

TransPAC5

Award #2028501

Year 1 Quarter 1 and 2

1 October 2020 through 31 March 2021

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Summary

The TransPAC5 project supports circuits and services for the use of high speed networks between the US and Asia, with a focus on measurement and end user support. Year 1 Quarter 1 and 2 highlights include adding new partners to the Asia Pacific Ring (APR) consortium and work towards a new MOU, joint work with partners for the planned Guam-Singapore Consortium 100G Circuit, and submitting a formal proposal to the GNA-G for a Routing Working Group.

1. TransPAC5 Overview

The TransPAC5 project is part of a larger portfolio supported by the International Networks at Indiana University (IN@IU) team. TransPAC5 supports the TransPAC-PacWave 100G circuit which is a 100 Gbps link between Seattle, Washington, and Tokyo, Japan, and associated network services. This circuit has been in production since February 2016 and is the primary project circuit for production traffic for TransPAC4 and TransPAC5. This link is fully funded by NSF and is managed in cooperation with Pacific Wave and Pacific Northwest GigaPop (PNWGP). The TransPAC5 award also supports science engagement, experimental network research, measurement deployments, and security activities.

As part of TransPAC5, we are planning to add capacity between Guam and Asia, via the planned Guam-Singapore Consortium 100G Circuit. Members of this consortium include TransPAC, Internet2, AARnet, ARENA-PAC, University of Hawaii, SingAREN, and Pacific Wave.

2. Staffing

We are only starting to ramp up the staffing, as part of the transition between TransPAC4 and TransPAC5. During this time frame, staffing included:

- Jennifer Schopf, PI, IN@IU Director
- Hans Addleman, Co-PI, TransPAC Network Engineer
- Heather Hubbard, Project Support

Francis Lee, SingAREN, is a coPI but does not receive funding for compensation.

3. Conference and Workshops

TransPAC staff participated in various meetings to support their role in collaborations in Asia. Meeting for Quarter 1 and 2 included:

- Schopf and Addleman attended the Internet2 TechExtra, October 6-7, 2020, <https://internet2.edu/techextra-2020/>. Schopf and Addleman participated in the virtual event and heard updates from Internet2 and their members.
- Addleman attended the NSF Large Scale Facilities Workshop, October 28, 2020, <https://na.eventscloud.com/emarketing/go.php?i=795905&e=am1zY2hvcGZAaXUuZWR1&l=https://www.largefacilitiesworkshop.com/>. Addleman participated in discussions about NSF property oversight, monitoring, and insurance.
- Schopf attended the fall APAN Board Meeting, October 29-30, 2020. Schopf represented Indiana University and gave an update on TransPAC.
- Addleman attended the US-Japan Bi-National Research Community Workshop on Programmable Networking, November 16-18, 2020 <https://sites.google.com/view/us-japan-workshop/home>. Addleman participated in and moderated breakout sessions that discussed shared experimentation between international research testbeds.
- Addleman attended the Fabric Facility Partners Workshop, December 3-4, 2020, <https://fabric-testbed.net/events/facility-partner-workshop-2020>. Addleman participated in sessions focused on updates for the hardware and facility deployment, network services that will be offered, and a deep dive into the computer hardware that will be used.
- Schopf attended the Annual TransPacific Research and Education (TPRE) Networking meeting, January 16, 2021, https://drive.google.com/drive/folders/18vJF32ze32JLNpiMD_9HbhX2_B9Z0U00?usp=sharing. Schopf presented updates for the TransPAC project.
- Schopf attended the APAN 51 Meeting, February 1-5, 2021, <https://apan51.apan.net>. Schopf led a BOF on the need for a working group to address routing issues, gave a talk on TransPAC5 as part of the engineering workshop, and participated in several detailed discussions during the meeting.
- Schopf and Addleman attended the Fabric FAB Kickoff Meeting, February 18, 2021, https://docs.google.com/document/d/1SC0oRf52a3NWU-u-U0_AgnT-4uopf_umc9utrHP8B0c/edit?usp=sharing. Schopf presented on how TransPAC5 will support FAB experimentation and several meetings with experiments have been noted for follow up.
- Schopf participated in SuperComputing Asia, March 2-4, 2021, <https://www.sc-asia.org/>. Schopf attended meetings that tracked partner progress and connections.
- Schopf presented for SingaREN, March 9, 2021. The presentation was on use cases and using NetSage as a monitoring tool.

