

# **America Connects to Asia (TP3) (SCI - 0962968) Annual Report 1-June-2010 thru 28-February-2011**

**James G. Williams – Principal Investigator**

## ***Summary***

Speaking most generally, the TransPAC3 (TP3) project has had a successful launch. We have tendered for a new TP3 circuit. We have installed new equipment in Los Angeles. We have continued and enhanced the relationships we have with our colleagues in Asia in collaborations established during TransPAC2. We have established new collaborations based around OpenFlow and Telepresence. In cooperation with the NSF Office of International Science and Engineering, we developed and executed a US-India Network enabled Research Collaboration Workshop. More specifically:

The TP3 project is operating within budget. See the Budget Summary section.

There was a formal announcement at Indiana University of the TP3 and ACE NSF awards. See: <http://internationalnetworking.indiana.edu/publications>

Williams spent time (considerable time) developing the US-India Network Enabled Research Collaboration Workshop. See: <http://usindiaworkshop.indiana.edu/>

Indiana University hosted the IRNC Program Kickoff in Washington, DC. See: <http://irncworkshop.indiana.edu/>

Williams participated in the US-India Joint Committee Meeting on Science and Technology Cooperation in Washington, DC. See: <http://www.whitehouse.gov/blog/2010/06/25/us-india-hold-joint-commission-meeting-science-and-technology-cooperation>

Williams and Sweeny attended the Vietnam APAN meeting. Sweeny discussed ideas for TransPAC3 deployment there with APAN engineers. See: <http://apan.net/meetings/Hanoi2010/schedule.php>

International Networking at Indiana University has a new web site. See: <http://internationalnetworking.indiana.edu/>

Williams, Hicks, and Sweeny attended the Hong Kong APAN31 meeting in February, and presented updates on TransPAC3 implementation details. Sweeny discussed details of TransPAC3 deployment there with APAN engineers, as well as JGN migration. See: <http://apan.net/meetings/HongKong2011/>

Williams and Sweeny met at APAN-HK with CERNET (Chinese R&E network) administrators and engineers to discuss their plans for bringing a 10GE circuit to the US. This is very important for the US R&E community.

Sweeny and Hicks met with JGN engineers at APAN-HK to discuss details of migrating their 10GE service to a new provider and location in Los Angeles. This must be done in a coordinated effort.

We have been working in earnest on implementation of the TransPAC3 network: circuit has been ordered; router upgrade has been ordered and received, circuit implementation details and schedule coordinated with the provider, all to be installed in March.

Sweeny attended and presented at the Internet2/ESnet Joint Techs conference in Clemson, SC in late January.

Williams attended the Chinese American Networking Symposium at Georgetown University in Washington, DC. See: <http://uis.georgetown.edu/cans2010/index.html>

Williams presented a talk about "International Networking at Indiana University" as a part of the Data 2 Information seminar series at Indiana University.

See: <http://internationalnetworking.indiana.edu/publications>

Williams attended the GENI Engineering Conference 9 in Washington, DC.

Williams attended the Internet2 meeting in Atlanta and presented an ACE/TP3 update at the ACE/TP3 side meeting.

Sweeny supported SC10 (supercomputing international conference) networking planning, implementation, and deployment throughout 2010, including several APAN-area projects. .

Sweeny met with Jason Borduchenko of AARnet to discuss in more detail AARnet's plans for establishing a continental TelePresence exchange like the one we have established in the US. Sweeny attended the Internet2 member meeting in Atlanta in early November.

## ***Milestones and accomplishments***

Williams spent time (considerable time) developing the US-India Network Enabled Research Collaboration Workshop. This is an NSF-OISE funded activity which will bring together US and Indian network engineers/administrators and domain scientists to discuss the value and requirements of high-performance networking in their research disciplines. See: <http://usindiaworkshop.indiana.edu/>

Indiana University hosted the IRNC Program Kickoff in Washington, DC. All IRNC PIs attended and presented summaries of their planned activities. See: <http://irncworkshop.indiana.edu/>

Williams participated in the US-India Joint Committee Meeting on Science and Technology Cooperation in Washington, DC. This meeting, a part of the regular US-India S/T dialogue, was particularly helpful in developing relationships for the upcoming US-Indian Workshop. See: <http://www.whitehouse.gov/blog/2010/06/25/us-india-hold-joint-commission-meeting-science-and-technology-cooperation>

