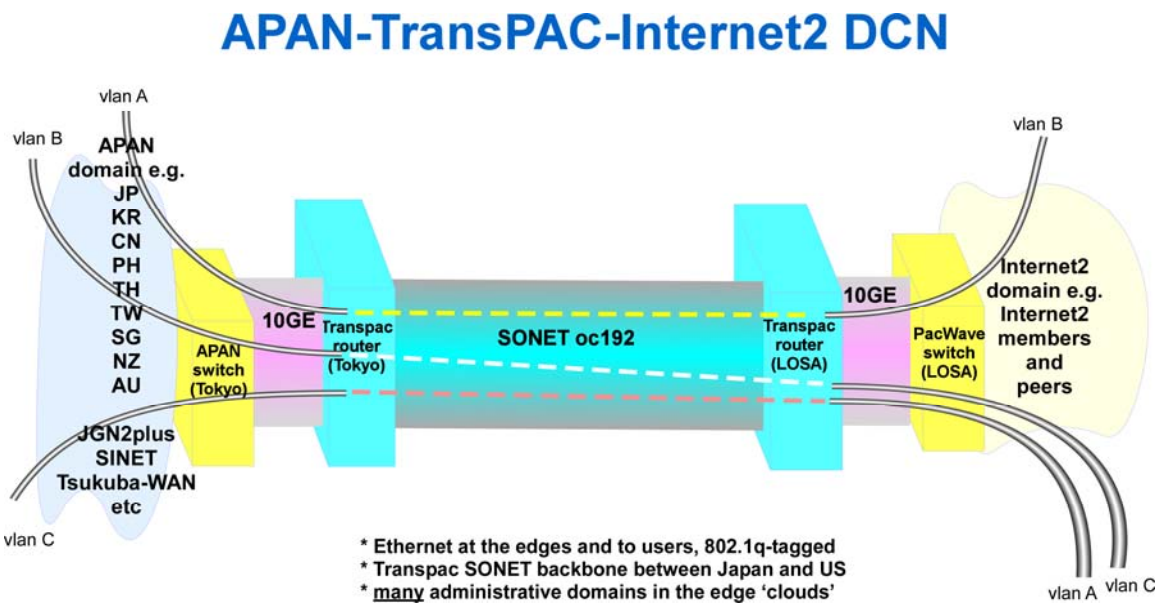


Figure 6: APAN-TransPAC-Internet2 DCN logical view

Other engineering activities: Sweeny also continues to refine and progress his proposal for "**BGP Path Hinting**", which has now been presented to technical groups such as Joint Techs, Internet2 Member Meetings, Joint Engineering Team (JET) with US Federal-networking colleagues, ARIN, and others, with response encouraging him to go forward. It is thought to be particularly useful in the R&E community, and particularly during Supercomputing, where some 'power users' require 'steering' of different streams of traffic via different routed paths through the network back toward them . Basically, the proposal suggests using BGP communities for end-sites to signal to upstream transit networks a desired "return path" for packets to the requesting site when paths through multiple networks are available. It allows the destination site to indicate its preference for that return path, which the transit network may choose to honor. In January 2008, he demonstrated a proof-of-concept by changing the path of return traffic using BGP to signal a return path modification across multiple networks including TransPAC, Internet2, and NLR. At the January Joint Techs meeting he was encouraged to document and publish this signaling protocol as an RFC, which is slowly progressing. Currently he is blocking on ARIN approval of an Autonomous System Number for use in the BGP community unique-id marker. For more information, see one of the presentations this year: http://events.internet2.edu/2008/jt-hawaii/sessionDetails.cfm?session=3608&event=278

Usage summary and performance activities over Project Year 4

The TransPAC2 project is fully integrated into the Internet2 perfSONAR (PS-PS) infrastructure. All currently available PS-PS services are deployed on TransPAC2 in Los Angeles and Tokyo. TransPAC2 BWCTL, OWAMP, SNMP, and PingER data are available from Los Angeles and Tokyo. The Lookup (LS) service for these data sources is located at **http://134.68.142.46:8080/perfSONAR_PS/services/LS**.

TransPAC2 measurement data can be viewed with early tools like perfADMIN (Internet2) and perfSONARUI (GEANT2-JRA1). We will continue to work with Internet2 and the DICE consortium to deploy perfSONAR resources and publish TransPAC2 performance data when available. PerfSONAR is rapidly becoming the infrastructure of choice to discover measurement resources and gather data available in the REN community. TransPAC2 is taking advantage of this momentum by becoming an early adopter and advocate of perfSONAR with deployment strategies and outreach.

TransPAC2 has deployed the latest version of perfSONAR in Los Angeles and Tokyo, publishing data with the following tools:

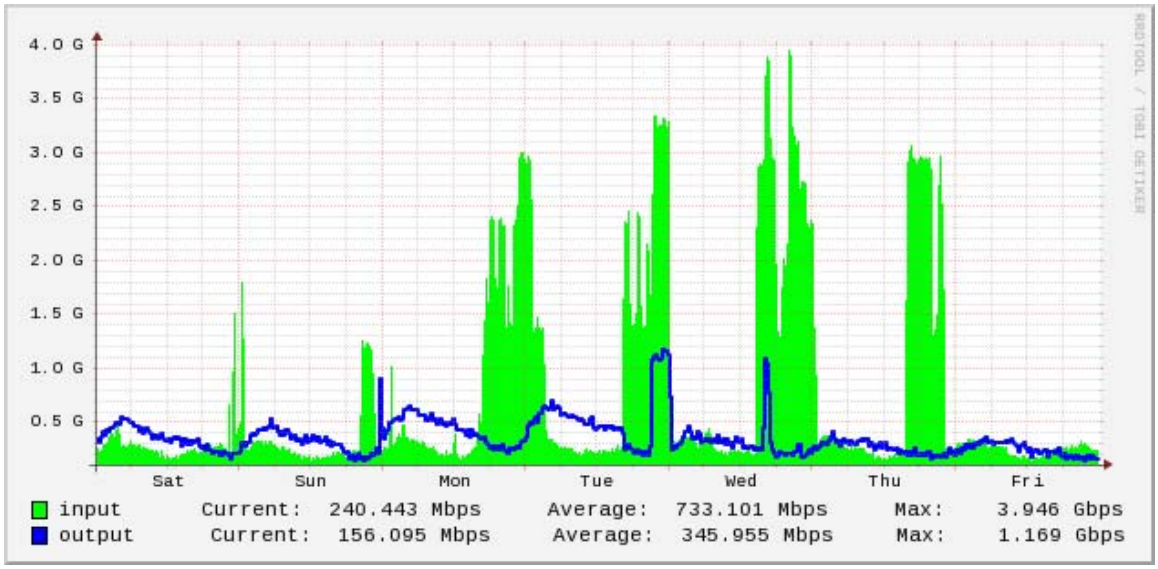
- perfSONAR-PS Lookup Service (LS) – Providing resource discovery through LS
- perfSONAR-PS SNMP MA - Exposing interface usage data of network equipment through SNMP
- perfSONAR-BUOY
- Throughput - Exposing throughput data on TransPAC2 and to other key locations using bwctl
- Delay - Exposing delay data from owamp
- perfSONAR-PingER MA – Expose pingER data

Current perfSONAR-PS resources are available through the internet2 perfADMIN: https://dc208.internet2.edu/gui/directory.cgi

TransPAC2 has presented material related to the development of perfSONAR at APAN conferences dating back to January 2007. At the last APAN meeting in New Zealand, a joint Internet2 and TransPAC2 workshop was conducted dedicated entirely to perfSONAR. The workshop was well received based on the feedback and inquiries. The JP NOC staff announced a deployment scheduled consisting of four locations (Kyushu, Tokyo, Osaka, Kashima) in Japan with data from SInet, JGN2, and TransPAC2. Other organizations including CERNET, AARNET, and KOREN have also expressed interest in a perfSONAR deployment strategy. A comprehensive installation document geared toward the AP Region was developed in collaboration with the JP NOC and Internet2 staff for this workshop. This working document serves as a step-by-step guide to getting started with perfSONAR-PS in the AP Region. The evolution of this document continues to reflect changes and updates to the perfSONAR-PS measurement software suite.

A new 4rrd-based TransPAC2 weather-map was developed with data collection through perfSONAR. The new TP2 Weather-map was displayed at Supercomputing 2008.

