TransPAC3- Asia US High Performance International Networking
(Award #0962968) Quarterly Report
1-September-2013 through 30-November-2013

Jennifer Schopf – Principal Investigator

(Prepared by John Hicks, Jennifer Schopf, Alice Jackson)

Summary

During the quarter of September 1, 2013 through November 30, 2013, the TransPacific Asia-US High Performance International Networking project (TransPAC) continued its collaborative and engineering activities to support international science. This report outlines collaborations, software and systems work, operational activities, and usage statistics for the project. Highlights include several updates to project by the new director to try to make sure production services are properly supported, shifting the support of the security work, and a demonstration of SDN over multidomains at SC.

1. TransPAC Overview

The TransPAC project supports three circuits and a set of network services between the US West coast and Asia. In the current set up, these circuits are:

- The **TransPAC Circuit:** a10Gbps link between Los Angeles, California, and Tokyo, Japan. This is the primary, NSF-funded circuit for the project and used for the bulk of the production project network bandwidth.
- The **JGN-X Circuit:** a 10Gbps layer-2 circuit, largely used for experiments and Software Defined Networking (SDN) trials. The Japan Gigabit Network Extension (JGN-X) project is a testbed funded by the Japanese National Institute of Information and Communications Technology (NICT) (http://www.nict.go.jp/en). This link is not supported by NSF funds. A backup routed peering connection between TransPAC and APAN also runs across this link.
- The **CERNET circuit**: a 10Gbps link between Los Angeles, California, and Beijing, China, which is only partially funded by NSF. This is a layer3-only connection at this time.

These circuits are used in production to support a wide variety of science applications and demonstrations of advanced networking technologies. In addition, the TransPAC award supports tool development, SDN experimental work, measurement deployments, and security activities.

Please note that some of the activities (outreach to Africa, PerfSONAR training, etc.) are also included in the ACE quarterly report project, as appropriate, as joint funding supports these efforts.

2. Staffing

Prior to this quarter, project staff consisted of:

- Jennifer Schopf, Director
- Brent Sweeny, primary TransPAC senior network engineer
- John Hicks, primary network research engineer
- Scott Chevalier, primary contact for GlobalNOC support desk
- Alice Warner, administration
- George McLaughlin, Asia-Pacific network consultant
- Dale Smith, consultant
- Gabriel Iovino, REN-ISAC staff member
- Wesley Young, REN-ISAC staff member
- Doug Person, REN-ISAC staff member

After consultations with GlobalNOC staff, Von Welch (Center for Applied CyberSecurity Research), and members of the ESnet team involved in security work, a re-evaluation of security staffing was performed, and the value contributed by the REN-ISAC staff was found lacking. They had had no direct activities related to TransPAC to report many months running, and upon consultation with them could not enumerate a work plan with Schopf. As such, Schopf terminated the contract paying REN-SAC staff members as of November 30, 2014. TransPAC will continue to receive basic REN-ISAC updates via the contract with the GlobalNOC, and if needed Welch offered staffing support for any security planning in the future.

George McLaughlin's contract was extended through June 2014.

3. Collaborations, Travel, and Training

The 15-year Global NOC celebration was held at IUPUI in September. Staff members gave open house tours to community members and press, and a series of presentations discussed recent achievements and plans going forward (http://newsinfo.iu.edu/news-archive/24560.html).

Schopf attended a 2-day meeting with ESnet staff at Lawrence Berkeley Lab in September. This meeting brought together the management staff of IU's Networks group (Jent, Herron, Fowler, Chitwood, Schopf) and their counterparts at ESNet (Bell, Monga, Tierney, Dart, Rotman). Collaboration in the international space was a main focus area, and several projects, including workshops and outreach to applications, were identified. Follow up meetings were planned.

Hicks attended the Chinese American Network Symposium (CANS) meeting in Hangzhou, China in September (http://cans2013.cstnet.cn/dct/page/1). Hicks presented material on the three continent demonstration discussed in previous quarterly reports and detailed in Section 4.C.