- Schopf attended the WIDE Project camp plenary on Global REN, March 15, 2021. Schopf participated in an invited panel that discussed global research and education networks.
- Schopf and Addleman attended the GNA-G Community VCs #4, March 15-16, 2021, <https://www.gna-g.net/attend-a-meeting/gna-g-community-vcs-2021q1/>. Schopf gave a presentation about the proposed Routing Working Group.
- Moynihan attended the LHCONE Meeting, March 23-24, 2021, <https://indico.cern.ch/event/983436>. Moynihan participated in discussions on the future trans-Pacific capacity needs of LHC and on potential new measurement and monitoring solutions for LHC traffic.

Presentations and publications for Quarter 1 and 2 included:

- Schopf, J., “TransPAC5 and NEA³R”, Invited Talk, Annual TransPacific Research and Education (TPRE) Networking Meeting, January 16, 2021. Slides available online at: <https://docs.google.com/presentation/d/1kFSmx3opVpzfWa8Fm1JPy42wikLjVVnVcFaZzXAk8tE/edit?usp=sharing>
- Schopf, J., “Routing Problems and How to Address Them”, BOF Talk, APAN 51, February 2, 2021. Slides available online at: https://docs.google.com/presentation/d/1I7ytZR_KmO_dpWfg1Bq0S044XyS_oTlr8BEKc6zQnTY/edit?usp=sharing
- Schopf, J., “TransPAC4 and TransPAC5 Update”, Invited Talk, APAN 51 meeting, February 4, 2021. Slides available at: https://docs.google.com/presentation/d/1EUrPQ_7j40okohptev_ark_AW_LJcN2PIkRUk-joTak/edit?usp=sharing
- Schopf, J., and Lee, F., “Routing Problems and How to Address Them (Summary)”, Invited Talk, APAN 51, February 5, 2021. Slides available online at: https://docs.google.com/presentation/d/1GV7mLPTbIjtpd0Vr2o3GXMw3_bEd48k3aOVI2N1xBUU/edit?usp=sharing
- Schopf, J., “International Networks at Indiana University Support for FAB”, Invited presentation for Fabric FAB Kickoff Meeting, February 18, 2021. Slides available at: https://drive.google.com/file/d/1yiYvcrTAc53bmk8wFEdn_qMpRyBuAglC/view?usp=sharing
- Schopf, J., “NetSage, TransPAC, and SingaREN”, Invited presentation, SingaREN Meeting, March 9, 2021. Slides available at: https://drive.google.com/file/d/1CW3EWOAdzLeor3Y-Wyk_YJh_OoWWCVcY/view?usp=sharing
- Schopf, J., “GNA-G Routing WG”, Invited Talk, GNA-G Community VCs #4, March 15, 2021. Slides available online at: <https://drive.google.com/file/d/1jEwqX5oheTsk6u6RWPG77mlYJbmJlJEy/view?usp=sharing>

4. Collaborative Activities

4.A Asia Pacific Ring

The most significant collaboration for TransPAC5 is the **Asia Pacific Ring (APR) Consortium**, which consists of the National Institute of Information and Communications Technology (NICT), National Institute of Informatics (NII)/ Science Information Network (SINET), WIDE/ARENA-PAC, SingAREN, Pacific Wave, Internet2, and TransPAC. We are in the process of updating the MOU to reflect needed additions by the partners. In addition, discussions are taking place with possible new MOU partners from AARNet, KISTI, REANNZ, and University of Hawaii.