There was a formal announcement at Indiana University of the TP3 and ACE NSF awards. See: <http://internationalnetworking.indiana.edu/publications>

Williams and Sweeny attended the Vietnam APAN meeting. Williams lead the Future Internet Testbed Working Group activities (See the IRNC GENI related section of this QR). Sweeny presented on the ACE and TP3 projects and discussed details for TransPAC3 deployment there with APAN engineers.  
See: <http://apan.net/meetings/Hanoi2010/schedule.php>

International Networking at Indiana University (IN@IU) has a new web site. This will be a permanent home for international activities and projects at Indiana University.  
See: <http://internationalnetworking.indiana.edu/>

Williams held a number of discussions with Eric Boyd of Internet2 regarding the Internet2 IRNC projects DyNES and IRIS and the MRI-R2 project DYNES. It seems that these projects will be important in both ACE and TP3 future operation. See the IN@IU web site for more details.

Hicks attended the SC10 measurement install fest in Ann Arbor and met with Internet2 staff to discussed DyGIR and IRIS.

TransPAC3 circuit-provider selection completed at a good price.

TransPAC3 routing equipment solicitation issued, proposals received, decision made. Vendor selection was completed in the first few days of December for delivery early in the year, coincident with the new circuit.

US-India Network Enabled Research Collaboration Workshop was held in December in New Delhi, India. There were approximately 150 attendees (130 from India and 20 from the US). In the opinions for the organizers, the workshop was a success and met its objectives. There were active discussions and questions during the sessions. There was widespread discussion in hallways and during/after lunches and dinners. US and India participants had ample opportunity to interact with each other socially and professionally. The fact that many participants expressed

interest in the planned follow-up meetings (APAN in August 2011 and Washington in March 2012) indicates their level of involvement in the workshop and their enthusiasm for continuing that involvement. A workshop report is being prepared.

Williams, Hicks, and Sweeny attended the Hong Kong APAN31 meeting in February, and presented updates on TransPAC3 implementation details. Sweeny discussed details of TransPAC3 deployment there with APAN engineers, as well as JGN migration.

See: <http://apan.net/meetings/HongKong2011/>

TransPAC3 circuit-provider contract negotiations completed.

TransPAC3 router upgrade selection completed, new router received—to be installed in March.

Discussions with CERNET about our support for a new 10GE R&E circuit from Beijing to Los Angeles were conducted before, during, and after the APAN meeting in Hong Kong. This is a very significant development for the US R&E community.

Discussions with JGN about migration of their circuit to a new provider in Los Angeles. Because of the close operational partnership between JGN/NICT and TransPAC3, this change must be coordinated on both sides to ensure that service is not interrupted because of JGN's circuit move or TransPAC3's at around the same time in March-April. Further complicating the JGN move is the fact—properly discussed in more detail in the March-May report—that the JGN Tokyo-US circuit was made inoperable by the March 2011 Japanese earthquake, so it is even more important to help them effect their migration in a timely way.

## **Operations Events and Activities**

An RFP for circuit services was prepared and sent to vendors. RFP responses were evaluated and a selection made.

TransPAC3 routing equipment solicitation issued, proposals received, decision made

### **September 2010**

The GlobalNOC completed a new GlobalNOC Change Management System. The system is a series of updated procedures and guidelines, along with a new web-form tool developed and incorporated into the GlobalNOC's ticketing system. Upon final approval of this system, network engineers may now quickly submit a change request adhering to pre-defined guidelines and scheduling timeframes. The new process ensures smooth and prepared changes and allows for proper notification, pre-planning, and approval of any network changes.

### **October 2010**

GlobalNOC began to assist the R&E community with reservations for use of the Tata Exchange for TelePresence conferences.

The new GlobalNOC Services and Support Team dedicated a project manager to the upgrade of TP3 and deployment of the ACE network. Project management methodologies will be used to schedule and track project tasks and resources.

On October 31, Steve Peck attended the International Update Sessions at the Fall Internet2 Members Meeting in Atlanta, GA.

## **November 2010**

Steve Peck attended the ACE/TP3 update side meeting presented by Jim Williams at the Fall Internet2 Members Meeting.