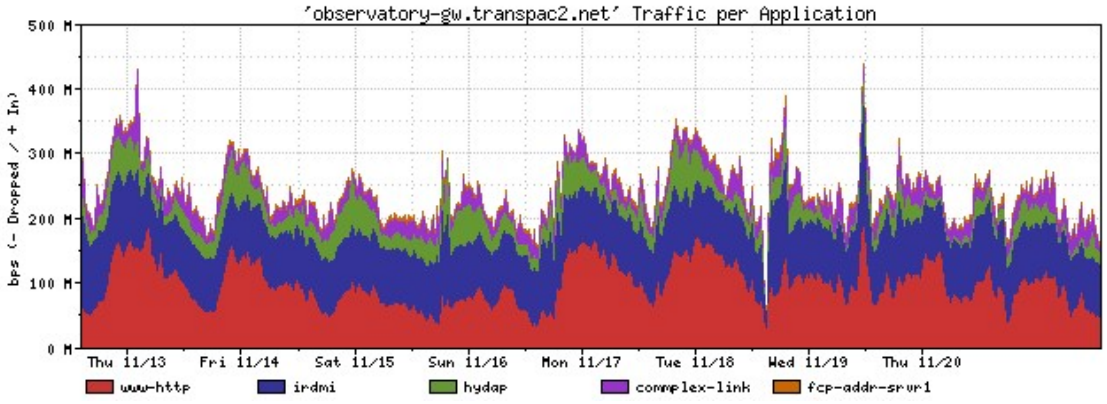
The following graph represents the aggregated traffic on the TransPAC2 network during the week of Supercomputing 2008.



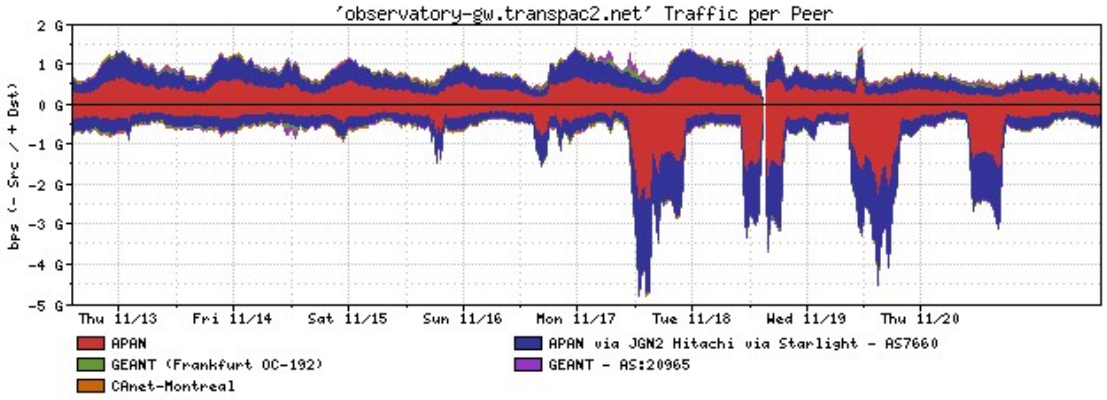
Worked with KDDI and NII engineers to deploy perfSONAR resources on Tokyo ⇔ Singapore and Singapore ⇔ Pakistan links. Policy issues regarding data access continue to hamper progress.

TransPAC2 will continue to use the statistics and reporting capabilities of the Arbor Peakflow SP System to publish Netflow and BGP analysis. The SP system implementation is made possible through support from Internet2, REN-ISAC, and Indiana University. The following two graphs are examples of Arbor Peakflow SP reports.

TransPAC2 TCP traffic breakdown (top 5 applications)



TransPAC2 peer traffic breakdown



Security events and activities over Project Year 4

There were no significant security events associated with TransPAC2 over the course of Project Year 4.

TransPAC2 continues with basic security deployment
Basic security infrastructure was put into place on the TransPAC2 T320 router.

a. The TransPAC2 router is protected against intrusions by packet filters applied to the control plane.
b. Using the RANCID system, the Global NOC monitors the TransPAC2 router's running configuration. The RANCID system automatically emails appropriate engineers whenever the router configuration is changed. See the following for more details: http://www.shrubbery.net/rancid/
c. Using GRNOC developed syslog scripts, we monitor the TransPAC2 router's syslog events. Appropriate engineers are then notified via email when an important event is identified. See the following for more details: http://sourceforge.net/projects/syslogscripts/

TransPAC2 is working with the APAN security list (t2-security-l@indiana.edu) to disseminate security information concerning the US and AP region.

Arbor Systems deployment on the TransPAC2 and Internet2 networks is complete. . The SP system implementation is made possible through the REN-ISAC and Indiana University. TransPAC2 security issues are addressed using the SP Peakflow system and the support from the REN-ISAC.

The Arbor Peakflow SP annual maintenance contract was renewed (paid for by Internet2).

TransPAC2 had zero downtime due to security issues.

1. Hicks upgrade Arbor Peakflow SP system. New feature set allows for more detail exploration of security incidents.
2. Attended Internet2 Joint Techs meeting security sessions.
3. Hicks investigated all security incidents on the TransPAC2 network. No major incidents to report .
4. Continued work with the REN-ISAC and Arbor Networks to automate Peakflow SP updates (topology changes).
5. Attended Internet2 members meeting security sessions.
6. Attended APAN meeting security sessions.

Williams attended the NSF Large Facility Cyberinfrastructure meeting in Washington, DC and participated in the Incident Reporting breakout. The IR breakout continues to be concerned about potential security issues with international network connections. There was discussion of this issue among the IRNC investigators. That discussion will continue.

TransPAC2 - Value to U.S. Science (continued)

The TransPAC program has provided high performance research and education (R/E) network connectivity between the US and Asian Pacific region for almost a decade. TransPAC2 has established itself as a well-respected voice in R/E networking issues in Asia. TransPAC2 provides connectivity and engineering support for a number of research communities including Grid, High Energy Physics, Earth Sciences, Astronomy, Bioinformatics, and Medical sciences. TransPAC2 is consistently part of the Asian network picture including part of the TEIN2 project and support for intra-Asian links.

TransPAC2 provides the "*glue*" for international collaborations. Application areas include:

- High Energy Physics
- Earth Sciences
- Astronomy
- Bioinformatics
- Medical sciences
- Remote access to major research instruments
- Data resources
- Community Grids
- Computing and storage Grids

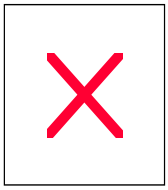
Communities benefiting from the network services (continued)

The following applications regularly benefit from the TransPAC2 networks:

Astronomy

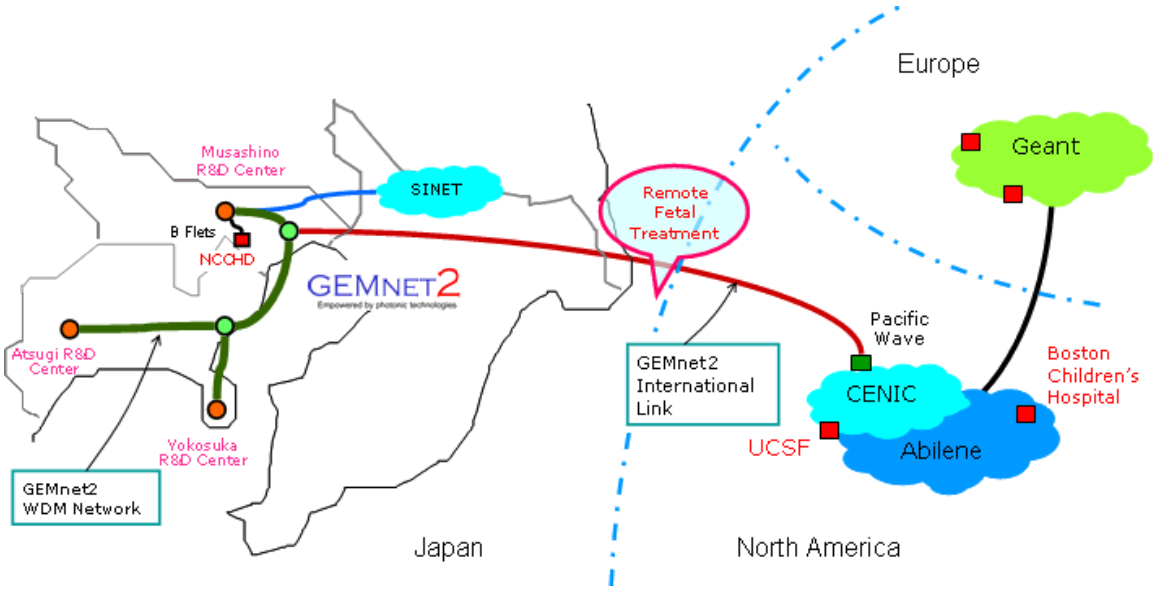
Very-Long-Baseline Interferometry (VLBI) is one of the most powerful techniques available for the high-resolution imaging of distant radio sources in the universe and for making accurate measurements of the motion of the earth in space. Multiple radiotelescopes scattered over the surface of the earth simultaneously record data from a radio source at streaming data rates as high as 1 Gbps for a 24-hour period. TransPAC2 provides high-performance network access to the VLBI facility in Kashima Japan.