Hicks lead a performance workshop for Open Science Grid (OSG) and GlobalNOC staff in October. The all day workshop consisted of basic performance and measurement techniques including perfSONAR. There were approximately 10 people in attendance as well as broadcast media for the rest of the GRNOC staff. A follow up workshop is tentatively scheduled for Spring 2014.

Sweeny gave OpenFlow tutorial and hands-on training to GRNOC staff in Bloomington and Indianapolis in October.

In November, Schopf and Hicks attended SC13 in Denver, Colorado (http://sc13.supercomputing.org/). Schopf gave an invited talk for the Network Aware Data Management workshop (http://2013.ndm-meeting.com/) entitled "The Changing Face of Network Projects and Funding". Schopf also ran the kick-off meeting for application and networking support over 100G networks, related to three recent NSF supplements including one to the ACE project. Approximately 45 researchers were part of a half day of presentation and discussions about what was needed to make good use of the upcoming 100G testbeds. (http://internationalnetworking.iu.edu/archives/science-trials_SC13-workshop/100%20Gbps%20transatlantic%20trials.html)

At the main meeting, the IU International Networks team had a kiosk that was part of the Indiana booth with continuously running informational slides. Schopf held meetings with many of the leaders in the field. Hicks also presented material on the three continent demonstration, detailed in Section 4.C.

Additional time was spent developing performance workshop material for perfSONAR training to be part of an upcoming Network Startup Resource Center(NSRC) meeting in Africa. The planned workshop in Rwanda for this quarter had a change of scope, so this material will now likely be part of a separate training session in December in Tunisia.

4. Software and Systems Work

A. Tool Development

Tool development continued this quarter with expected patches and upgrades to existing tools. No new tools were developed.

B. Dynamic Circuits

The TransPAC project provides Dynamic Layer 2 Network services through the OSCARS software suite. This service peers with the Internet2 ION project and the JGN-X Dynamic network facilities. Researchers and scientists can interactively create a layer2 dynamic circuit between Asia and the US to transfer data.

C. Software Defined Networking (SDN) Activities

One of the primary research goals of the TransPAC project is to enable Software Defined Networking (SDN) using Open Flow to provide a mechanism to dynamically configure and control circuit behavior between the US and Asia.

Hick supported a demonstration at CANS that was designed by professor Jun Bi (CERNET/Tsinghua University). It showed the transfer of Genomics Data on Inter-domain paths set up by WE-Bridge software for CERNET-CSTNET-Internet2 SDN Peering. The setup consisted of a virtual OpenFlow switch, controller, and host. Data was transferred through the virtual switch to the virtual host in China.

At SC13, preliminary work on the three-continent SDN demonstration was presented. This is part of an ongoing collaboration with Martin Swany and Ezra Kissel using their Phoebus implementation. The idea behind this work is to segment long application paths into shorter pieces and provide pre-tuned hosts strategically paced in the network. These hosts act as a gateway to move data along taking advantage of different circuit provisioning mechanisms and

are pre-configured to deal with heterogeneous network technologies. We are evaluating the performance of GridFTP transfers between servers in Tokyo, Los Angeles, Bloomington (IN), and (soon) Amsterdam. We will measure the differences between direct transfers using commodity IP, transfers over dedicated virtual circuits, and those accelerated using Phoebus Gateways (PGs), using both circuits and commodity IP. The PG software is running on the host in LA effectively segmenting the end-to-end path from Tokyo to Bloomington. The Globus XIO-Phoebus driver is used to allow GridFTP transfers to direct data channel connections over the PGs.

Figure 1 shows overview of this demonstration. The data center in Bloomington has 4 static VLANs provisioned to Indianapolis via the I-Light network and terminates into the Indiana-Gigapop, which carries the static VLANs to AL2S in Chicago. The AL2S segment peers with ION in LA, and a single hop is made from ION to the TransPAC3 router, which then terminates the circuit on the LA PG host. The LA-to-Tokyo path is constructed via a dynamic circuit is created between LA and Tokyo using the OSCARS IDC software suite and hosts are connected directly to the network devices in both LA and Tokyo. The LA PG host acts as a "bridge" between the two circuit segments to help improve the end-to-end performance. The next step of this work will be to extend the project to include a link from Chicago to Amsterdam.