After the ACE/TP3 update meeting, representatives of APAN, DANTE, and the GlobalNOC mutually recognized the need for a collaborative workshop to share operational procedures, discuss international networking, and form a closer working relationship between the three organizations.

The GlobalNOC began beta support for the U.S. governmental agency National Oceanic and Atmospheric Administration (NOAA). Support includes GlobalNOC engineering, Service Desk functions, and systems engineering support for their new research network, N-Wave. N-Wave will initially be used to support their R&D HPCS program, connecting 17 NOAA sites to the network.

TransPAC3 circuit-provider selection completed at a good price. Working with Indiana University Purchasing Department, contract negotiations with the circuit provider were completed early in this reporting period. The new circuit is scheduled to be delivered for testing in late March 2011, for full production implementation 1 April.

As an addendum to the 10GE circuit negotiations, provision was made for a 10Mbps Ethernet out-of-band service to our management equipment, to replace an ISDN out-of-band service.

TransPAC3 router upgrade selection was completed on good terms. The router was ordered for delivery in early 2011 (received by mid-February) and installation was scheduled for March.

Extensive discussions with JGN, including at the Hong Kong APAN meeting, on coordinating migration of their circuit to a new location (and provider) in Los Angeles. This became even more important after the March 2011 Japanese tsunami destroyed much Japanese infrastructure and took out the JGN2+ circuit to Los Angeles. Their new circuit, from a provider unaffected by the earthquake and tsunami, is scheduled to come up before the end of March.

## **December, 2010**

Preliminary discussions began on the development of a network procedure workflow tool. It would be used to help guide Service Desk technicians through various processes & procedures, identifying subtle differences between support procedures for various networks. It also would serve as a training tool.

## **January, 2011**

Preparations are being made for the new office of the GlobalNOC Service Desk in the Cyber Infrastructure Building (CIB) being built in Bloomington. The current Bloomington Service Desk office does offer redundant support services in the event of an emergency or weather event. When the Bloomington Service Desk moves to the new office, it will feature additional phone and

persistent video communications to aid in the coordination of day to day operations between offices as well as supporting the business continuity functions.

## **February, 2011**

The city of Indianapolis was paralyzed by an ice storm from January 31st to February 3rd. The GlobalNOC continued to be operational in spite of severe transportation issues. GlobalNOC management considered this an excellent test of current business continuity planning. Staff worked on site and remotely to provide continuous service to all networks during this period. <http://www.indy.gov/icestorm/Pages/Home.aspx>

Steve Peck gave a presentation on GlobalNOC operations to the TERENA 2nd TF-NOC Meeting in Ljubljana, Slovenia using video conferencing. <http://www.terena.org/activities/tf-noc/meeting2/>

Testing has been completed on the Targeted Notification Tool that should increase the effectiveness of GlobalNOC notifications while decreasing the overall volume of messages. The tool is expected to go into production in early March.

## ***Network Engineering***

The most significant engineering accomplishment during this period was completion of the TransPAC3 circuit Request for Proposals, receiving and evaluating the responses, and making a decision on an awardee. A great deal of discussions on implementation and contractual details continued with the vendor aimed at implementation of the new native 10GE service replacing the OC192 service in the first calendar quarter of 2011.

Additionally, negotiations were completed with the same provider for an improved out-of-band function, and with Juniper for an upgraded core router at good terms.

Sweeny held discussions with APAN engineers during the preparation of the TransPAC3 RFP, throughout the year, and at the APAN meetings in Hanoi and Hong Kong, regarding desired new functions and engineering enhancements that might be incorporated into an enhanced TransPAC3. Chief among those enhancements was to convert the current SONET circuit into a native Ethernet one in order to be able to offer a greater range of dynamic circuit options. We also discussed changing the routing technology in a way that would allow a more powerful native combination of layer2 and layer3 technologies in the same platform, and which will provide for IPv6 netflow data collection. We have been pleased to be able to accomplish this goal, upgrading the TransPAC2 Juniper T320 router to a Juniper MX480 for Transpac3.