e-VLBI won the Internet2 IDEA award, 2006
For more information about e-VLBI see: Internet2 e-VLBI



Tele-medicine
US-Japan telepresence and telemedicine in fetal care management

Nippon Telegraph and Telephone Corporation (NTT, headquarters: Chiyoda-ku, Tokyo) and the National Center for Child Health and Development (NCCHD, Setagaya-ku, Tokyo) tested the feasibility of transmitting digitalized fetal medical images (including 3-dimensional ultrasound as well as fetoscopic images) between the US and Japan. The purpose is to implement the telediagnosis and prospective telesurgical treatment of fetal diseases on a global scale. These feasibility studies are to be conducted using ultrahigh-speed network technologies through interconnections of the GEMnet2 ultrahigh-speed experimental network operated by NTT Laboratories with overseas research and education (R&E) networks from March 1, 2006 through March 31, 2007.



This application is an example of the type of tele-medical activities going on between the U.S. and Asia. TransPAC2 is in a prime position to provide networking connectivity and support to these kinds of applications. TransPAC2 is currently working with the Barrow Neurological Institute, Internet2, and the APAN medical application group to use the TransPAC2 network to support this type of applications. Other applications include viewing remote surgical and diagnostic procedures. These applications are valuable teaching tools that connect experts to remote locations. The goal is to move electrons, not atoms. In these virtual classrooms, surgeons and operating room staff can see and interact with an entire classroom of students as if they are there in the operating room. TransPAC2 will continue work with these groups to bridge the gap in the medical application space between the U.S. and the AP Region.

Information courtesy of Dr. Hisao Uose (uose.hisao@lab.ntt.co.jp) of NTT laboratories.

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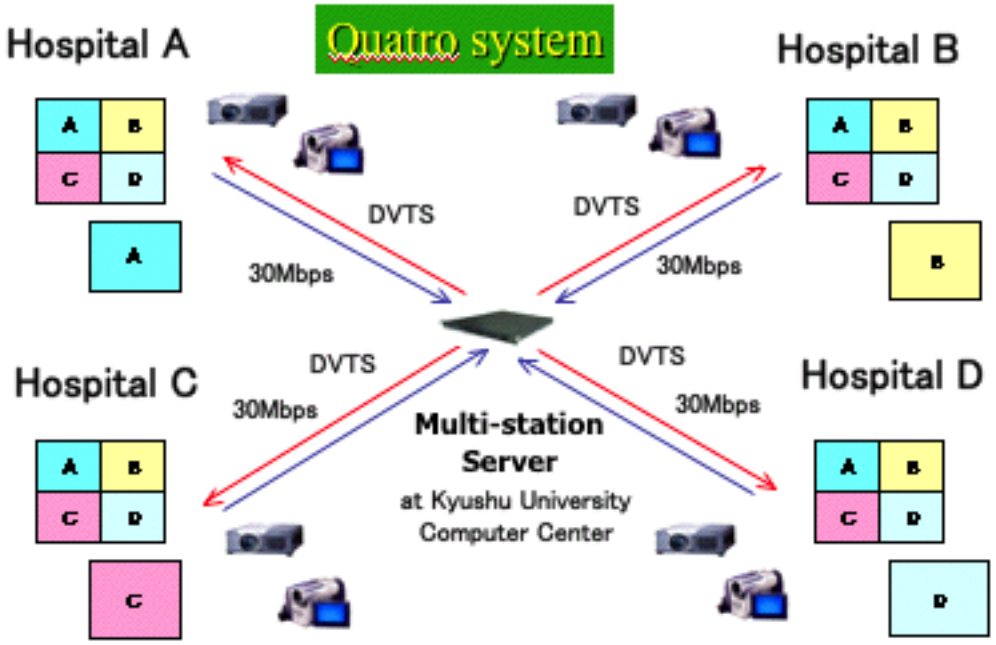
Phone: 03-3416-0181 (ext. 5305, 7007)
E-mail: chiba-t@ncchd.go.jp

VDTS
Remote medical activity in Asia-Pacific
Telemedicine requires high quality high speed multi-channel moving images to broadcast operating room procedures to remote locations. Current projects include tele-mentoring for

endoscopy and neurosurgery. Using 30Mbps DVTS streams, medical procedures are viewed from remote locations to aid in training and diagnosis.



A whole variety of medical content is current under investigation including:

- Surgery
- Endoscopy
- Medical informatics
- Robotic surgery
- Interventional radiology
- Regular teleconferencing
- Teleconsultation
- Bird flu, SARS, etc

Some of the advantages of telemedicine include:
For doctors and institutions

- **Learn new and different procedures by real watch**
- **Many people at once, and at anytime**
- **Reduce accidents and complications**
- **Deepen friendship by frequent communication**

For patients

- **Provide better and safer medical care**

For global health care

- **Standardization and globalization**

Information provided by Dr. Shuji Shimizu, MD, PhD
Email: shimizu@surg1.med.kyushu-u.ac.jp

TransPAC2 engineers helped facilitate a DVTS demonstration between the Internet2 members meeting venue in New Orleans, Indiana University, and Stanford University. Future meetings

between Indiana University medical faculty and staff are planned to continue these efforts. The video demonstration was part of TransPAC2's ongoing support of tele-medicine within APAN and provided an opportunity for US physicians to both participate in and experience a DVTS session.

Database

Bio-Mirror public service for high-speed access to biosequence data

http://bio-mirror.net/

Don Gilbert - Department of Biology, Indiana University, Bloomington, IN 47405, USA

ABSTRACT

Summary: Timely worldwide distribution of biosequence and bioinformatics data depends on high performance networking and advances in Internet transport methods. The Bio-Mirror project focuses on providing up-to-date distribution of this rapidly growing and changing data. It offers FTP, Web and Rsync access to many high-volume databanks from several sites around the world. Experiments with data grids and other methods offer future improvements in biology data distribution.

Description:

This is a world-wide bioinformatic public service for high-speed access to up-to-date DNA/protein biological sequence databanks. In genome research, these databanks have been being growing tremendously. There is over 495 Gigabytes (compressed) total data. The Bio-Mirror project is devoted to facilitate timely access to important large data sets for this research. High speed access is provided by Internet2, TransPAC2, the Australian Academic Research Network (AARNet) and the Asia-Pacific Advanced Network (APAN). Bio-mirror has resources available in the following countries:

Australia, Austria, China, Japan, Korea, Malaysia, New Zealand, Philippines, Singapore, Taiwan, Thailand, USA.

Grid technologies

PRAGMA

The Pacific Rim Application and Grid Middleware Assembly (PRAGMA) was formed in 2002 to establish sustained collaborations and advance the use of grid technologies in applications among a community of investigators working with leading institutions around the Pacific Rim. Currently there are 29 institutions in PRAGMA, who meet twice a year at PRAGMA Workshops. In PRAGMA, applications are the key, integrating focus that brings together the necessary infrastructure and middleware to advance the application's goals. Working groups focus our activities. PRAGMA is governed by a Steering Committee.

TransPAC2 serves on the Steering Committee and supports PRAMGA applications using the TransPAC2 network connection.

For more information about PRAGMA see: PRAGMA Home

OSG
The Open Science Grid (OSG) is a global Data Grid that will serve forefront experiments in physics and astronomy. Its computing, storage and networking resources in the U.S., Europe, Asia and South America provide a unique laboratory that will test and validate Grid technologies at international and global scales. The OSG demonstrated the capabilities with U.S, European, and Asia counterparts. The OSG and the OSG grid operations center (GOC) are supported by Indiana University. TransPAC2 is used as a primary network link to connect the US with the AP-region. TransPAC2 is continuously striving to meet the needs of the grid community by providing a reliable HP network and working with the NOC and GOC to improve services.
http://www.opensciencegrid.org

Assessing Use

TransPAC2 consists of a single OC-192c connection between the west cost of the United States and the Tokyo XP Japan. SNMP, Flow, and BGP data are used to identify applications on the TransPAC2 network. Aggregated statistics can be obtained at http://www.transpac2.net.

The following table represents top source-destination pairs on the TransPAC2 network for most of 2008.