4.B Collaborations with Partners

We continue to build collaborations with international partner organizations around the world. In Quarter 1 and 2, interactions included:

- **Asia Pacific Advanced Network (APAN)** - Schopf attended the APAN Board meeting and the team presented at the APAN meeting in February.
- **Arterial Research and Educational Network in Asia-Pacific (ARENA-PAC)** - Several discussions took place with Jun Murai, in addition to the APR meetings, about his plans for circuits in the Asia Pacific region and the planned Guam-Singapore Consortium 100G Circuit.
- **Australia's Academic and Research Network (AARNet)** - We met multiple times with AARNET to advance discussions on the possibility of partnering to procure R&E connectivity between Guam and Singapore as part of the Guam-Singapore Consortium 100G Circuit. We are also working with Warrick Mitchell of AARNET to establish a Routing Working Group at APAN and with the GNA-G.
- **FABRIC/FAB:** The FABRIC testbed is an adaptive programmable research infrastructure for computer science and science applications. FABRIC Across Borders (FAB) is the international component that will connect FABRIC to international testbeds and institutions doing experiments. Schopf and Addleman have attended a number of FABRIC meetings including the FAB kickoff meeting at which Schopf presented on TransPAC5. TransPAC has offered to support several of the international experiments and TransPAC engineers will work to make sure the end-to-end paths for the testbed are running smoothly.
- **Global Network Architecture Group (GNA-G)** - The GNA-G was created as a result of the merger of the Global Network Architecture (GNA) Technical Working Group and the Global Lambda Integrated Facilities (GLIF) group. We have submitted a proposal for a Routing Working Group that will work to identify and address routing anomalies.
- **Internet2** - Internet2 has been part of the APR discussions as well as part of the Guam-Singapore Consortium 100G Circuit discussions.
- **Korea Institute of Science and Technology Information (KISTI)** - We held discussions with KISTI regarding joining the APR partnership.
- **The National Institute of Information and Communications Technology (NICT)** - We met with NICT staff several times to discuss project goals and the APR. We are also working with NICT staff to update and sign a revised MOU.

- **National Institute of Informatics (NII)/ Science Information Network (SINET)**
We had several meetings with NII/SINET staff, primarily focused on the next steps for the APR.
- **Pacific Wave/CENIC** - We maintained a close collaboration with Pacific Wave, not only through our joint support of the TransPAC-PacWave 100G circuit but also through bi-weekly calls to coordinate activities to ensure that our services and resources are complementary. Pacific Wave have also been part of the discussions around the planned Guam-Singapore Consortium 100G Circuit, since traffic to and from the continental US will transit their network.
- **Research and Education Advanced Network New Zealand (REANNZ)** – We met with REANNZ staff multiple times to discuss joining the APR.
- **Singapore Advanced Research and Education Network (SingAREN)** - Francis Lee from SingAREN is a co-PI for the TransPAC5 project, and as such meets with the other PI's monthly. The TransPAC-PacWave 100G circuit is currently carrying traffic for SingAREN as they are in the process of replacing their old capacity. SingAREN is also a part of the Guam-Singapore Consortium 100G Circuit. The circuit is planned to land in Singapore on the Singapore Open Exchange (SOE) that is run by SingAREN.
- **University of Hawaii/GOREX** - We began discussions with the University of Hawaii to see if they would like to join the APR. GOREX is also the planned landing point for the Guam-Singapore Consortium 100G Circuit and they have been involved in the discussions. University of Hawaii will also carry traffic to and from the continental US for the consortium on the PIREN circuit between Guam, Hawaii, and California.

4.C Routing Working Group

In February 2021 at APAN51, Schopf held a Bird of a Feather session to discuss the need for a Routing Working Group within APAN. Network owners and users need to ensure data is moving over the R&E circuits correctly so that data transfers are performing well. Experience has shown that adding or removing capacity can have unexpected routing results that are difficult to detect automatically and impossible to correct without coordination. A channel was created on the APAN Slack instance and an email list was created.

At the end of February Schopf, Addleman, and Warrick Mitchel, AARNET, submitted a draft charter for a GNA-G working group as well.

4.D Science Engagement

TransPAC5 provides support for US researchers with projects and partnerships in the Asia Pacific region. We expect this work to grow over the next few quarters.

4.D.1 High Energy Physics

We participate in the LHCONE overlay network in support of LHC related computing centers in the US and Asia. TransPAC is an LHCONE Network Service Provider (NSP) and provides the connectivity between NICT and ESnet LHCONE VRFs across the TransPAC-PacWave 100G Circuit.

We are engaging with the LHCONe community as we look to create capacity between the Guam Open Exchange (GOREX) and the SingAREN Open Exchange (SOE), planned to be provided by the Guam-Singapore Consortium 100G Circuit. We are also engaged with LHCONe engineers to prepare for dry runs of the LHC's third run in March 2022. At the LHCONe meeting in Quarter 2, TransPAC staff discussed the future capacity needs of LHC and potential new measurement and monitoring solutions for LHC traffic.