The new TransPAC3 MX480 core router was delivered in February and will be installed in Los Angeles in late March, replacing the Juniper T320 which has served as the TransPAC2 router for several years. The old router has some critical components which are no longer supported by Juniper, and does not support layer2 functions natively; the MX480 will bring enhanced functionality, particularly in combined layer2/layer3 abilities including some support for truly dynamic circuit provisioning through the wide-area circuit connecting the US with the APAN region, as well as enhanced netflow collection (including line-rate ipv6), lower power consumption, and supportable hardware and software and capacity for growth. This new router should last us

well for the duration of the TransPAC3 project. The new router supports both SONET (WAN-PHY) and Ethernet (LAN-PHY) OC192/10GE interfaces and has an upgrade path for higher-speed circuits.

The router was powered up, tested, and configured at the Indiana GRNOC before shipping to Los Angeles. The change from the old to the new router will of necessity be a hotcut and require several hours of downtime while the old router is deinstalled and the new router installed in its place, but this testing, burn-in, and preconfiguration will remove some uncertainty and shorten the downtime.

We're excited about the possibilities made possible by this new router. In the previous TransPAC3 quarterly report, we expressed hope that APAN would be able to acquire a similarly-multifunctioned router for their end of the TransPAC3 circuit, and we're pleased to report that they were able to leverage our purchase of the MX480 to also purchase an MX for their end of the circuit, enabling us to leverage the ION/OSCARS work on pushing dynamic circuits through MX routers to greater dynamic control through TransPAC3.

At the Hanoi APAN meeting, Sweeny delivered a presentation on the ACE and TransPAC3 networks and moderated a network engineering session on behalf of Jim Williams. See <http://www.jp.apan.net/meetings/1008-Hanoi/>

On August 28, Sweeny delivered an update to the Indiana Statewide IT conference in Bloomington. See <http://www.statewideit.iu.edu/program/sessions/details.php?sessionID=10>

Additionally, a great deal of discussion and investigation has occurred in support of a high-performance network demonstration between Cal Tech and the University of Mumbai in India in relation to the NSF-sponsored India workshop in December.

For SC10's high-performance computing and networking conference, we worked throughout the year on discussions on network requirements and preparations for fulfilling them among our user community and in conjunction with Internet2 and NLR. APAN members made substantial use of the TransPAC2 network for SC10. Considerable work went into deployment of switched and routed paths to the SC10 show floor in support of experiments and demonstrations of high-performance computing, network, and applications. Members of the APAN community are very active in this show, and represented themselves well. TransPAC2 provided a key path for them to reach the supercomputing conference network, including its current dynamic-network opportunities over high-performance networks.

Sweeny was again a member of the routing core team of SCinet, assembling and operating the network for the conference.

Cisco Telepresence for R&E continues to grow, both domestically and internationally, under our leadership. 100 systems are now connected to the R&E exchange, and after lengthy talks with Tata Communications, a functional connection to them becomes operational, providing university users access to a large group of commercial-customer international telepresence rooms, "public" for-pay rooms around the world, and other exchanges including Cisco, and through Tata to other commercial exchanges beginning with BT, Telefonica, and Telstra. We continue to consult with and advise AARnet engineers on creation of a similar R&E Telepresence exchange in the Asia-Pacific region, with Cisco about creation of a similar exchange in Europe, and with many users who want to connect.

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We continue to support the PERN connection through TEIN and APAN to the North American R&E community. All is working there as expected.

TransPAC3 coordinated with NLR peering changes in Seattle and Los Angeles due to NLR network migration in December.

## **IRNC related GENI activities**

As a part of his continuing involvement with APAN, Williams is co-chair of the Future Internet Testbed Working Group within APAN. In this role, he participated in the development of the FIT-WG program for the APAN meeting in Vietnam and Hong Kong.

See: <http://apan.net/meetings/Hanoi2010/Session/FutureInternet.php>

See: <http://apan.net/meetings/HongKong2011/>

The APAN FIT-WG closely tracks activities related to GENI (such as OpenFlow) and how to more closely link APAN and US-based future Internet activities.

Williams attended the GEC 9 meeting in Washington, DC and discussed possible GENI participation in the upcoming US-India Workshop and the APAN meeting which will be held in Hong Kong.

As OpenFlow becomes more established and adopted by more vendors and networking organizations, the insights and relationships developed as a part of the IRNC GENI activities will be of great value. We plan to leverage the leadership role the GRNOC is now playing in OpenFlow testing, coordination, and development.