Institution 1	Instituion 2	Protocol
WWW-http, https, http-alt (approximately equal stat significance)		
weather.noaa.gov	Asian Institute of Technology, Thailand	TCP
Caltech	Kyungpook Natnl. Univ, Korea	TCP
Academica Sinica	various	TCP
San Jose State University	Tsinghua University, China	TCP
Dnan-Farber Cancer Inst.	University of S/T of China	TCP
University of Tulsa	Natl. Chengchi Univ. Taiwan	TCP
FTP-data		
NIH	KRNIC-KR, Korea	TCP
Chiyoda-ku, Tokyo	NASA	TCP
IRDMI (prot 8000 VC traffic)		
FUJITSU, Japan	University of Maryland	UDP

Contributions to Science (continued)

"The primary goal of TransPAC2 is to increase research and educational (R/E) collaboration between the United States and Asia. To increase R/E collaboration, TransPAC2 will deploy a secure, production-quality high-performance network infrastructure between Asia and the US and will assist our Asian partners in the deployment of high-performance infrastructure within Asia. TransPAC2 will enhance collaborations between US researchers and governments and Asian researchers and governments. TransPAC2 will also provide technical support for collaboration activities where requested." This section describes activities that TransPAC2 is involved in and/or groups that benefit from TransPAC2.

Earth Science

- DIAL is a web-based distributed system to search, access and visualize satellite remote sensing data for Global Change research. In collaboration with NASDA and other institutions, NASA has DIAL servers set up to distribute satellite remote sensing data. NASA and NASDA also collaborate on the Tropical Rainfall Measurement Mission (TRMM); 3D data is transferred from NASA to NASDA using TransPAC/APAN, processed and visualized for the web.

- The Space Physics and Aeronomy Research Collaboratory (SPARC) is an NSF-sponsored community resource for the upper atmospheric and space sciences; operating 24 hours a day for scientific collaboration and access to real-time and archival data.
  http://sparc-1.si.umich.edu/sparc/central

High Energy Physics

- The BELLE detector is the state-of-the-art detector to investigate CP (C=Charge conjugation, P=Parity) violating phenomena with unprecedented precision at the KEK B meson factory. The CP violation is a key to explain why the universe is dominated by the matter, not by the anti-matter. The primary goal of the BELLE detector is to identify the origin of the CP violation. The BELLE collaboration consists of more than 40 institutions from Japan, Korea, China, Taiwan, India, Russia, USA, Australia, and Europe.

- The **GriPhyN** (**Gri**d **Phy**sics **N**etwork) collaboration is a team of experimental physicists and information technology (IT) researchers who plan to implement the first Petabyte-scale computational environments for data intensive science in the 21st century.

- ATLAS is a general-purpose experiment for recording proton-proton collisions at LHC. The ATLAS collaboration consists of 144 participating institutions (June 1998) with more than 1750 physicists and engineers (700 from non-Member States). The detector design has been optimized to cover the largest possible range of LHC physics: searches for Higgs bosons and alternative schemes for the spontaneous symmetry-breaking mechanism; searches for supersymmetric particles, new gauge bosons, leptoquarks, and quark and lepton compositeness indicating extensions to the Standard Model and new physics beyond it.

Life Sciences

- DNA data has accumulated more rapidly than compute power so researchers must often exclude potentially informative data to make statistical analysis practical. Utilizing the computationally intensive maximum-likelihood method of phylogenetic inference in a globally distributed collection of computational nodes, Indiana University, National University of Singapore and ACSys CRC in Australia have analyzed the DNA of cytoplasmic coat proteins, micro-sporidia, and cyanobacteria. http://www.indiana.edu/~rac/hpc/cp.html

Astonomy and Space Science

- Sloan Digital Sky Survey (SDSS) is a project to carry out imaging and spectroscopic surveys of half the northern sky using a dedicated, wide-field, 2.5-m telescope. The imaging survey with a large mosaic CCD camera will produce digital photometric maps of the sky in five color bands. These maps will be used to extract the position and various photometric parameters of about 100 million galaxies and close to the same number of stars. The SDSS is a collaborative project between the US and Japan involving seven US institutions and the Japan Promotion group (JPG).

- The LIGO Scientific Collaboration (LSC) is a forum for organizing technical and scientific research in LIGO. Its mission is to insure equal scientific opportunity for individual participants and institutions by organizing research, publications, and all other scientific activities. It includes scientists from the LIGO Laboratory as well as collaborating institutions.

Tele-Sciences

- Scientists at the Osaka University Research Center for Ultra High Voltage Electron Microscopy (UHVEM) and University of California San Diego National Center for Microscopy and Imaging Research (NCMIR) successfully use international advanced research networks to couple the world's largest and most powerful (3 million volt) transmission electron microscope at UHVEM to a remote-use computer pavilion set up at NCMIR.
http://www.npaci.edu/online/v3.10/telemicroscopy.html

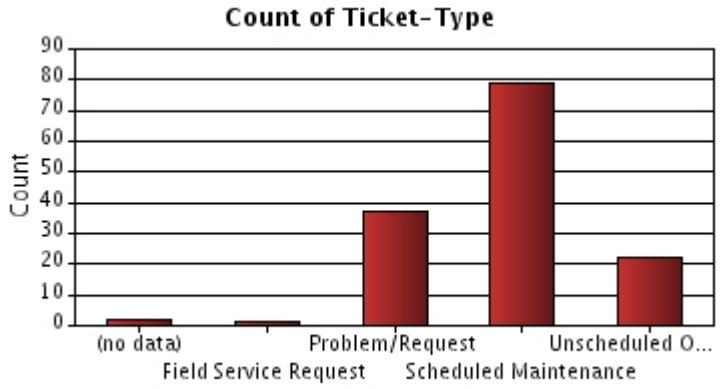
Budget Summary

CIREN/TransPAC2 Budget Year 4							
One-time costs							Expended
							Year 4
	Router/switch equipment in LA						
		Juniper T-320 router					0
		HP 3400 switch					0
		HP 6400 switch 2					0
Total							
On-going costs							
	Circuit costs and related expenses						
		OC-192 Los Angeles - Tokyo					498,000
		PacificWave connection fee					21,000
		KDDI-America co-lo fee					18,000
		Juniper T-320 maintenance					28,000
	Personnel costs (including indirects)						
		One-half network engineer					71,663
		One-half NOC support					40,950
		Student hourly					6,000
		Application consultant					10,000
	Travel and other						
		Travel					28,500
		Reporting					5,000
Total							727,113

TransPAC2 Business Activity, Annual Report 2008

TROUBLE TICKET ACTIVITY

This report contains data from 141 Tickets.



Count of Ticket-Type	
(no data)	2
Field Service Request	1
Problem/Request	37
Scheduled Maintenance	79
Unscheduled Outage	22

TransPAC2 Network Availability Statistics and Analysis Annual Report 2008

Downtime and Availability

TransPAC2 Core Nodes	Down Time	Reporting Period Availability	52 Week Availability
TransPAC2 T320 - LA	0 hr 1 min	99.99977%	99.96216%
6410 Ethernet Switch	0 hr 20 min	99.99543%	99.99622%
3410 Ethernet Switch	0 hr 20 min	99.99543%	99.99622%
OOB Router	0 hr 0 min	100.00000%	100.00000%
Aggregate TransPAC2 Core Nodes	0 hr 41 min	99.99766%	99.98865%

TransPAC2 Backbone Circuits	Down Time	Reporting Period Availability	52 Week Availability
TransPAC2 LOSA-JGN2 LOSA 10GigE	0 hr 0 min	100.00000%	100.00000%
TransPAC2 LOSA-Pacific Wave LOSA 10GigE	35 hr 26 min	99.51435%	99.59771%
TransPAC2 TOKY-TransPAC2 LOSA	41 hr 16 min	99.43439%	98.72616%
Aggregate All TransPAC2 Backbone Circuits	76 hr 42 min	99.64958%	99.44129%

Unscheduled Outages Summary

Ticket Number	Customer Impact	Network Impact	*Title*	Outage Type	*Start Time (UTC)*	*End Time (UTC)*
737	2-High	2-High	TransPAC2 TOKY-TransPAC2 LOSA Circuit Outage Resolved	Circuit - Other	01/31/2008 12:55 AM	01/31/2008 1:05 AM
750	2-High	2-High	TransPAC2 TOKY-TransPAC2 LOSA Circuit Outage Resolved	Circuit - Other	02/21/2008 1:28 AM	02/21/2008 1:29 AM
768	1-Critical	1-Critical	TransPAC2 TOKY-TransPAC2 LOSA Circuit Outge Resolved	Circuit - Other	04/30/2008 11:25 PM 05/01/2008 12:56 AM	05/01/2008 12:40 AM 05/01/2008 3:32 AM
774	2-High	3-Elevated	TransPAC2 LOSA-Pacific Wave LOSA Circuit Outge Resolved	Hardware	05/16/2008 2:09 AM	05/17/2008 1:35 PM
810	1-Critical	1-Critical	TransPAC2 TOKY-	Circuit -	07/10/2008	07/11/2008