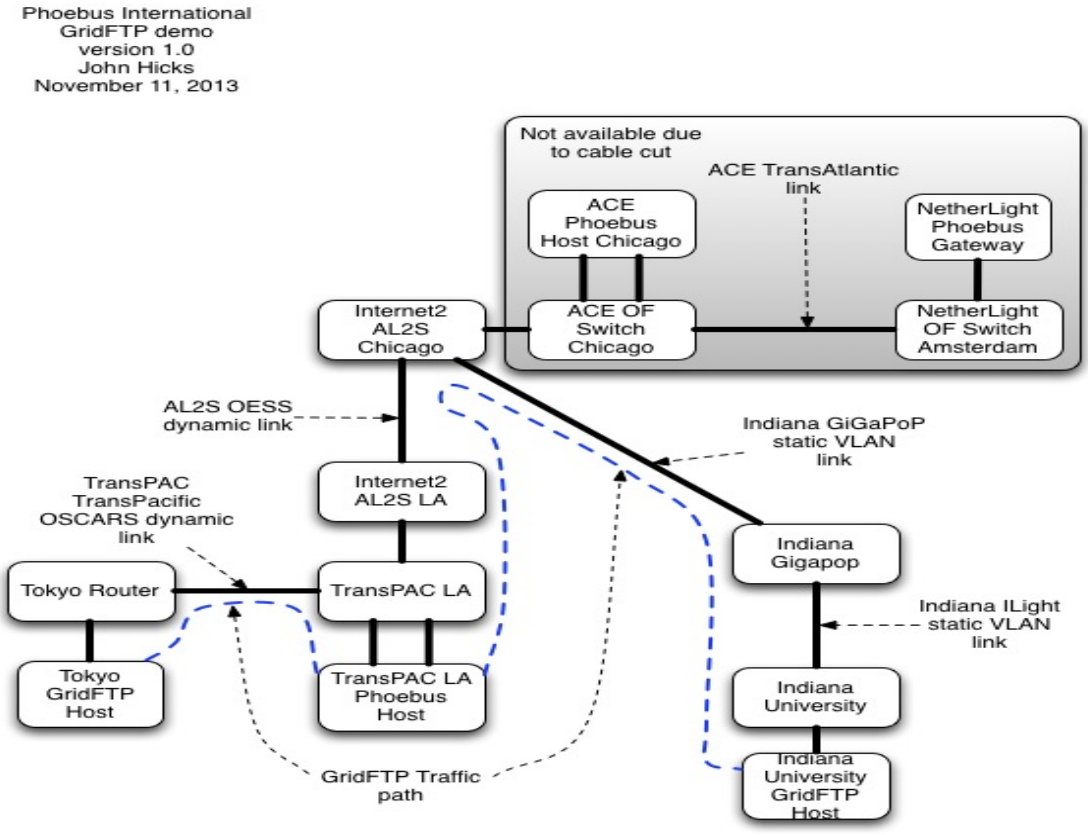

Figure 1: shows the OpenFlow demonstration traffic path on the TransPAC, Internet2 AL2S, and Indiana networks.

D. Measurement Activities

The TransPAC project supports a perfSONAR deployment in Los Angeles that provides periodic testing between several US and Asian sites. A testing matrix is available at http://tp3-

3.transpac3.iu.edu/maddash-webui/ .

As part of the ongoing evaluation of TransPAC services taking place by the new director, support of monitoring services over the TransPAC links will be handed off to the GlobalNOC production team. That team already receives support funding for those efforts, however the TransPAC project has not taken advantage of this to date, preferring in the past to do their own, one-off support. By handing off these services, TransPAC staff will be able to focus more on novel experimental work, and the monitoring services will be professionally managed.