## **Measurement Activities**

TransPAC3 staff attended the DICE meeting in Ottawa. The principals met as well as technical representatives to discuss compatibility issues between perfSONAR PS and MDM as well as dynamic circuit compatibility between Asia, the US and Europe. The DICE perfSONAR WG goals include; defining what and how to deploy resources, what data to make available, integration, support and scalability. We will support these goals by working in concert with the DICE community and contributing to policy documents concerning perfSONAR and dynamic circuit software integration.

Hicks attended the NSF/Internet2 sponsored perfSONAR workshop in Arlington VA and discussed DyGIR and IRIS with Internet2.

Hicks attended the SC10 measurement install fest in Ann Arbor and discussed DyGIR and IRIS with Internet2.

Hicks is a member of the SCinet measurement team, providing network monitoring and measurement support to the annual supercomputing conference. This year the SC10 event provided exposure to the challenges of 100 Gbps.

Hicks attended APAN 31 and gave a talk concerning ACE & TP3 updates, perfSONAR and dynamic circuit implementation issues. See: <http://apan.net/meetings/HongKong2011/>

TP3 engineers will travel to Los Angeles, CA to upgrade to TP3 router and measurement equipment in late March. Considerable time has been spent preparing for the upgrade.

TransPAC3 provides the following NOC supported monitoring services.

- Manage the measurement machines, tools, data archives
- Weather-map service
- Nagios monitoring status service
- perfSONAR Lookup service (gLS)
- perfSONAR SNMP MA
- perfSONAR BOUY
- BWCTL
- OWAMP
- Packet loss and reordering
- Network flow data collection and analysis.
- Router state information collected (Junos script).
- All TransPAC3 data is published via perfSONAR (where appropriate)

Hicks talked to DANTE concerning TEIN2/3 connectivity and monitoring issues

Hicks worked with APAN & DANTE engineers to establish a three continent dynamic layer 2 connection, with monitoring, for large data flows. This work involves finding resources, compatibility issues between different implementations of dynamic circuits (G-lambda, Autobahn, ...), and minor issues between implementations of perfSONAR - PS-SP (perl) and PS-MDM (java). There will be further discussions concerning OSCARS & perfSONAR implementations at the upcoming DICE meeting in March.

## ***Security events and activities***

TransPAC3 will continue to use the security capabilities of the Arbor Peakflow SP System to monitor and mitigate DDOS and other security concerns detected by the system. The SP system implementation is made possible through support from Internet2, REN-ISAC, and Indiana University.

There were no significant security events associated with TransPAC3 during this reporting period.

- Investigated all security incidents on the TransPAC3 network. No major incidents to report this reporting period.
- Continued work with the REN-ISAC and Arbor Networks to provide PeakflowSP updates (topology changes).
- Attended APAN meeting security sessions.

TransPAC3 continues to work in concert with the REN-ISAC to investigate security issues.

## TransPAC3 Business Activity, Annual 01/01/11 through 02/28/11

Note – TP3, as a network was only in operation from 1/1/11 – 2/28/11 in the period covered by this report.

### TROUBLE TICKET ACTIVITY

*This report contains data from 6 Tickets.*

Count of Ticket-Type	
Problem/Request	2
Scheduled Maintenance	2
Unscheduled Outage	2

## TransPAC3 Network Availability Statistics and Analysis 01-Jan 2011 through 28-Feb-2011

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TransPAC3 Core Nodes	Down Time	Reporting Period Availability	52 Week Availability
TransPAC3 T320 - LA	0 hr 0 min	100.00000%	99.98748%
6410 Ethernet Switch	0 hr 0 min	100.00000%	99.95921%
3410 Ethernet Switch	0 hr 0 min	100.00000%	100.00000%
OOB Router	0 hr 0 min	100.00000%	100.00000%
<b>Aggregate TransPAC3 Core Nodes</b>	<b>0 hr 0 min</b>	<b>100.00000%</b>	<b>99.98667%</b>
TransPAC3 Backbone Circuits	Down Time	Reporting Period Availability	52 Week Availability
TransPAC3 LOSA-JGN2 LOSA 10GigE	0 hr 0 min	100.00000%	99.99829%
TransPAC3 LOSA-Pacific Wave LOSA 10GigE	0 hr 0 min	100.00000%	100.00000%
TransPAC3 TOKY-TransPAC3 LOSA	0 hr 31 min	99.96351%	99.54652%
<b>Aggregate All TransPAC3 Backbone Circuits</b>	<b>0 hr 31 min</b>	<b>99.98784%</b>	<b>99.84827%</b>