			TransPAC2 LOSA Circuit Outage Restored	Damaged Fiber	3:58 PM	5:18 AM
864	1-Critical	2-High	TransPAC2 TOKY-TransPAC2 LOSA Backbone Circuit Outage Resolved	Circuit - Damaged Fiber	10/17/2008 3:12 PM	10/18/2008 4:02 AM
868	2-High	2-High	TransPAC2 TOKY-TransPAC2 LOSA Backbone Circuit Outage Resolved	Circuit - Damaged Fiber	10/23/2008 6:19 PM	10/23/2008 6:21 PM

Unscheduled Outages Detail

Ticket No.: 737:62
Subject: TransPAC2 TOKY-TransPAC2 LOSA Circuit Outage Resolved
Affected: TransPAC2 TOKY-TransPAC2 LOSA Circuit
Start Time: Thursday, January 31, 2008, 12:55 AM (0055) UTC
End Time: Thursday, January 31, 2008, 1:05 AM (0105) UTC
Description: TransPAC2 TOKY-TransPAC2 LOSA Circuit was briefly un available. KDDI America Engineers report the problem was traced to an optical amplifier issue in Japan. Technicians have replaced the amplifier and the circuit remains stable.

Ticket No.: 750:62
Subject: TransPAC2 TOKY-TransPAC2 LOSA Circuit Outage Resolved
Affected: TransPAC2 TOKY-TransPAC2 LOSA Circuit
Start Time: Thursday, February 21, 2008, 1:28 AM (0128) UTC
End Time: Thursday, February 21, 2008, 1:29 AM (0129) UTC
Description: TransPAC2 TOKY-TransPAC2 LOSA Circuit was briefly unavailable to the community. KDDI America Engineers report their local carrier experienced a problem between Higashi-Shinagawa to Otemachi, but are unable to determine the exact cause of the outage.

Ticket No.: 768:62
Subject: TransPAC2 TOKY-TransPAC2 LOSA Circuit Outage Resolved
Affected: TransPAC2 TOKY-TransPAC2 LOSA Circuit
Start Time: Wednesday, April 30, 2008, 11:25 PM (2325) UTC
End Time: Thursday, May 1, 2008, 12:40 AM (0040) UTC
Start Time: Thursday, May 1, 2008, 12:56 AM (0056) UTC
End Time: Thursday, May 1, 2008, 3:32 AM (0332) UTC
Description: TransPAC2 TOKY-TransPAC2 LOSA Circuit was unavailable due to a faulty card in Emi, Japan. The card has been replaced and the circuit was restored.

Ticket No.:	774:62
Subject:	TransPAC2 LOSA-Pacific Wave LOSA Circuit Outage Resolved
Affected:	Peers ESNET, Pacific Northwest Gigapop, Cenic, NREN TransPAC2 LOSA-JGN2 LOSA 10GigE
Start Time:	Friday, May 16, 2008, 2:09 AM (0209) UTC
End Time:	Saturday, May 17, 2008, 1:35 PM (1335) UTC
Description:	Various Peers experienced instability to the TransPAC2 community. TransPAC2 Engineers, with the assistance of an HP Technician, replaced a defective optic module and the circuit was restored.

Ticket No.:	810:62
Subject:	TransPAC2 TOKY-TransPAC2 LOSA Circuit Outage Restored
Affected:	TransPAC2 TOKY-TransPAC2 LOSA Circuit
Start Time:	Thursday, July 10, 2008, 3:58 PM (1558) UTC
End Time:	Friday, July 11, 2008, 5:18 AM (0518) UTC
Description:	TransPAC2 TOKY-TransPAC2 LOSA Circuit was unavailable to the community. KDDI Engineers have informed us that the outage was due to a fiber cut in Los Angeles. Repair work has been completed and the circuit was restored.

Ticket No.:	864:62
Subject:	TransPAC2 TOKY-TransPAC2 LOSA Backbone Circuit Outage Resolved
Affected:	TransPAC2 TOKY-TransPAC2 LOSA Backbone Circuit Peer APAN
Start Time:	Friday, October 17, 2008, 3:12 PM (1512) UTC
End Time:	Saturday, October 18, 2008, 4:02 AM (0402) UTC
Description:	TransPAC2 TOKY-TransPAC2 LOSA Backbone Circuit was unavailable. KDDI Engineers reported that this outage was caused by a fiber cut between Los Angeles, CA and Hillsboro, Oregon. The fiber has been repaired and the service restored.

Ticket No.:	868:62
Subject:	TransPAC2 TOKY-TransPAC2 LOSA Backbone Circuit Outage Resolved
Affected:	TransPAC2 TOKY-TransPAC2 LOSA Backbone Circuit
Start Time:	Thursday, October 23, 2008, 6:19 PM (1819) UTC
End Time:	Thursday, October 23, 2008, 6:21 PM (1821) UTC
Description:	TransPAC2 TOKY-TransPAC2 LOSA Backbone Circuit was unavailable to the TransPAC2 Community. KDDI Engineers reported there was a fiber outage between San Francisco, CA and Oakland, CA. Service has been restored.

Scheduled Maintenances Summary

Ticket Number	Customer Impact	Network Impact	*Title*	Maintenance Type	*Start Time (UTC)*	*End Time (UTC)*
738	3-Elevated	2-High	TransPAC2 TOKY-TransPAC2 LOSA Circuit Maintenance Completed	Circuit	02/05/2008 1:22 PM	02/05/2008 1:50 PM
739	3-Elevated	2-High	TransPAC2 TOKY-TransPAC2 LOSA Circuit Maintenance Completed	Circuit	02/06/2008 8:52 AM	02/06/2008 8:53 AM
746	3-Elevated	2-High	TransPAC2 TOKY-TransPAC2 LOSA Circuit Maintenance Completed	Circuit	02/27/2008 11:11 AM	02/27/2008 11:31 AM
748	3-Elevated	1-Critical	TransPAC2 Core Node LOSA Maintenance Completed	Software	02/27/2008 11:11 AM	02/27/2008 11:31 AM
744	3-Elevated	2-High	TransPAC2 TOKY-TransPAC2 LOSA Circuit Maintenance Completed	Circuit	03/04/2008 6:17 PM	03/04/2008 9:01 PM
763	3-Elevated	2-High	TransPAC2 TOKY-TransPAC2 LOSA Circuit Maintenance Completed	Circuit	04/24/2008 9:05 PM	04/24/2008 10:26 PM
770	3-Elevated	2-High	TransPAC2 TOKY-TransPAC2 LOSA Circuit Maintenance Completed	Circuit	05/14/2008 9:01 PM	05/14/2008 9:33 PM
784	3-Elevated	2-High	TransPAC2 Core Node LOSA Maintenance Completed	Software	06/14/2008 1:13 PM	06/14/2008 1:14 PM
779	3-Elevated	2-High	TransPAC2 TOKY-TransPAC2 LOSA Circuit Maintenance Completed	Circuit	06/15/2008 7:39 AM	06/15/2008 12:00 PM
850	3-Elevated	2-High	TransPAC2 TOKY-TransPAC2 LOSA Circuit Maintenance Completed	Circuit	09/24/2008 10:02 PM	09/24/2008 10:41 PM
862	3-Elevated	2-High	TransPAC2 Core Node LOSA Maintenance Completed	Hardware	10/16/2008 12:07 PM	10/16/2008 12:37 PM
872	3-Elevated	2-High	TransPAC2 TOKY-TransPAC2 LOSA Backbone Circuit Maintenance Completed	Circuit	10/26/2008 9:50 AM	10/26/2008 9:55 AM

					10/26/2008 10:13 AM	10/26/2008 10:14 AM

Scheduled Maintenances Detail

Ticket No.:	738:62
Subject:	TransPAC2 TOKY-TransPAC2 LOSA Circuit Maintenance Completed
Affected:	TransPAC2 TOKY-TransPAC2 LOSA Circuit
Start Time:	Tuesday, February 5, 2008, 1:22 PM (1322) UTC
End Time:	Tuesday, February 5, 2008, 1:50 PM (1350) UTC
Description:	TransPAC2 TOKY-TransPAC2 LOSA was unavailable as KDDI America performed fiber relocation in Oakland, CA. Maintenance has been completed.