E. Telepresence

The Internet2 Video Services exchange is now operational, with Sweeny acting in a leading architectural, engineering, and operational role. This exchange emphasizes interoperability among all high-end video technologies including Cisco Telepresence and SIP and legacy H.323 systems, and is connecting institutions to its new exchange in Washington DC (completed Fall 2012, co-located with WIX). Significantly for the APAN region, Internet2 also has created an additional Telepresence exchange in Singapore in connection with the POPs described below, and is connecting Asian and US users and institutions there, with Duke University being the first full participant. In order to increase this exchange's functionality, we have worked with regional R&E providers beginning with Singaren, and in this quarter Gloriad, to provide R&E connectivity to North American R&E networks and TransPAC.

We will continue to expand those connections in the next quarters hopefully to TEIN, for improved connectivity to Europe, for which latency is an important challenge.

(Note this work is not funded by TransPAC but is included for informational purposes and relevance to Asia-Pacific networking projects.)

5. Operational Activities

A. Network Engineering

The TransPAC circuit between Los Angeles, California, and Tokyo, Japan, continues to function as designed with no unscheduled outages. It supports ipv4, ipv6, and dynamic-circuit functions, and is prototyping OpenFlow capabilities.

TransPAC staff upgraded the router and switch during this period. In particular, the Brocade software was upgraded from 5.2 to 5.4.0d, which is a to a more SDN-capable and bug-free version. This is the most current version and the same version used by Internet2.

The JGN-X circuit between Los Angeles, California, and Tokyo, Japan, operates in layer 2 between switches in Tokyo and Los Angeles, and is primarily used for experimental network research, particularly DCN, OpenFlow, glif, Optical testbeds, and OpenGOLEs.

The CERNET circuit between Los Angeles, California, and Beijing, China, saw increased usage, with several peaks above 1Gbs.

TransPAC staff did quite a bit of work with the Asian networks and the SC13 bandwidth-planning coordinators to plan circuit-selection and support all of the Asia-Pacific research and demo requests.

The Singapore Internet2 exchange added GLORIAD peering and TransPAC staff worked with them on routing to make sure traffic took the correct path to Internet2 sites. There's still no path over TransPAC. TransPAC staff were, however, able to add a second Tata peering directly to Tata's Telepresence exchange. This connection provides for R&E access to worldwide videoconferencing with other commercial providers and Cisco sites.

As part of the general project cleanup taking place, TransPAC staff worked to clean up TransPAC DNS and database entries This involved moving all DNS entities from the domain name 'transpac2.net' to 'transpac.org', in part to avoid having recurring renaming and allow for consistency. This was coordinated with IDC configuration, GRNOC SysEng group, DNS managers, and the GRNOC database.

B. Traffic Graphs

Figure 2 and Figure 3 show the traffic on the TransPAC network during the period of September 1 2013 through November 30 2013, and Figures 4 and 5 shows data for the CERNET connection for the same period. Monitoring data is not available for the JGN-X circuit.