4.D.2 Astronomy

TransPAC staff are part of an ongoing project to collect baseline network performance data from the eleven telescopes that are part of the Event Horizon Telescope (EHT) collaboration to the MIT Haystack observatory, that will be storing and processing the astronomical data. In Quarter 2, we began to work with the two EHT telescopes in Hawaii, the James Clerk Maxwell Telescope (JCMT) and Submillimeter Array (SMA) telescope. Work has been slow due to the project lead at Haystack having limited time to devote to this project.

4.D.3 Other Science Engagement

TransPAC also participates in several international science engagement and coordination projects including GEANT's Task Force on Researcher Engagement, the Pacific Research Platform, PRAGMA, and the Joint Engineering Team (JET).

5. Circuit Deployments and Technical Updates

The current TransPAC5 circuit diagram is shown in Figure 1.

5.A Technical Updates for the TransPAC-PacWave 100G Circuit

The TransPAC-PacWave 100G Circuit is a 100Gbps network connection between the Pacific Wave Exchange switches in Seattle and Tokyo. The connection is across the TATA TGN-N subsea cable.

During Quarter 1, there were no technical updates or changes made to the 100G TransPAC-PacWave circuit and associated equipment. The circuit is carrying traffic for SingAREN while they work to procure and install their new trans-Pacific circuits. Engineers from Pacific Wave, National Institute of Information and Communications Technology (NICT), and the National Institute of Informatics (NII) partnered with TransPAC to create this backup path for SingAREN.

The 5-year contract for the TransPAC-PacWave 100G Circuit ended October 31, 2020, but we have continued with a month-by-month contract. PNWGP is re-negotiating with Tata for the core service, at which point a new contract discussion will take place.

We have also begun evaluating the need for TransPAC owned equipment located in the Pacific Wave PoP in Seattle. With Pacific Wave's recent peering exchange switch/router upgrade, it may be possible to move all peerings directly between customers or on to the Pacific Wave exchange. Some details related to monitoring are still being evaluated.