Ticket No.:	739:62
Subject:	TransPAC2 TOKY-TransPAC2 LOSA Circuit Maintenance Completed
Affected:	TransPAC2 TOKY-TransPAC2 LOSA Circuit
Start Time:	Wednesday, February 6, 2008, 8:52 AM (0852) UTC
End Time:	Wednesday, February 6, 2008, 8:53 AM (0853) UTC
Description:	TransPAC2 TOKY-TransPAC2 LOSA was unavailable as KDDI America performed fiber relocation in Oakland, CA. Maintenance has been completed.

Ticket No.:	746:62
Subject:	TransPAC2 TOKY-TransPAC2 LOSA Circuit Maintenance Completed
Affected:	TransPAC2 TOKY-TransPAC2 LOSA Circuit
Start Time:	Wednesday, February 27, 2008, 11:11 AM (1111) UTC
End Time:	Wednesday, February 27, 2008, 11:31 AM (1131) UTC
Description:	TransPAC2 TOKY-TransPAC2 LOSA was unavailable as KDDI America relocated backbone fiber in California. Maintenance has been completed.

Ticket No.:	748:62
Subject:	TransPAC2 Core Node LOSA Maintenance Completed
Affected:	Core Nodes HP 6410 and HP 3400
Start Time:	Wednesday, February 27, 2008, 11:11 AM (1111) UTC
End Time:	Wednesday, February 27, 2008, 11:31 AM (1131) UTC
Description:	During the above time frame, TransPAC2 Engineers performed maintenance on both switches in Los Angeles. Maintenance has been completed.

Ticket No.:	744:62
Subject:	TransPAC2 TOKY-TransPAC2 LOSA Circuit Maintenance Completed
Affected:	TransPAC2 TOKY-TransPAC2 LOSA Circuit
Start Time:	Tuesday, March 4, 2008, 6:17 PM (1817) UTC
End Time:	Tuesday, March 4, 2008, 9:01 PM (2101) UTC
Description:	TransPAC2 TOKY-TransPAC2 LOSA was unavailable as KDDI America replaced an amplifier between Los Angeles and Santa Clara. Maintenance has been completed.

Ticket No.:	763:62
Subject:	TransPAC2 TOKY-TransPAC2 LOSA Circuit Maintenance Completed
Affected:	TransPAC2 TOKY-TransPAC2 LOSA Circuit
Start Time:	Thursday, April 24, 2008, 9:05 PM (2105) UTC
End Time:	Thursday, April 24, 2008, 10:26 PM (2226) UTC
Description:	TransPAC2 TOKY-TransPAC2 LOSA Circuit was briefly unavailable as fiber provider KDDI moved it to an alternate path to prepare for an upcoming maintenance. Maintenance has been completed.

Ticket No.:	770:62
Subject:	TransPAC2 TOKY-TransPAC2 LOSA Circuit Maintenance Completed
Affected:	TransPAC2 TOKY-TransPAC2 LOSA Circuit
Start Time:	Wednesday, May 14, 2008, 9:01 PM (2101) UTC
End Time:	Wednesday, May 14, 2008, 9:33 PM (2133) UTC
Description:	TransPAC2 TOKY-TransPAC2 LOSA Circuit was briefly unavailable during the above time frame as fiber provider KDDI moved it back to its original path. Maintenance has been completed.

Ticket No.:	784:62
Subject:	TransPAC2 Core Node LOSA Maintenance Completed
Affected:	TransPAC2 Core Node in LOSA
Start Time:	Saturday, June 14, 2008, 1:13 PM (1313) UTC
End Time:	Saturday, June 14, 2008, 1:14 PM (1314) UTC
Description:	TransPAC2 Core Node underwent a code upgrade in Los Angeles, CA. Maintenance has been completed.

Ticket No.:	779:62
Subject:	TransPAC2 TOKY-TransPAC2 LOSA Circuit Maintenance Completed
Affected:	TransPAC2 TOKY-TransPAC2 LOSA Circuit
Start Time:	Sunday, June 15, 2008, 7:39 AM (0739) UTC
End Time:	Sunday, June 15, 2008, 12:00 PM (1200) UTC
Description:	TransPAC2 TOKY-TransPAC2 LOSA Circuit was unavailable while the fiber provider performed scheduled maintenance. Maintenance has been completed.

Ticket No.:	850:62
Subject:	TransPAC2 TOKY-TransPAC2 LOSA Circuit Maintenance Completed
Affected:	S050403100 TransPAC2 10G (LA-Tokyo)
Start Time:	Wednesday, September 24, 2008, 10:02 PM (2202) UTC
End Time:	Wednesday, September 24, 2008, 10:41 PM (2241) UTC
Description:	Circuit Provider KDDI America performed circuit maintenance during the above time frame. Maintenance has been completed.

Ticket No.:	862:62
Subject:	TransPAC2 Core Node LOSA Maintenance Completed
Affected:	TransPAC2 TOKY-TransPAC2 LOSA
Start Time:	Thursday, October 16, 2008, 12:07 PM (1207) UTC
End Time:	Thursday, October 16, 2008, 12:37 PM (1237) UTC
Description:	TransPAC2 Engineers worked with APAN Engineers to perform a software maintenance on the TransPAC2 core nodes in Los Angeles and Tokyo. During this time, the TransPAC2 TOKY-TransPAC2 LOSA backbone circuit was unavailable. Maintenance has been completed.

Ticket No.:	872:62
Subject:	TransPAC2 TOKY-TransPAC2 LOSA Backbone Circuit Maintenance Completed
Affected:	TransPAC2 TOKY-TransPAC2 LOSA Backbone Circuit Peer APAN
Start Time:	Sunday, October 26, 2008, 9:50 AM (0950) UTC
End Time:	Sunday, October 26, 2008, 9:55 AM (0955) UTC
Start Time:	Sunday, October 26, 2008, 10:13 AM (1013) UTC
End Time:	Sunday, October 26, 2008, 10:14 AM (1014) UTC
Description:	TransPAC2 TOKY-TransPAC2 LOSA Backbone Circuit was briefly unavailable to the TransPAC2 Community. KDDI Engineers identified the outage was due to circuit maintenance being performed. Maintenance has been completed.

Plans for Project Year 5 (1-January-2009 thru 31-December-2009)

Engineering

- Continue to work with APAN and Internet2 to improve the functionality of the TransPAC DCN capability. John Hicks will complete the IDC implementation which will allow the TransPAC HP switch to participate dynamically in DCN, but the Juniper routers are not currently able to be dynamically configured. We'll work with Internet2 to explore adding (and if feasible, test) that capability, as well as other functions as they become available.
- Continue to seek input from others—NANOG is a key venue, following on RENOG, which has been done with positive results—on the BGP path-hinting proposal.
- Complete the ARIN processing and technical documentation (including creation of a draft RFC, if advisable) of the BGP path-hinting protocols and work with R&E and other relevant networks toward its implementation. SC09 should be a key demonstration of its usefulness.
- Continue to improve our peer networks' ability to control their interaction with TransPAC routing policy dynamically, generally through BGP communities.
- Continue to improve transparency of the TransPAC network configuration and policy.
- Continue to evaluate and improve public-facing and internal TransPAC technical documentation.
- Continue to monitor and improve where needed core network security.
- Continue to implement and document network best practices.

Measurement

- Continue to work with perfSONAR and APAN developers to develop new applications and deploy resources using perfSONAR.
- Develop additional measurement point (MP) and measurement archive (MA) perfSONAR services.
- Develop integrated NOC tools using the perfSONAR API.
- Try to incorporate perfSONAR into OSG GOC and other grid monitoring services.
- Continue work on perfSONAR installation documentation focused on the AP region.
- Investigate IPv6 monitoring and measurement tools.
- Investigate monitoring and measurement tools outside the perfSONAR framework.

Security

- Work with the REN-ISAC on TransPAC2 security issues.
- Work with US security WGs to disseminate information.
- Work with APAN security WG to disseminate information.

Applications

- Continue to work with the APAN Medical WG to help bring together US and Asian doctors and medical researchers for meetings and demonstrations.

- Work to develop US-Pakistan R/E collaborations
- Organize a US-Pakistan R/E Workshop in conjunction with the planned US S/T meeting in Islamabad, if possible.
- Investigate funding a US-South East Asia (Vietnam, Laos, and Cambodia) R/E Workshop in Vietnam in 2010.

