TransPAC4
Award #1450904
Year 1 Quarter 3 and Annual Report
1 March 2015 through 31 November 2015

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Summary

During its first year, the TransPAC4 project focused on the transition from the TransPAC3 project. This report outlines the collaborations and management activities for the first year of the project, with additional details for Quarter 3. (Note: Due to NSF reporting requirements, the first reporting year of a project has only 3 quarters.) Operational aspects of TransPAC will be handed over to this project in March 2016.

1. TransPAC4 Overview

The TransPAC project supports two circuits and a set of network services between the US West coast and Asia: 1) The NSF-funded TransPAC 10G Circuit, which runs between Los Angeles, California, and Tokyo, Japan; and 2) The NICT funded JGN-X 10G Circuit, which is used for experimental traffic between LA and Tokyo. A third circuit, the 10G CERNET funded 10G link between Beijing and LA, was handed off to Internet2 in May 2015. These circuits are used in production to support a wide variety of science applications and demonstrations of advanced networking technologies.

TransPAC4 will take over operational responsibilities of these links in March 2016. In the meanwhile, the project staff are negotiating for additional links, as described below.

2. Staffing

Project staff consists of:

Jennifer Schopf, Director (10%)
Andrew Lee, International Networks network architect (10%)
Hans Addleman, primary TransPAC network engineer (20%)
Alice Jackson, administration (20%)

Over the next six months, percentages of current staff will be increasing in anticipation of the TransPAC4 award financing the full support of the TransPAC project.

In September a job advert for the TransPAC4 Science Engagement Specialist was posted. We received eight applicants, and in October and November phone interviews were conducted with the top three candidates. A verbal offer has been made to the best candidate, who has a background in IRNC networks and working with international

partners. We expect the offer to be accepted in early December with the goal of a January 4 start date.

3. Project Startup and Management

The Project Execution Plan for TransPAC4 was submitted to NSF in August, 2015. In addition to standard management plans, it contained a complete WBS for the life of the project. The WBS will be updated annually. Section 8 includes this years updates.

MOUs for the project have been delayed in order to better understand Indiana University's internal processes. It appears that all MOUs issued in the past with only a PI signature are not valid according to university regulations. Requests to IU legal staff have been slow, although we have some meetings planned for January 2016 in order to move this forward.

Over the next six months, additional staff time will be spent as support for TransPAC shifts fully onto the TransPAC4 award.

4. Collaborations, Travel, and Training

TransPAC staff participated in various meetings to support ongoing collaborations. These included in Project Quarter 1 and 2:

- Schopf and Lee - APAN 39 March 1-6, 2015 in Fukuoka Japan, http://www.apan.net/meetings/Fukuoka2015
- Schopf, Lee, Addleman, and Jackson – IRNC PI meeting, April 26, 2015 in Washington, DC, http://internationalnetworking.iu.edu/news/events/IRNC2015.html
- Schopf, Lee, Addleman, and Jackson - Internet2 Global Summit April 26- April 30, 2015 in Washington, DC, http://meetings.internet2.edu/2015-global-summit
- Addleman and Chevalier APAN40, August 7-14 in Kuala Lumpur, Malaysia http://www.apan.net/meetings/KualaLumpur2015/. Schopf had planned to attend but could not due to illness.

In Project Quarter 3, TransPAC4 staff also supported:

- Lee attended the Global Network Architecture meeting in Copenhagen, Denmark Sept 23-24 2015 (https://events.nordu.net/display/GNA2015/Welcome). There, he participated in discussions on the content of the initial set of GNA documents, the next steps and publication process for those documents, and represented the interests of the IRNC funded projects at IU. Consensus of the discussion was the IRNC projects at IU will be used as an example of how global research and education networks should function.
- September 27-29, 2015, Lee attended the GLIF meeting in Prague, Czech Republic (http://glif2015.cesnet.cz/). He participated in the GLORIAD group meeting and was involved in discussions on the winding down of that project and the potential impacts on that networks users. He also had a brief conversation with Greg Cole on the cooperation between the Insight project and NetSage. Lee

participated in the GLIF Americas meeting, presenting on the all the projects we manage. He also participated in the wider GLIF meeting that followed, both in the general sessions and side conversations with a wide variety of partners.