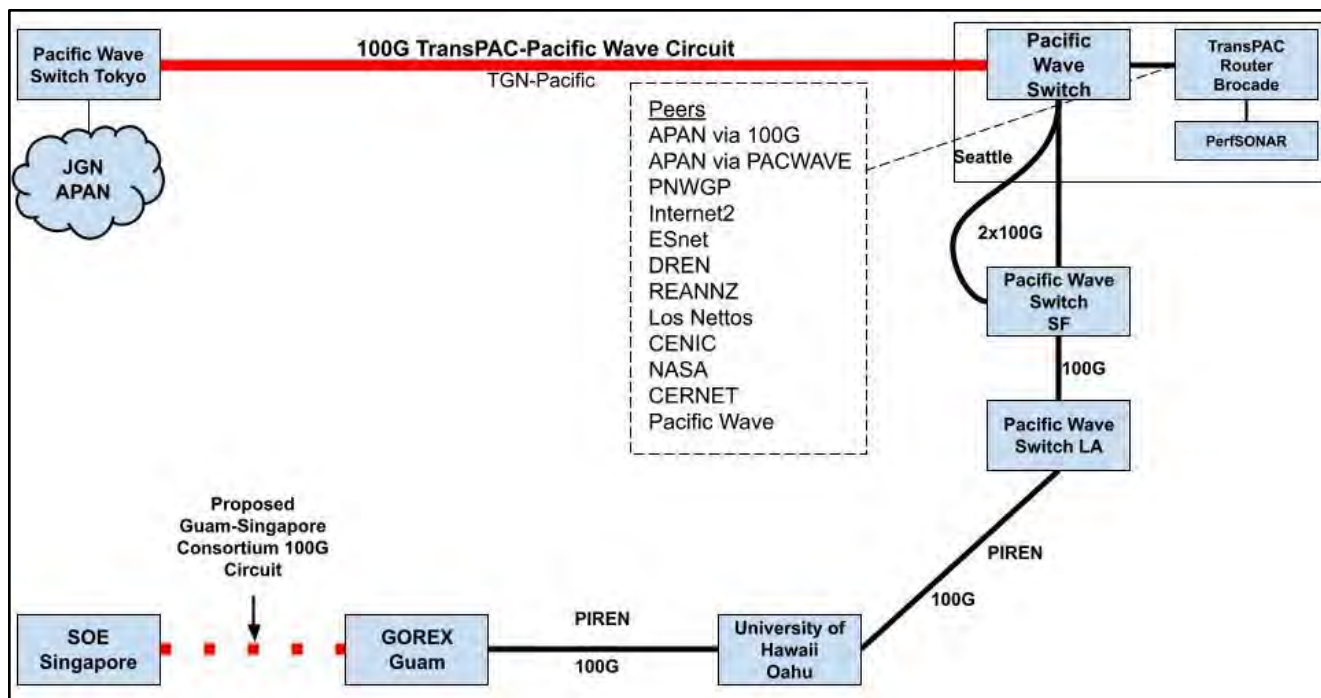


Figure 1: TransPAC5 circuit and peering diagram. Red links are supported by NSF TransPAC5 funding.

5.B New Capacity

We are participating in discussions for the planned Guam-Singapore Consortium 100G Circuit, which will be a shared 100G circuit between the Guam Open Exchange (GOREX) and the SingAREN Open Exchange (SOE). Internet2 has offered to hold the contract for a 15-year IRU with the circuit provider RTI. Then Internet2, TransPAC, ARENA-PAC, and AARNet will split the costs evenly, starting with the first 5-years. Partners will have the flexibility to leave during the contract if, for example, they no longer have funding. TransPAC5 would only sign a 5-year contract with Internet2 if this works out. CENIC/Pacific Wave, University of Hawaii, and SingAREN are also involved and plan to provide exchange point and network transit services.

As a first step in the Indiana University process to be part of this consortium, TransPAC released an RFP for 100G capacity between Guam and Singapore over 5 years on February 18, 2021, see Appendix A. The RFP responses were returned on March 17, and the estimated cost for the Guam-Singapore Consortium 100G Circuit was the lowest bid. When the Internet2 contract with RTI is in place, we will be able to sign our service contract with Internet2.

6. Circuit Status and Performance

For the TransPAC-PacWave 100G circuit we currently collect sampled flow data and SNMP data.

6.A. SNMP Traffic Graphs

Figures 2, 3, 4 and 5 show traffic on the TransPAC-PacWave 100G circuit during Quarter 1 and 2. Several changes in performance were seen:

- The traffic spike between 11/01/20 and 11/15/20 was the result of large transfers from JISC and SURF to the Chinese University of Hong Kong.
- The second spike seen between 02/15/21 and 03/01/21 represents heavy transfer activity between Academia Sinica Grid Computing Center and primarily Deutsches Forschungsnetz, but also includes traffic from other European entities as well.
- During Quarter 1, the National Library of Medicine transferred 169TB of data to the National University of Singapore, the City University of Hong Kong, and the Chinese University of Hong Kong. These transfers ended around January 16, 2021. This can be seen by the step down of traffic in Figure 4.
- In early March, Figure 5 shows a significant shift in traffic as well. Before this shift, there appears to have been a number of tests between the Academia Sinica Grid Computer Center in Taiwan and Simon Fraser University in the US. This traffic was bursty in nature and ended when the shift appeared. The month-to-month volume of data over this period remained consistent, indicating that what appear to be sustained, higher than normal values on the MAX utilization graph are in fact a series of short duration peaks which have been smoothed due to the six-month timeframe being displayed.