Pakistan

As outlined above, continue to work to develop US-Pakistan R/E collaborations and a Workshop.

With the assistance of APAN, publish clear usage statistics regarding the US-Pakistan network connection.

Investigate the interest in perfSONAR or other measurement tools by PERN in Pakistan. Assist in deployment if useful.

GENI

Work closely with the IU GENI project to clearly understand and communicate GENI activities and progress to APAN colleagues

Act as a focal point for GENI South East and South Asia interactions, particularly with respect to federation interconnection and operation.

TransPAC2 NOC

Complete work on a comprehensive revision of all existing TransPAC2 NOC process & procedure documentation, with improvements in user accessibility and interface.

Within the new documentation environment, incorporate revised and new NOC training documentation so that the end result is a dynamic and integrated environment, aimed at improved worker efficiency and performance.

Complete work on a new, comprehensive Change Management process for all GRNOC supported networks, including TransPAC2.

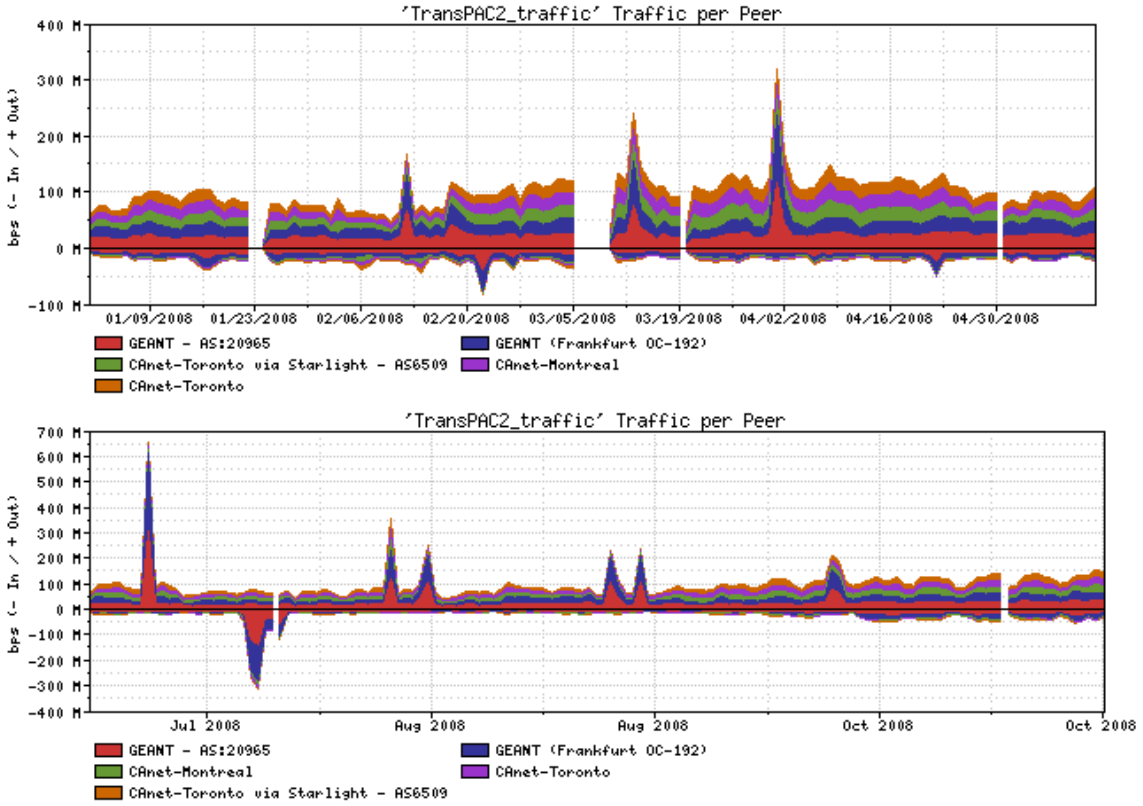
Complete work on a new version of our network customer notification tool. The tool will have increased functionality, including the ability to send targeted notifications directly to affected customers

Additional TransPAC2 Traffic Graphs

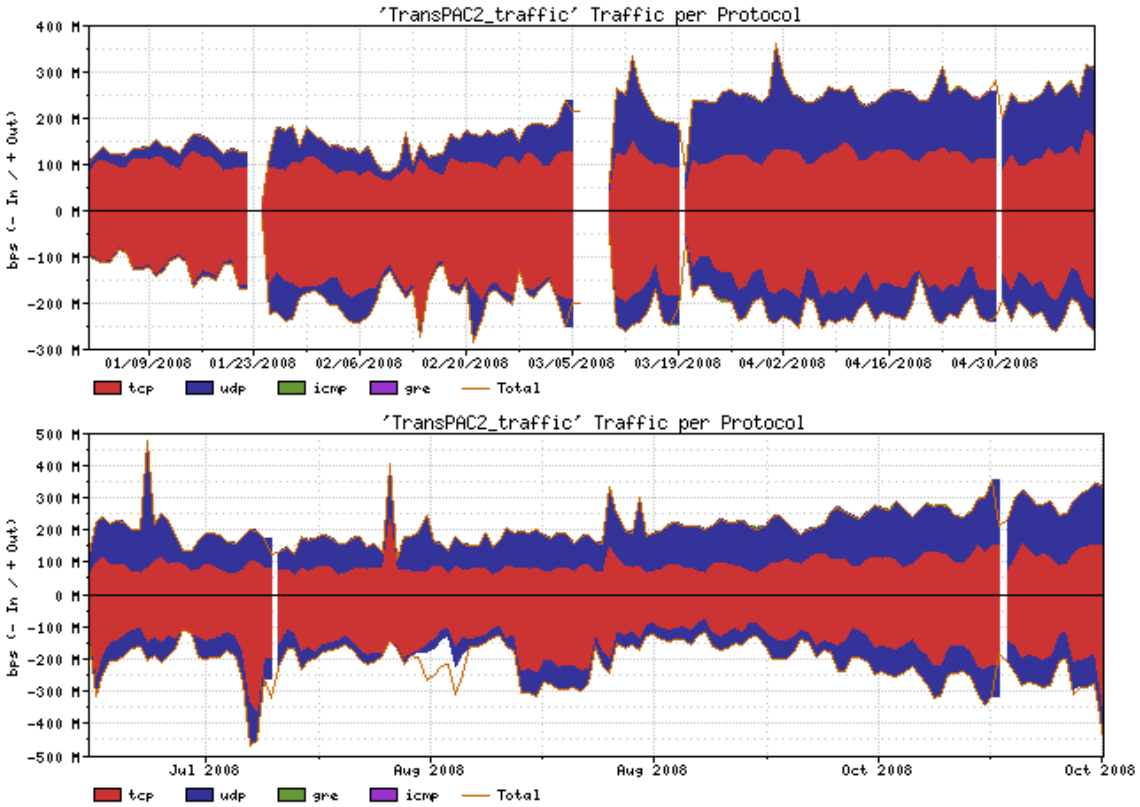
Annual usage graphs

The following graphs represent a simple breakdown of traffic behavior on the TransPAC2 network from the end of the fourth quarter of 2007 though the fourth quarter 2008. There are two graphs per section from January 2008 through middle May 2008 and then from middle June through November 2008. There were issues in reporting arbor data between middle May through middle June 2008 so that section was deleted for readability. The traffic during that time period exhibited behavior typical of other months and is available upon request. The reporting issue is an artifact of the Arbor system and has been addressed for future reports.