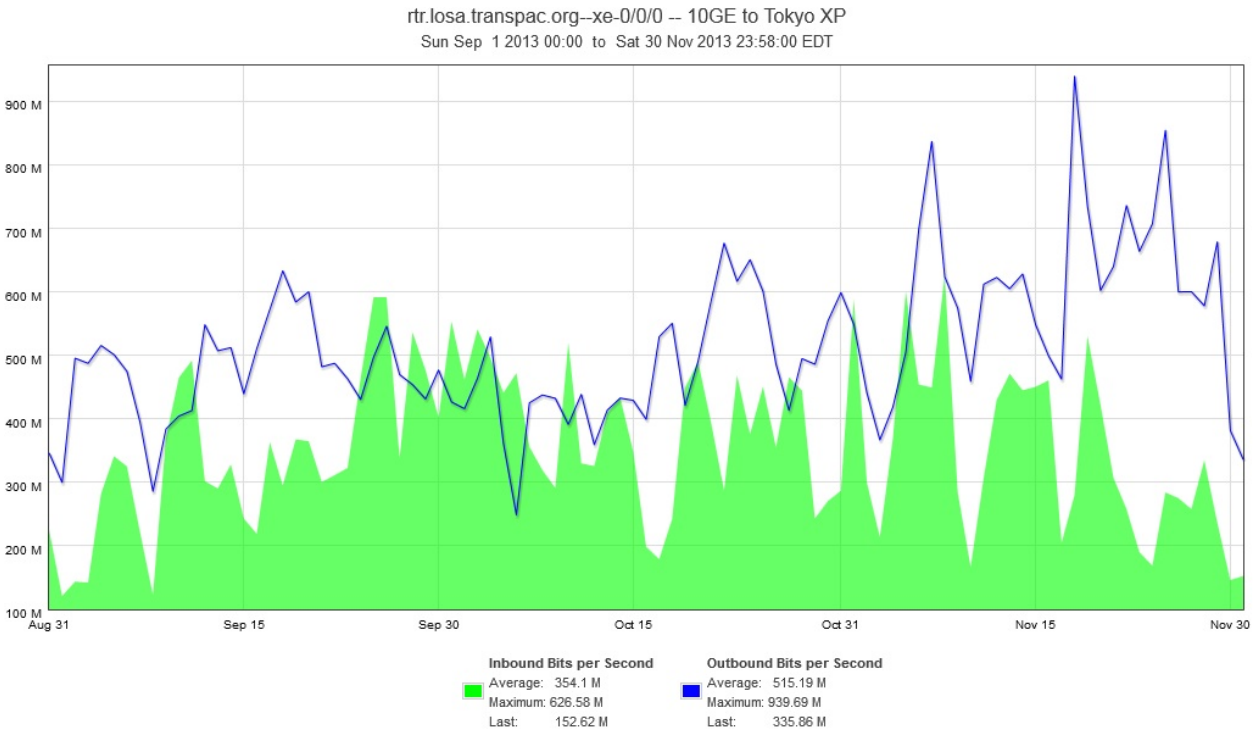

Figure 2: Aggregate traffic using smoothed daily averages on the 10Gbps TransPAC (NSF-funded) circuit between Los Angeles and Tokyo for September 1-November 30, 2013.