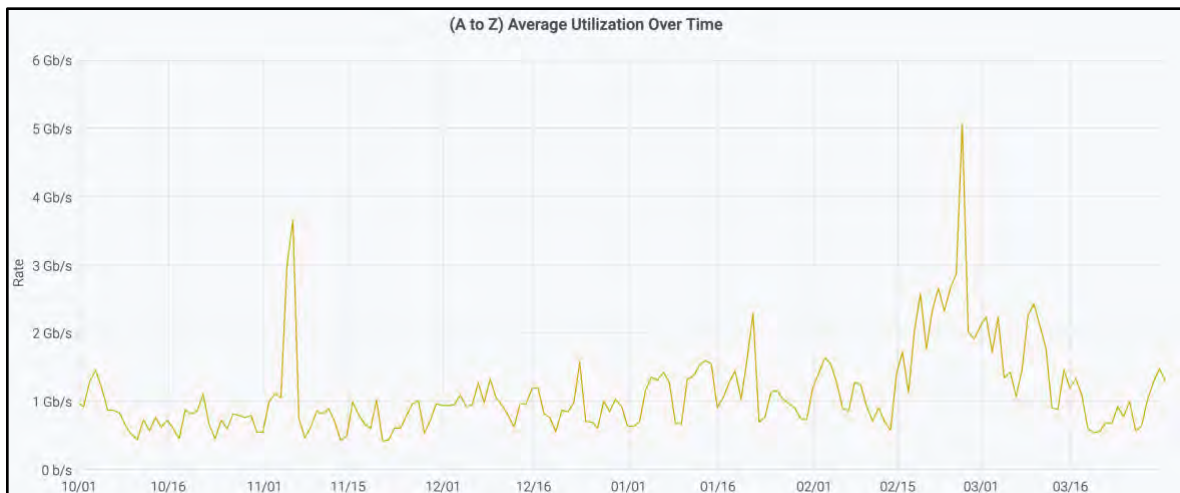


Figure 2: TransPAC-PacWave 100G circuit traffic from Seattle to Tokyo using smoothed average traffic rate of 1.1 Gb/s, 0:00:00 October 1, 2020 - 23:59:59 March 31, 2021. Graph can be found online at:

<https://portal.netsage.global/grafana/d/000000003/bandwidth-dashboard?orgId=2&from=1601524800000&to=1617249599000>

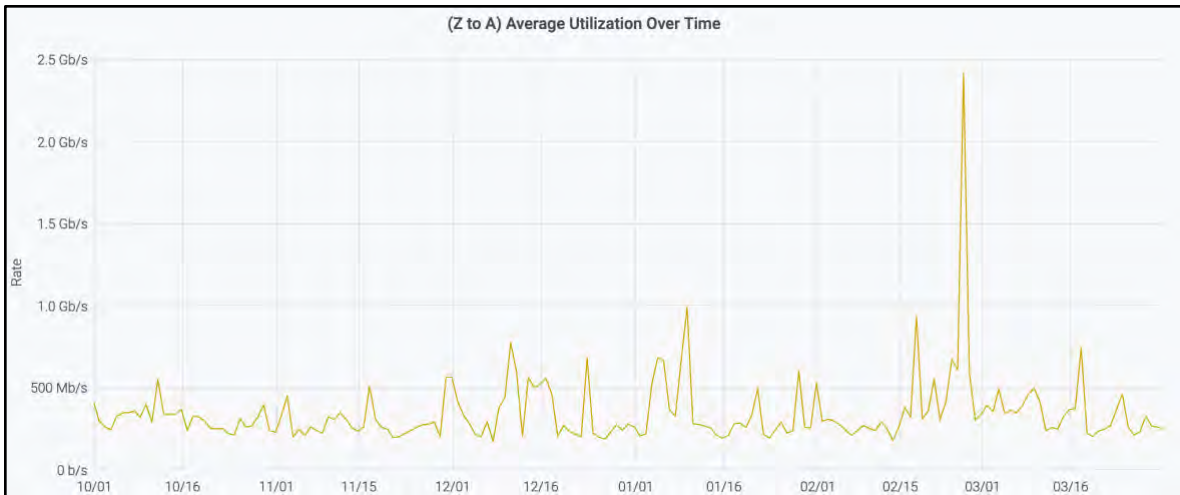


Figure 3: TransPAC-PacWave 100G circuit traffic from Tokyo to Seattle using smoothed average traffic rate of 341.1 Mb/s, 0:00:00 October 1, 2020 - 23:59:59 March 31, 2021. Graph can be found online at: <https://portal.netsage.global/grafana/d/000000003/bandwidth-dashboard?orgId=2&from=1601524800000&to=161724959000>