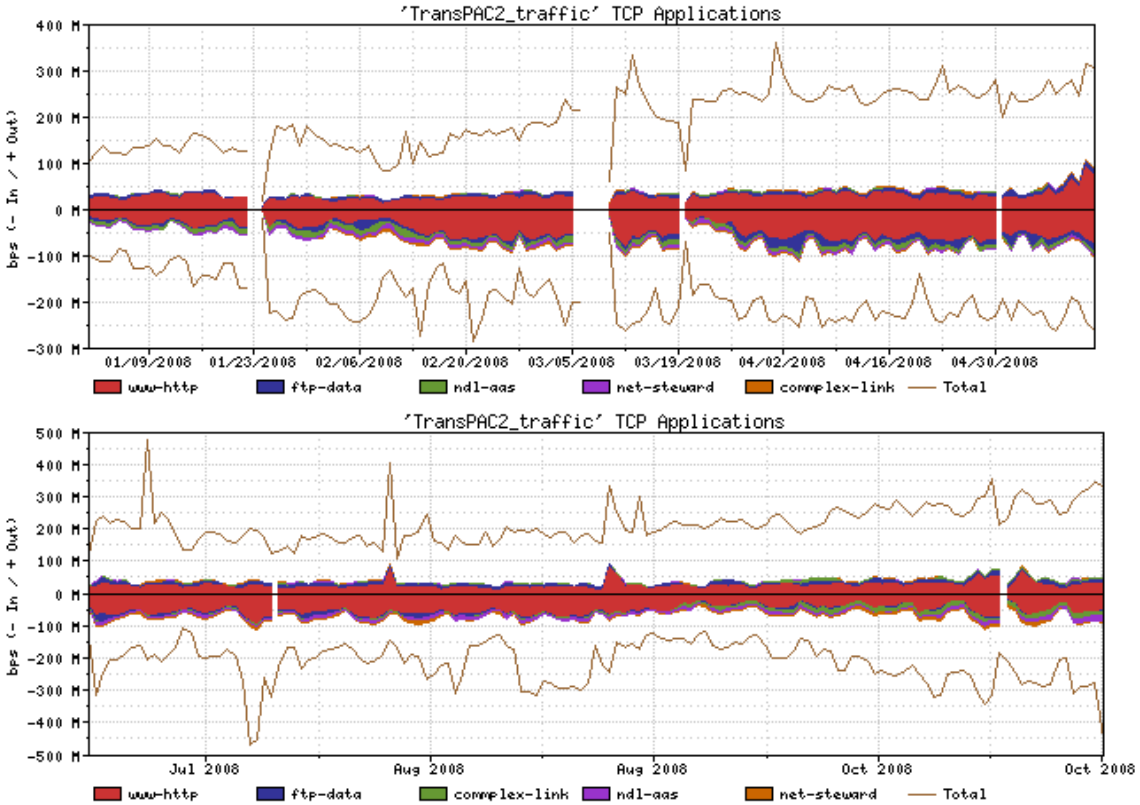
The figure below represents an arbitrary list of peer contributions to the traffic load on the TransPAC2 network.



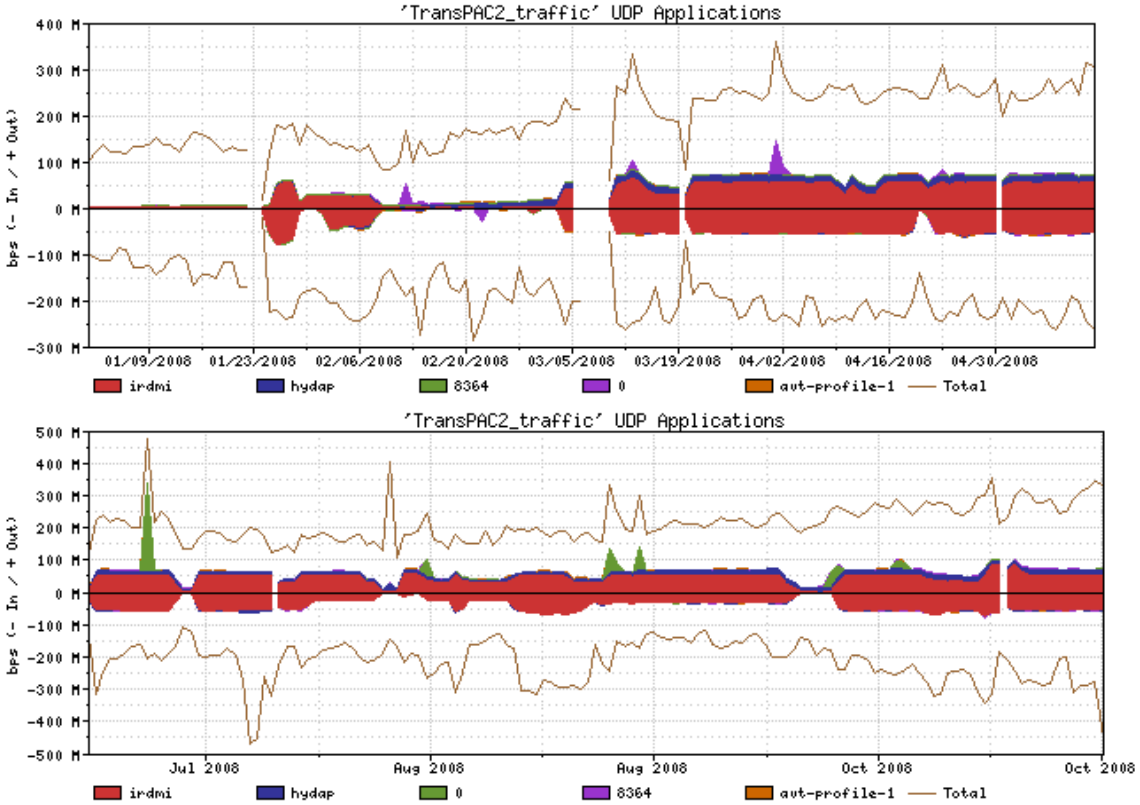
The figure below represents a simple breakdown of traffic by IP protocol.



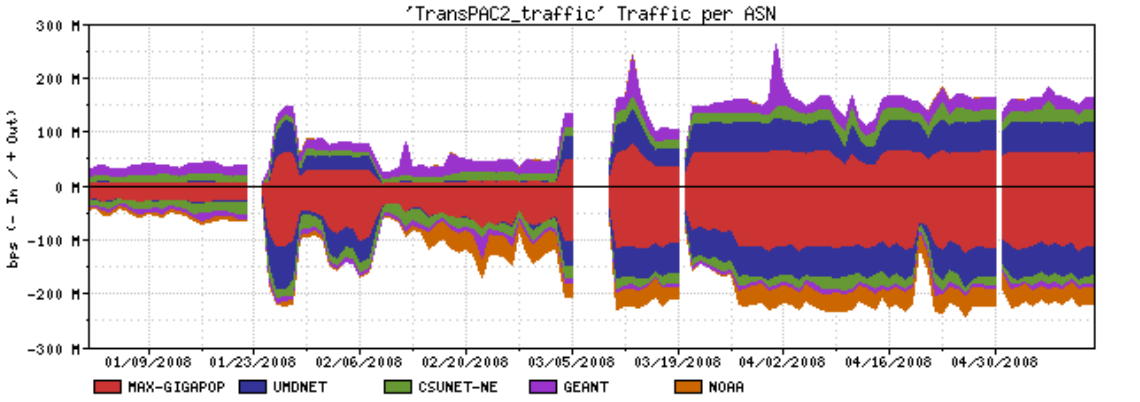
The figure below represents an arbitrary list of TCP application contributions to the traffic load on the TransPAC2 network.

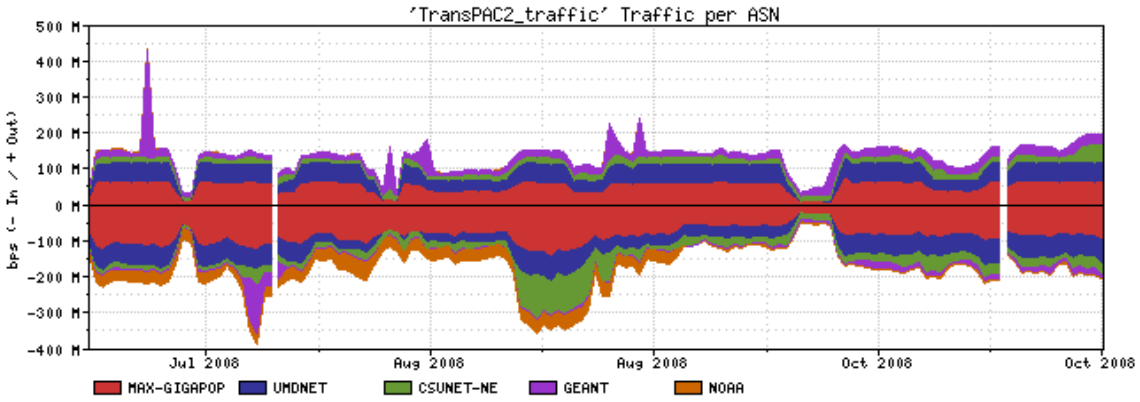


The figure below represents an arbitrary list of UDP application contributions to the traffic load on the TransPAC2 network.



The figure below represents the number of routes during the reporting period




'TransPAC2_traffic' Traffic per ASN
bps (- In / + Out)
500 M
400 M
300 M
200 M
100 M
0 M
-100 M
-200 M
-300 M
-400 M
Jul 2008
Aug 2008
Aug 2008
Oct 2008
Oct 2008
MAX-GIGAPOP
UMDNET
CSUNET-NE
GEANT
NOAA