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## Unscheduled Outages Summary

<i>Ticket Number</i>	<i>Customer Impact</i>	<i>Network Impact</i>	<i>Title</i>	<i>Outage Type</i>	<i>Start Time (UTC)</i>	<i>End Time (UTC)</i>
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None during this report period

## Scheduled Maintenances Summary

<i>Ticket Number</i>	<i>Customer Impact</i>	<i>Network Impact</i>	<i>Title</i>	<i>Maintenance Type</i>	<i>Start Time (UTC)</i>	<i>End Time (UTC)</i>
<a href="#">1142</a>	3-Elevated	2-High	TransPAC3 TOKY-TransPAC3 LOSA Backbone Circuit Maintenance Completed	Circuit	01/08/2011 4:08 PM	01/08/2011 4:39 PM

## Scheduled Maintenances Detail

Ticket No.: 1142:62  
Subject: TransPAC3 TOKY-TransPAC3 LOSA Backbone Circuit Maintenance Completed  
Affected: TransPAC3 TOKY-TransPAC3 LOSA Backbone Circuit  
Start Time: Saturday, January 8, 2011, 4:08 PM (1608) UTC  
End Time: Saturday, January 8, 2011, 4:39 PM (1639) UTC  
Description: TransPAC3 TOKY-TransPAC3 LOSA Backbone Circuit was unavailable while KDDI engineers performed maintenance to replace a bad pump module. This maintenance is complete.

## Usage summary and performance

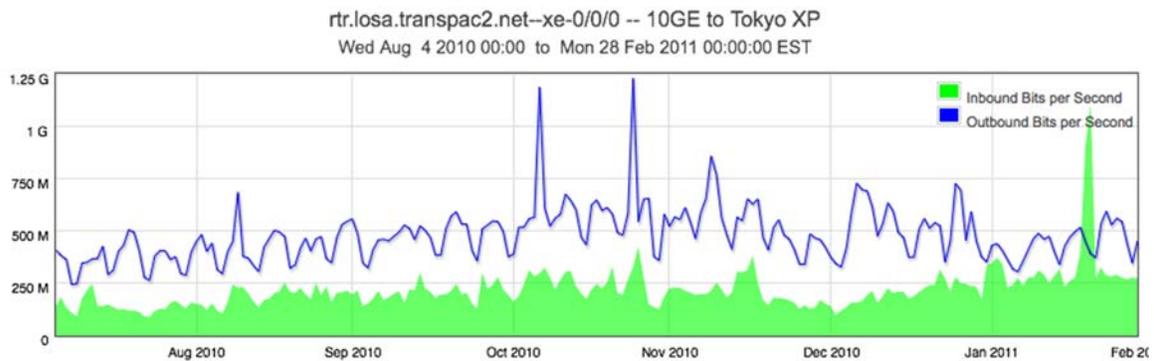
Note – TP3, as a network was only in operation from 1/1/11 – 2/28/11 in the period covered by this report.

## Usage Graphs

The following graphs represent a simple breakdown of traffic behaviors on the TransPAC3 network during the reporting period.

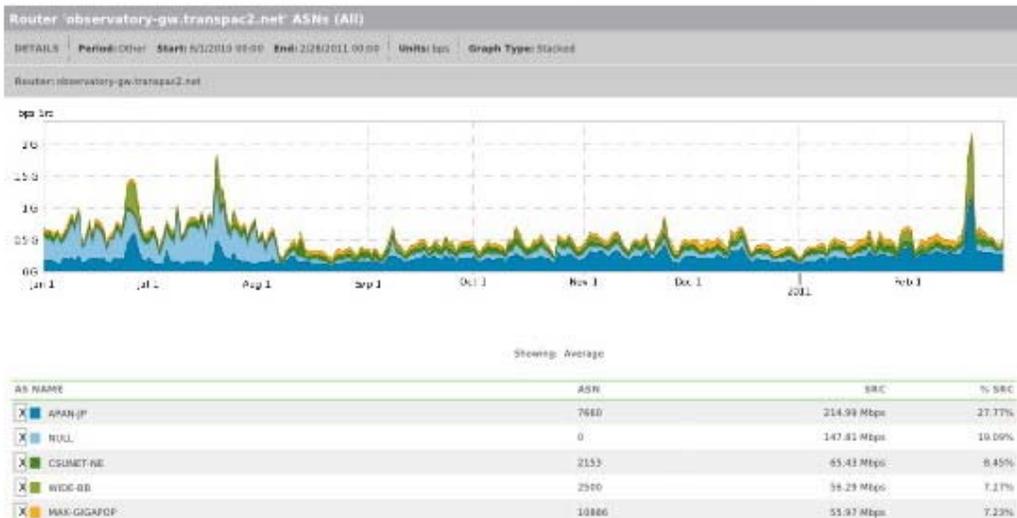
The following graphs represent a simple breakdown of traffic behaviors on the TransPAC3 network during the reporting period.