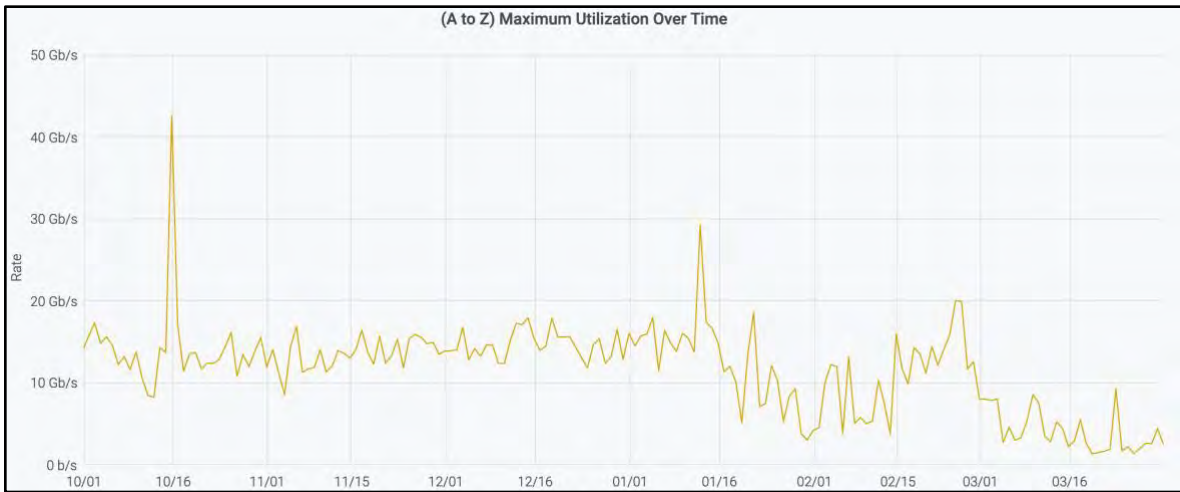


Figure 4: TransPAC-PacWave 100G circuit traffic from Seattle to Tokyo using maximum average traffic of 42.5 Gb/s, 0:00:00 October 1, 2020 - 23:59:59 March 31, 2021. Graph can be found online at: <https://portal.netsage.global/grafana/d/000000003/bandwidth-dashboard?orgId=2&from=1601524800000&to=161724959000>

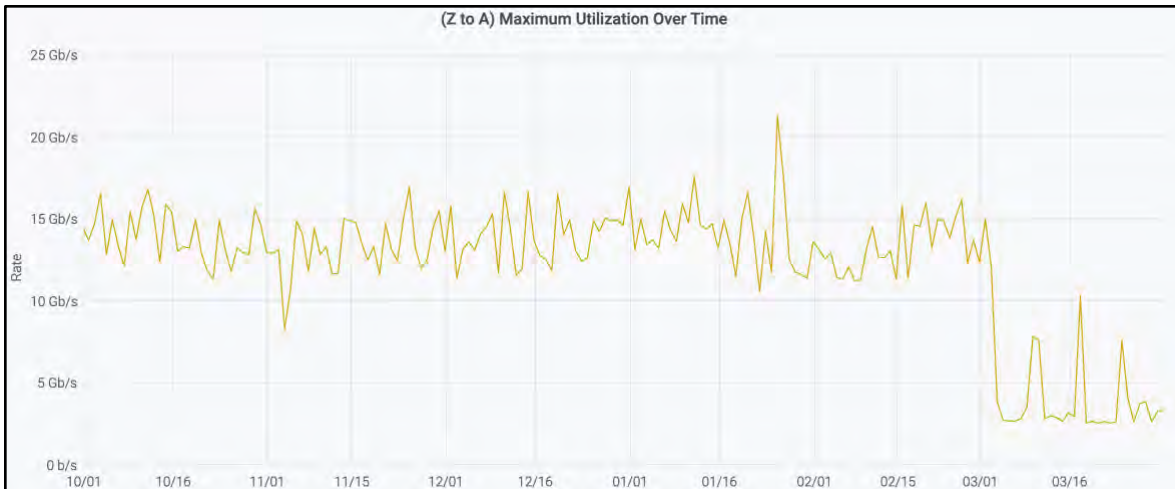


Figure 5: TransPAC-PacWave 100G circuit traffic from Tokyo to Seattle using maximum average traffic of 21.2 Gb/s, 0:00:00 October 1, 2020 - 23:59:59 March 31, 2021. Graph can be found online at: <https://portal.netsage.global/grafana/d/000000003/bandwidth-dashboard?orgId=2&from=1601524800000&to=1617249599000>

6.B SNMP Traffic Volume

Table 1 shows that almost 3 petabytes of data were transferred over the TransPAC-PacWave 100G Circuit during Quarter 1 and 2. The traffic volume increase seen in February is a result of the heavy transfer activity between Academia Sinica Grid Computing Center and primarily Deutsches Forschungsnetz mentioned in Section 6.A.