- Schopf, Lee, Chevalier, attended the Internet2 TechX event in Cleveland, OH, October 4-9, 2015 (https://meetings.internet2.edu/2015-technology-exchange/). Lee attended the conference to keep abreast of the activities of the wider research and education community in the United States, and to discuss monitoring strategies with the PIs of other IRNC projects. IRNC PIs and Lee met on strategies to deal with routing with Europe in light of the new trans Atlantic bandwidth, and also met with our Asian partners. Lee and Chevalier (assumed he attended) also attended the perfSONAR developer planning meeting on Thursday to discuss the direction of the project and to advocate for small node and virtual environment support within the project.
- Addleman attended NANOG 65 in Montreal, October 5-7, 2015 (https://www.nanog.org/meetings/nanog65/home). Addleman attended several talks of interest on denial of service attacks. These talks focused on new attack vectors, damage caused, and mitigation strategies. There was also an update on upcoming and current undersea fiber cables. Addleman attended a few sessions on new NetFlow and BGP tools that may be of use to TransPAC.
- On October 20, 2015, Addleman attended Operating Innovative Networks (OIN) in St. Louis, MO (http://oinworkshop.com/3/miscellaneous3.htm). This workshop covered introductions to SDN, ScienceDMZ, Globus, perfSONAR, and DTN. It was a small group attending the workshop, giving Addleman time for discussion and deep dives into topics of interest to the attendees. Moving forward, Addleman will work with the OIN team to develop new material for use in upcoming workshops.
- Lee attended the Large Hadron Collider Open Networking Environment (LHCONE) meeting October 26-30, 2015, Amsterdam, Netherlands (http://lhcone.net). There, he participated in discussions concerning the state of networking for the high energy physics community, especially the Large Hadron Collider and the Belle-II project. Current operational state as well as projected usage were considered. He also represented the networks supported by IU, especially ACE and TransPAC, as resources for these communities and answered questions concerning these networks.
- November 15-20, Addleman, Lee, and Schopf attended SC15 in Austin, TX (http://sc15.supercomputing.org/). The 100G TransPAC PacificWave circuit was demonstrated at the conference. Schopf met with Konishi, APAN-JP NOC, among others to discuss how the new Seattle-Tokyo TransPAC 100G circuit was impacting traffic. As part of the Measurement Team's work at SC15, Chevalier deployed 12 small-form perfSONAR nodes in tandem with the normal, larger form perfSONAR nodes for analysis. Addleman met with Ikeda, KDDI, about this new circuit and gathering more data on its use.

We have also initiated planning with ESnet for two Cross Connect Workshop focusing on bioinformatics. The first workshop will take place in Spring 2016, in Berkeley, CA, with a follow on workshop expected 6-8 months later at the IU offices in Beijing. This workshop

will be supported with both TransPAC funding (as part of the planned TransPAC4 science engagement work) and other NSF funding for Cross Connect workshops.

Collaboration with the IRNC AMIS awardee, NetSage, is moving forward successfully, with TransPAC able to be a guinea pig for first deployments of several measurement sources.

Collaboration with the IRNC NOC awardee is moving forward more slowly. As TransPAC currently pays the Global NOC for some services, ongoing support will be seamless however there is a need to re-negotiate pricing. Currently, TransPAC3 pays for a full set of Tier 1 NOC services, but the IRNC NOC is now also being paid directly by NSF, so the TransPAC expenses should be reduced.

5. Circuit Planning

In August, an RFP for a 100G circuit between Seattle and Tokyo was issued. Responses were due back September 10, 2015, and negotiations began with PacificWave for a circuit from their exchange point in Seattle to the WIDE exchange point in Tokyo. Pacific Northwest GigaPop (PNWGP) is providing the 100G fabric in collaboration with Tata. The circuit will be referred to formally as the "TransPac-PacificWave 100g circuit".