The following graph represents the aggregated traffic on the TransPAC3 network

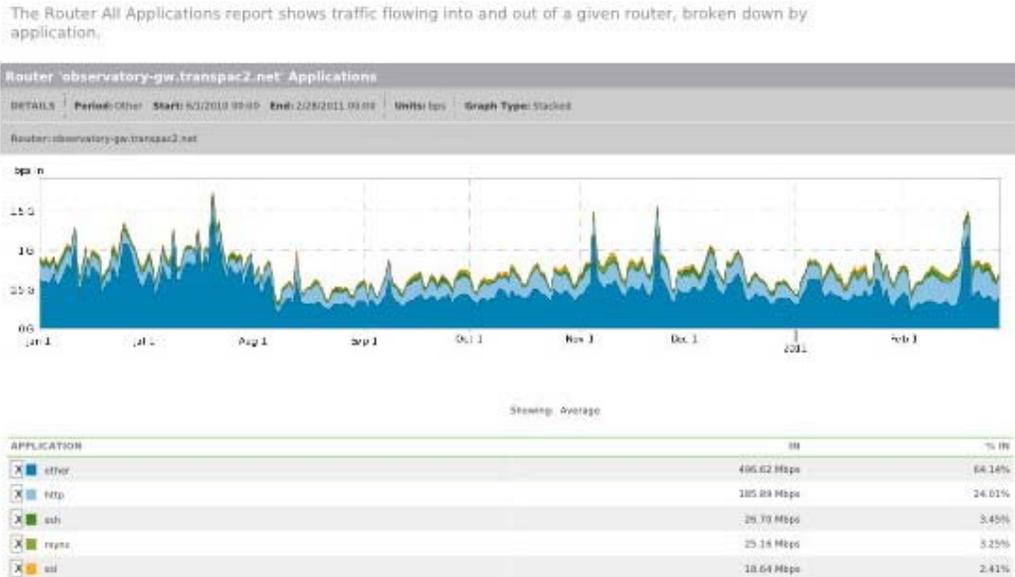


The following graph represents the distribution of traffic for the top 5 ASNs during the reporting period.

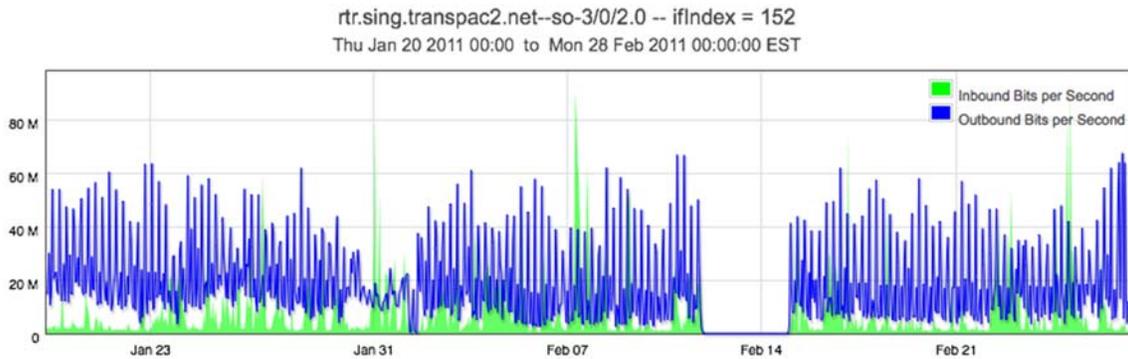
The Router ASN All report shows in and out traffic data for a selected router broken down by origin (source or destination) AS, transit AS, or aggregate AS (origin + transit) for both Origin and Peer ASNs.