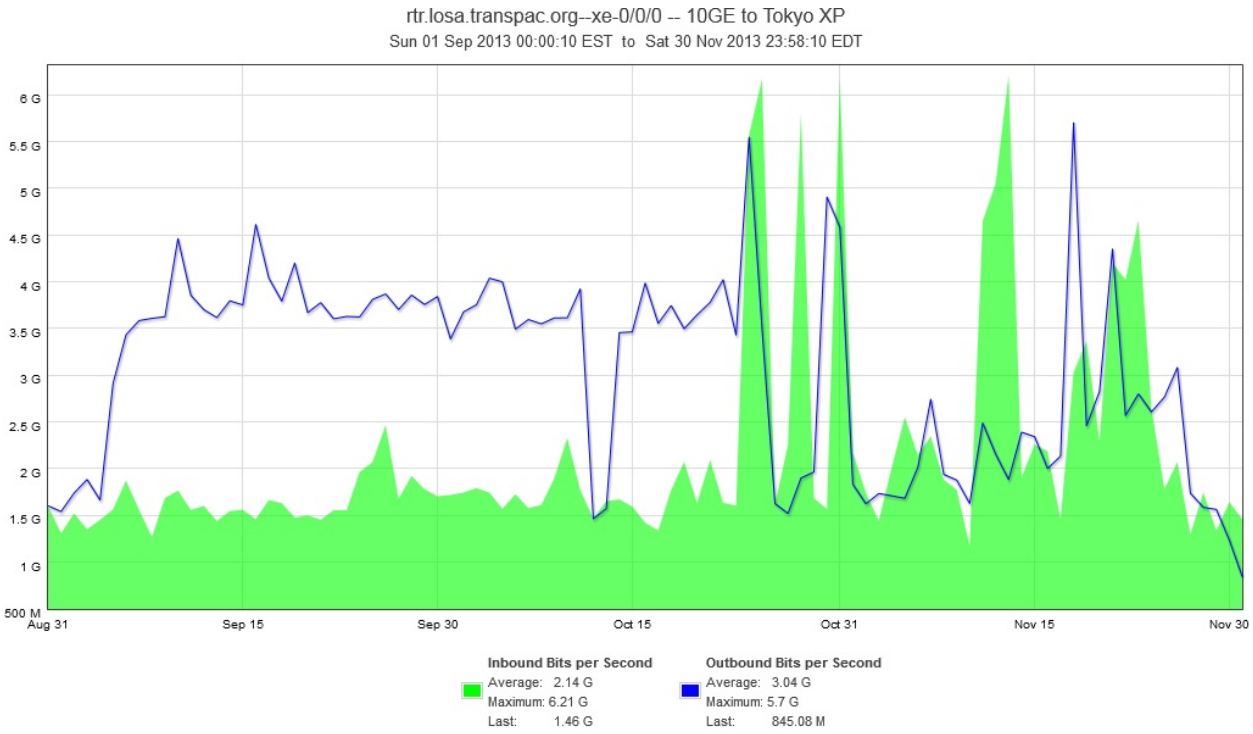

Figure 3: Aggregate traffic using maximum daily values on the 10Gbps TransPAC (NSF-funded) circuit between Los Angeles and Tokyo for September 1-November 30, 2013.