Despite best efforts, this circuit was still experiencing a small amount of packet loss in the days before SuperComputing'15, so efforts shifted to supporting the applications who wanted to use this route. At SC, the University of Tokyo used the new circuit to demonstrate what happens to TCP performance over ultra long, ultra large circuits. They used Cubic-TCP and Jumbo Frames, and achieved 100G throughput at several occasions over the week, as shown in Figure 1.
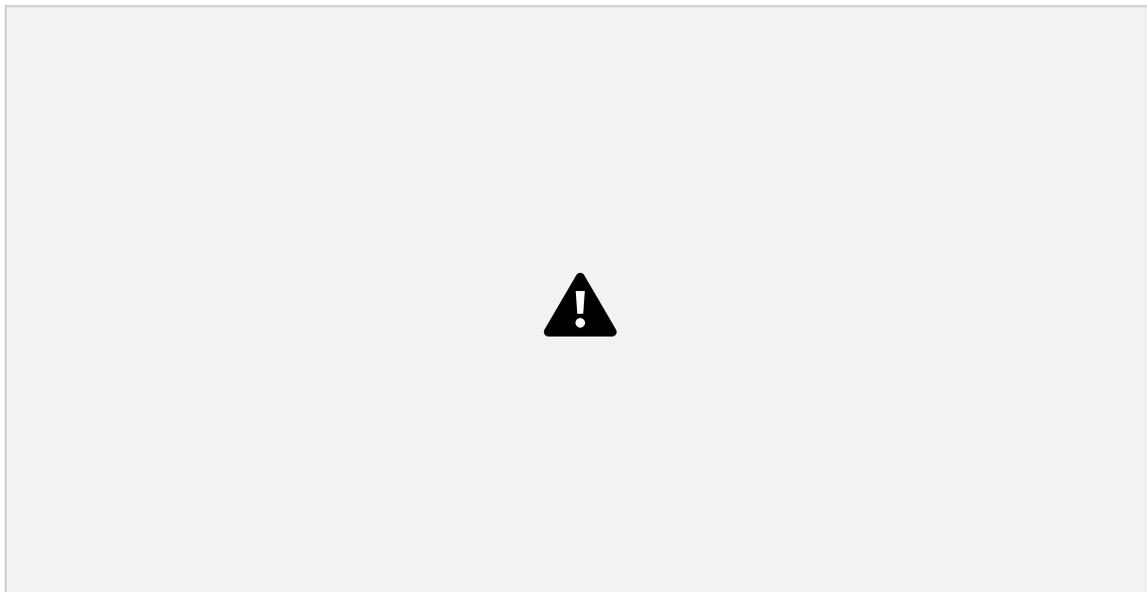
Figure 1: SNMP measurement data during SC'15 for the TransPAC-PacificWave 100G circuit.

Now that SC is finished, and we are past the Thanksgiving Holidays the hope is to debug the small amount of packet loss, have the circuit test clean, and hand over production operation of the link to the IRNC NOC.

Over the first year of the project we were also part of negotiations for a second 100G circuit. However, after being approached in March to be part of a three-way partnership for an additional 100G collaboration between Internet2, Singaren and IU, this fell through in September 2015. Conversations have continued to ensure that this circuit and the TransPac-PacificWave 100g circuit will be able to provide mutual backup and shared peerings going forward.

Separate from these circuits, we have been hearing from the community that there is interest in additional capacity using Guam as a waypoint. Conversations are ongoing, jointly with David Lassner, U Hawaii Manoa, and a meeting is scheduled to take place at PTC in January.

6. Software and Systems Work

Software and systems work for TransPAC are currently covered by the TransPAC3 project. These duties will be shifted to the TransPAC4 project in March 2016.

7. Security Events and Activities

Basic security measures are being maintained, and there were no security incidents to report for this quarter.

We have contacted the CACR to begin work on our Security Plan for the 5 year project. We are currently working through their self-guided forms for a more successful collaboration when their schedule clears up for one-on-one meetings with us.

8. Reporting against Objectives for Year 1, and WBS Updates for Year 2

From the Work Breakdown Structure for Years 1 and 2. Bulleted items are status updates for the indicated WBS items. Additional WBS items are also indicted. In the Year2 Quarter 1 project report, some of these items will be renumbered to reflect what is current for Year 2.

1.1   Planning / Coordination Year 1

1.1.1   Renew current 10G circuit - Negotiate to renew the current TransPAC3 Los Angeles to Tokyo 10G Circuit.

ONGOING: Circuit currently extended through Feb 29, 2016. Current plan is to extend this to May 2016 in Y2Q1

1.1.2   Research best new paths and end points - Work with partners in both the Asia-Pacific and United States regions to determine appropriate end points for a circuit landing in Seattle. Identify the most appropriate Asian endpoint for an additional circuit.