The following graph represents the contribution of the top 5 applications based on traffic load during the reporting period.



The following graphs represent information collected from the Singapore (SG) TEIN2 router concerning the SG <-> Pakistan link. Thanks to the kind assistance of our TEIN2 partners a dedicated monitoring page for SG-PK STM-1 link is now in place:



We have only been getting data consistently since January. The sudden drop of SG-PK traffic in middle February is due to a glitch with the SNAPP software upgrade. These and other issues have now been fixed.

## **Financial Reporting Details**

See accompanying spreadsheet.

## **Summary of Activity 1-June-2010 thru 28-February-2011**

1. TP3 Routing equipment received and configured
2. New circuit installed and operational
3. New routing equipment installed and operational
4. Participate in multiple professional meetings
5. Developed and executed US-India workshop

## **Plans for 1-March-2011 thru 28-February-2012**

1. Continue professional engagement in all forums (APAN, SC, ...)
2. Begin work on security activities.
3. Work with Internet2, Stanford and involved international participants to implement OpenFlow across the TP3 infrastructure.
4. Upgrade measurement equipment (see items 10-12 below)
5. Work with JGN engineers to help ameliorate the effects of the Japanese earthquake on their downed circuit to continue to provide high-performance research connections between the US and APAN (March-April).
6. Work with JGN engineers to assist them in the transition of their circuit in Los Angeles (March-April).
7. Work with CERNET engineers to help them to locate and install their equipment and new circuit in the US, and help them arrange for optimal peering to accomplish their goals and best complement US and TransPAC3 objectives. This will require extra funding from the NSF, as it is not a part of the original TransPAC3 planning and award.
8. Implement the TransPAC3 IDC to control dynamic circuits using software from Internet2 & ESnet.
9. Establish a three continent dynamic layer 2 connection, with monitoring, for large data flows

10. Working with IRNC:SP projects to deploy, where deemed appropriate, new measurement and advanced service technologies developed in SP projects. (See #4 above)
11. Investigate capabilities to understand traffic characteristics mapped to NSF supported science applications, potentially including flow level mapping, measurement, and reporting (See #4 above)
12. Work with NSF to provide greater insight into NSF-supported science projects and applications are directly supported and enabled by TP3connections and services.

## TransPAC3 – Annual Financial Report

<b>TP3 NSF, OCI-0962968</b>				
<b>Compensation</b>	<b>1st Quarter total(s)</b>	<b>2nd Quarter total(s)</b>	<b>3rd Quarter total(s)</b>	<b>Annual total(s)</b>
Williams, James	1,936.58	2,962.96	3,079.14	7,978.68
Sweeny, Brent	0.00	0.00	11,254.88	11,254.88
Williamson, Adam	0.00	0.00	6,806.35	6,806.35
IC on Compensation 32%	619.70	948.15	6,764.93	8,332.78
<b>Total Qtr Compensation</b>	<b>2,556.28</b>	<b>3,911.11</b>	<b>27,905.33</b>	<b>34,372.72</b>
<b>Other Expense</b>				
Fedex Charges	0.00	0.00	117.19	117.19
Travel - Hicks/Active Measurement Workshop	0.00	0.00	844.17	844.17
Travel - Williams/APAN Conference Hotel Exp	0.00	0.00	1,478.33	1,478.33
Travel - Hicks/ APAN Conference	0.00	0.00	3,319.40	3,319.40
IC on Other Expense 32%	0.00	0.00	1,842.91	1,842.91
<b>Total Qtr Other Expense</b>	<b>0.00</b>	<b>0.00</b>	<b>7,602.00</b>	<b>7,602.00</b>
<b>Circuit Expense</b>				
KDDI Circuit Charges	0.00	0.00	68,164.35	68,164.35
<b>Total Circuit Expenses</b>	<b>0.00</b>	<b>0.00</b>	<b>68,164.35</b>	<b>68,164.35</b>
<b>Grand Total ACE Annual</b>	<b>2,556.28</b>	<b>3,911.11</b>	<b>103,671.65</b>	<b>110,139.04</b>