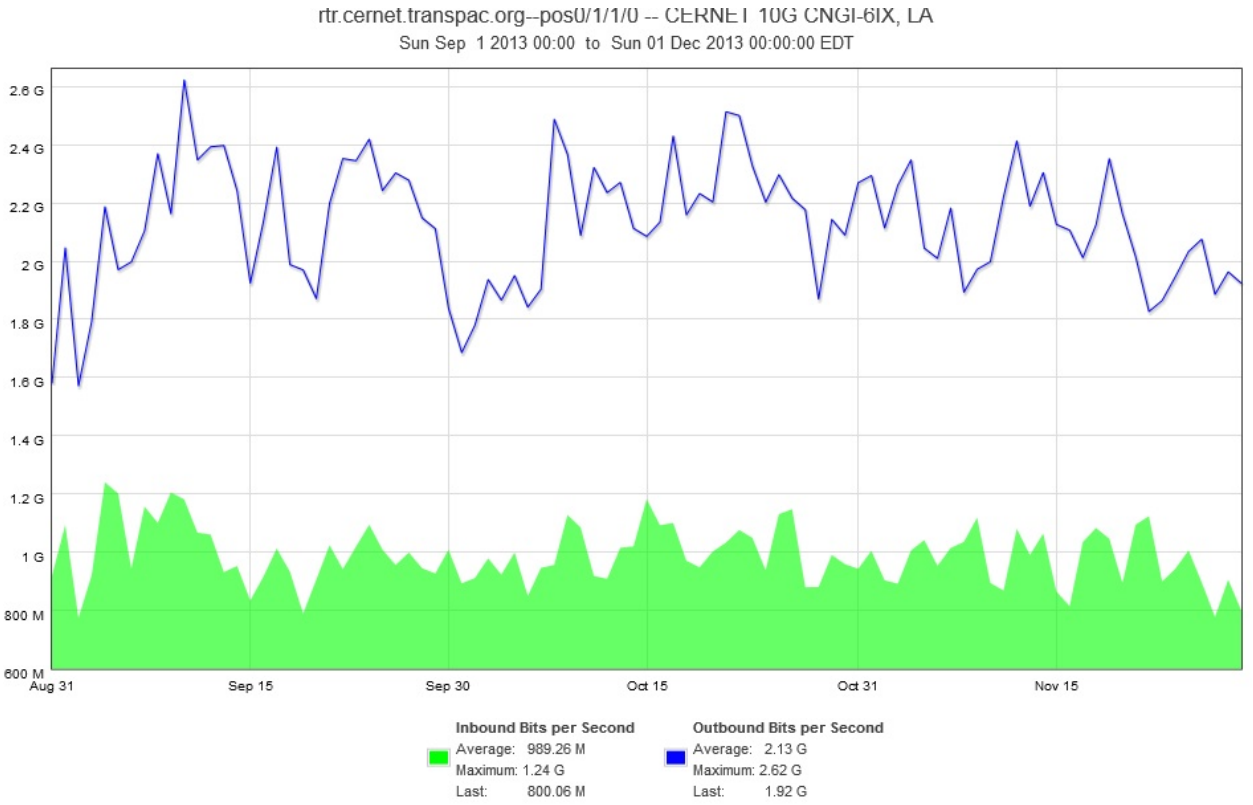

Figure 4: Aggregate traffic using maximum daily value on the 10G CERNET circuit between Beijing and Los Angeles for September 1-November 30, 2013.

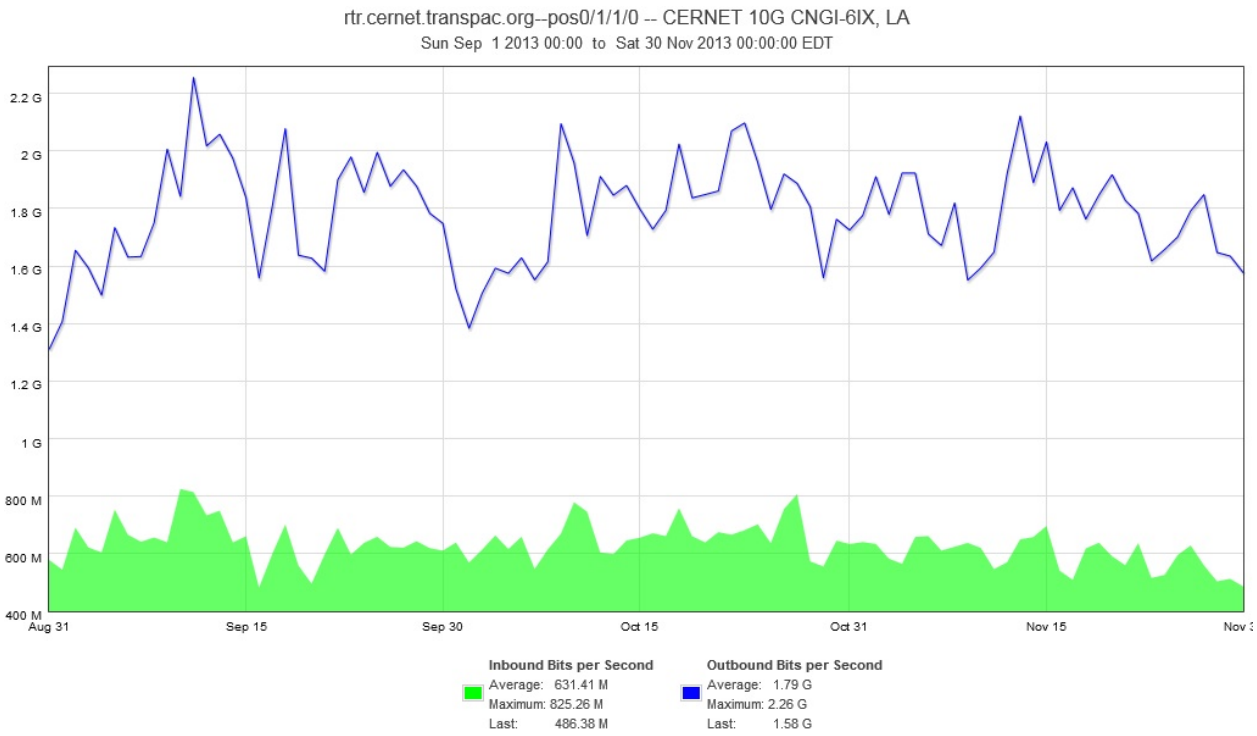

Figure 5: Aggregate traffic using smoothed average daily values on the 10G CERNET circuit between Beijing and Los Angeles for September 1-November 30, 2013

C. Trouble Tickets

There were two outages during this quarter.