COMPLETED. The TransPac-PacWave 100G circuit runs from Tokyo to Seattle. Year 2 will bring production use of the circuit. Additional circuits will be sought in Year 2.

1.1.3   Start partner MOU process - Contact partners and start the process of signing Memorandum of Understandings with each.

DELAYED due to IU process needs, meetings arranged for Y2Q1

1.1.4   Form TransPAC External Advisory Council populated by partner and support organizations.

DELAYED to Year 2 due to Schopf illness

1.2 Planning / Coordination Year 2

1.2.1 Evaluate circuit capacity and community needs. Negotiate with vendors and partners for new circuits as capacity demands grow. Phase 2 planning.
ONGOING. Discussions of a possible circuit via Guam will take place in January 2016 (Y2Q1)
1.2.2   Finish partner MOUs Finish the process of signing Memorandum of Understandings with each.
DELAYED due to IU process – this will be a focus of Year 2

1.3   Planning / Coordination Ongoing

1.3.1   Evolve network architecture - New network designs over the evolution of the 5 year award. This will include 100G circuit speeds, software defined networking / exchanges, possible new peering points, and greater then 10G flows.

ONGOING Expectation to have an RFP for a second circuit, possibly based in Guam, in Project Year 2; possible joint work with partners for an Open Exchange Point in Asia, likely Hong Kong

1.3.2   Coordinate with IRNC:NOC winner - Coordinate with the IRNC:NOC awardee to ensure they have a sufficient and appropriate level of access to all of the TransPAC4 equipment supporting international activities. This includes appropriate logs, SNMP access, portal or login access to obtain data not available via SNMP, etc.

DELAYED Waiting on NOC for pricing changes, expected in Year 2 Q1

1.3.3   Coordinate with IRNC:AMI winner - Coordinate with the IRNC:AMI awardee for the appropriate distribution of flow data, per our own security and data policies, SNMP and other access as appropriate.

ONGOING TransPAC will be first backbone to share measurement data, expected in January 2015 (Y2Q1)

1.3.4   Overall Management of the project

ONGOING Meetings continue almost quarterly with project partners at APAN, TNC, and Internet2 conferences

1.3.5   Project Reporting - Report generation for the life of the project

ONGOING - Project Execution Plan was submitted in Y1Q2; Reporting infrastructure in place for more up to date quarterly reporting; WBS update as part of this report

1.3.6   Documentation and dissemination

PLANNED - Website refresh being planned for January 2016 (Y2Q1)

1.3.7 – ADDED - Security plan for project
DELAYED – Focus for Year 2 with CACR

2.2   Outreach Year 2

2.2.1   Analyze usage data developed during TransPAC3 to identify geoscience/bioinformatics researchers. Leverage our TransPAC4 partners to provide support and if possible connectivity for these researchers.

ONGOING - Altered from original from genomics to include bioinformatics , in part in support of the cross connect with ESNet

2.6 Outreach Ongoing

2.6.1 Attend domestic and international conferences for application identification and relationship maintenance

ONGOING: PLANNED:
- o Pacific Telecommunications Conference (PTC), Hawaii January 2016
- o APAN 41 Manilla, January 2016
- o Cross Connect on Bioinformatics, Bekerely, CA April 2016
- o Global Summit, Chicago, May 2016
- o Terena, Prague, June 2016
- o APAN 42, Hong Kong, August 2016
- o Internet2 Technical Exchange, Baltimore, September 2016
- o SuperComputing'16, Salt Lake City, November 2016

2.6.2 Coordinate connectivity with existing and new TransPAC Partners

ONGOING – meeting at APAN, TNC, and Internet2 Conferences

2.6.3 Ensure connectivity in support of the Large Hadron Collider

ONGOING - Attendance at LHC meetings

2.6.4 Ensure connectivity in support of Belle-II

ONGOING - Discussion at SC'15 indicated this project is in line for their own 100G circuit in Spring 2016. Conversations will continue at meetings.

3.1 Operations

3.1.1 Analyze TransPAC3 Flow data in support of research and operations. Develop policy and plan for anonymizing and storing data. Provide data to researchers as requested.

PLANNED - Shifting from TransPAC3 in Y2Q2

3.2 Operations Year 2

3.2.1 Integrate TransPAC3 SDN Controller - Work with systems engineers to transition the TransPAC3 SDN controller into the TransPAC4 network.

PLANNED – Y2Q3

3.2.2 Deploy SDN DDOS Solution Deploy the SDN based DDOS mitigation solution developed in TransPAC3.

PLANNED Year 2

3.2.3   Evaluate and update existing POPs and equipment Evaluate and install new points of presence and equipment as community demands expands and changes.

ONGOING - Part of this has been completed as part of Seattle turnup in Year 1, Ongoing in Year 2.

3.2.4   Deploy Path Hinting service into the TransPAC4 routers and work with partners, connectors, and peers to adopt the service.

DELAYED – Due to lack of need, this will shift to an evaluation in Year 3

3.5   Operations Ongoing

3.5.1   Refine network measurement and monitoring data   Refine and make network telemetry useful to researchers and the IRNC:NOC. This will include creating public web pages and repositories that provide easy access to data.

PLANNED for Year 2

3.5.2   Tune and support large flows Monitor large flows across the network and work with researchers to fine tune the end points and entire path. Work with researchers to ensure performance is as expected.

PLANNED for Year 2

3.5.3   Deploy support and telemetry for large flows Work with partners to configure and allow for large flows across the TransPAC4 network. Work with systems to deploy monitoring solutions for large flows.

PLANNED for Year 2

3.5.4   Operate Infrastructure; Pay for circuit, port, maintenance, and hardware costs.

ONGOING

4.1   Research / Experimentation Year 1

4.1.1   SDN for DDOS mitigation - Research the feasibility of using SDN technologies for detection and mitigation of DDOS attacks on the TransPAC network.

ONGOING - Primarily part of TransPAC3 in Year 1, shifting to TransPAC4 in Year 2

4.2   Research / Experimentation Year 2

4.2.1   Test larger then 10G flows   Test network equipment, configuration, and support for greater then 10G flows.

PLANNED for Year 2

4.2.2   Path Hinting deployment for testing, experimentation, and running community
    demonstrations.
DELAYED until Year 3

4.2.3   SDN for Network Measurement and Monitoring. Use SciPass and Open Flow as load balancer to an intrusion detection system cluster or netflow cluster.

PLANNED for Year 2

4.2.4   WAN Acceleration   Work with the Phoebus project to do WAN acceleration experimentation.

DELAYED/CANCELED – Due to lack of contact with Swany throughout Year 1 despite numerous attempts to contact him, it is likely this portion of the project will need to be rescoped

4.2.5   Undergrad Research Project Work with 1-2 undergraduate students to form a research project of their choosing.

PLANNED for Year 2

9. Financial Reporting Details Project Year1 1

Current spending is on track with the predicted Project Year 1 budget.

Description	March 2015	April 2015	May 2015	June 2015	July 2015	Aug 2015	Sept 2015	Oct 2015	Nov 2016	TOTAL
Schopf, Jennifer (PI)	1,235	1,235	1,235	1,235	1,267	1,267	1,267	1,267	1,267	11,276
Alice Walker Jackson	0	0	0	0	1,328	1,328	1,328	1,328	1,328	6,640
Andrew Lee	1,709	1,709	1,709	1,709	1,190	1,190	1,190	1,190	1,190	12,784
Hans Addleman	1,924	1,980	1,980	1,980	986	986	986	986	986	12,796
F&A on Compensation 32%	1,558	1,576	1,576	1,576	1,527	1,527	1,527	1,527	1,527	13,918
Subtotal Compensation	**6,426**	**6,500**	**6,500**	**6,500**	**6,298**	**6,298**	**6,298**	**6,298**	**6,298**	**57,413**
Travel - Addleman-OIN St Louis								446		446
Ixia maintenance contract									4,111	4,111
Travel - Reduovic - Interview									1,441	1,441
F&A on Other Expense 32%	0	0	0	0	0	0	0	143	1,777	1,920
Subtotal Other Expenses	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**589**	**7,329**	**7,918**
Circuit Expenses										0
Wire Transfer Fees										0
Subtotal Circuit Expense	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Grand Total	**6,426**	**6,500**	**6,500**	**6,500**	**6,298**	**6,298**	**6,298**	**6,887**	**13,627**	**65,332**

Table 1. Financial Reporting Details for Project Year 1, March through November 2015.