Unscheduled Outages Summary

Ticket Number	Customer Impact	Network Impact	Title	Outage Type	Start Time (UTC)	End Time (UTC)
1389	1-Critical	2-High	TransPAC3 Core Node LOSA Brief Outage	Unannounced Maintenance	10/05/2013 10:21 PM	10/05/2013 10:23 PM
1407	1-Critical	1-Critical	Outage Resolved - TransPAC Core Node	Hardware	11/14/2013 7:15 PM	11/14/2013 7:45 PM

Table 1: Unscheduled maintenance tickets for the ACE circuits, September 1, 2013 – November 30, 2013.

D. Downtime

TransPAC Core Nodes	**Down Time**	**Reporting Period Availability**	**52 Week Availability**
TransPAC MX480 - LA	0 hr 32 min	99.98%	99.99%
Brocade MLXe4	0 hr 0 min	100.00%	100.00%
3410 Ethernet Switch	0 hr 0 min	100.00%	100.00%
OOB Router	0 hr 0 min	100.00%	100.00%
Aggregate TransPAC Core Nodes	0 hr 32 min	99.99%	100.00%
TransPAC Backbone Circuits	**Down Time**	**Reporting Period Availability**	**52 Week Availability**
TransPAC LOSA-JGN2 LOSA 10GigE	0 hr 0 min	100.00%	100.00%
TransPAC LOSA-Pacific Wave LOSA 10GigE	0 hr 0 min	100.00%	100.00%
TransPAC TOKY-TransPAC2 LOSA	0 hr 0 min	100.00%	99.96%
Aggregate All TransPAC Backbone Circuits	0 hr 0 min	100.00%	99.99%

6. Security Events and Activities

Basic security measures were maintained during this quarter and no security incidences were reported. REN-ISAC had no TransPac activities to report again, which has been an ongoing issue. Because of this, and after discussion with IU and ESnet security experts for options, TransPAC has ceased funding REN-ISAC specific staff. Basic security work is included as part of the ongoing funded support TransPAC receives from the GlobalNOC. If additional assistance is needed, Von Welch at the IU Center for Applied Cybersecurity Research has volunteered staff members who can consult with TransPAC.

7. Reporting against Objectives June 2013-August 2013

1. Overall – new director to review activities and adjust as needed
    a. REN-ISAC staffing adjusted (Section 2, Section 6)
    b. PerfSONAR monitoring to shift to production support (Section 4.D)
2. Collaboration and Demonstrations
    a. Attend SC13 conference, SC demos (Section 3, 4.C)
    b. Attend CANS conference (Section 3)
    c. Conduct performance workshop for OSG(Section 3)
    d. SC13 coordination (Section 4.B and 5.A)
3. Systems and Software Work
    a. Plan for software upgrades of core devices in Los Angeles: Brocade switch and Juniper router. (Section 5.A)

8. Plans for December-2013-February-2014

1. Overall – new director to review activities and adjust as needed
2. Collaboration and Demonstrations
    a. Attend APAN37 (January - Bandung, Indonesia)
    b. Attend PerfSONAR workshop (February - Arlington, VA)
    c. Identify scientific applications using TransPAC more specifically
    d. Work to improve flow-gathering and –identification capabilities
3. Systems and Software Work
    a. Continue to define monitoring framework
    b. Extend 3-continent SDN demo work
4. Operational Activities
    a. Continue full support of TransPAC circuit
    b. Continue to shift production system support to production GlobalNOC teams