Table 1: Traffic in terabytes transferred over TransPAC links, October 1, 2020 - March 31, 2021.

Source-Destination	Oct	Nov	Dec	Jan	Feb	Mar	Total
Seattle-Tokyo	260.9	297.1	315.1	376.3	516.7	425.8	2,191.9
Tokyo-Seattle	103.8	91.6	116.2	118.2	129.1	112.4	671.3
Total	364.7	388.7	431.3	494.5	645.8	538.2	2,863.2

6.C Flow Data

The TransPAC-PacWave 100G Circuit collects sampled flow data. De-identified versions of this data are shared with the NetSage project.

6.C.1 Flows over the TransPAC-PacWave 100G Circuit

Figure 10 shows the Top Ten Talkers by source and Figure 11 shows this data by destination for the TransPAC-PacWave 100G circuit in Quarter 1 and 2. Table 2 shows the Top Talker pairs. The National Library of Medicine and the University of Chicago are the sources of half of the Top Talker pairs and are the top two sources by volume on the circuit, showing a continued strong interest in bio-medical data in the Asia-Pacific region. Transfers from Microsoft Corp and to Beijing Primezone Technologies, both cloud providers, in the Top 10 indicate a possible increase in cloud provider usage on the circuit. Astronomy traffic continues to be prevalent on the circuit as well, with transfers from NASA and the WIDE Project showing up in their typical top talker spots.

Source	Total Vol. ↓	Largest Flow	# Flows
National Library of Medicine	405.7 TB	625.2 GB	607.6 K
University of Chicago	150.8 TB	152.0 GB	224.9 K
Stanford University	145.1 TB	697.6 GB	219.6 K
University Corporation for Atmospheric Research	107.7 TB	634.3 GB	158.1 K
National Aeronautics and Space Administration	103.9 TB	999.5 GB	560.1 K
Jisc Services Limited	76.6 TB	422.1 GB	182.4 K
University of California at Berkeley	70.8 TB	738.4 GB	97.7 K
Microsoft Corporation	62.5 TB	84.3 GB	560.2 K
University of Hawaii	60.1 TB	74.5 GB	14.6 K
NOAA	50.3 TB	46.0 GB	266.5 K

Figure 10: Top Ten Sources on TransPAC-PacWave 100G circuits, 0:00:00 October 1, 2020 - 23:59:59 March 31, 2021. Graph can be found at: https://portal.netsage.global/grafana/d/xk26IFhmk/flow-data-for-circuits?orgId=2&from=1601524800000&to=1617249599000&var-Sensors=TransPAC%20Seattle%20sFlow&var-country_scope=All&var-is_net_test=no

Destination	Total Vol. ↓	Largest Flow	# Flows
City University of Hong Kong	225.7 TB	186.8 GB	468.5 K
China Education and Research Network Center	208.0 TB	2.2 TB	906.7 K
Chinese University of Hong Kong (The)	181.4 TB	289.5 GB	393.4 K
Academia Sinica	173.0 TB	422.1 GB	858.0 K
National University of Singapore	163.1 TB	286.5 GB	297.8 K
WIDE Project	121.2 TB	491.9 GB	281.7 K
A*STAR	96.4 TB	625.2 GB	264.8 K
Office of Info.Tech. Admin. for Educational Development	82.9 TB	388.3 GB	182.3 K
CERNET2 IX at Shanghai Jiaotong University	68.0 TB	279.3 GB	66.2 K
Beijing Primezone Technologies Inc.	53.5 TB	420.8 GB	649.3 K

Figure 11: Top Ten Destinations on TransPAC-PacWave 100G circuits, 0:00:00 October 1, 2020 - 23:59:59 March 31, 2021. Graph can be found at: https://portal.netsage.global/grafana/d/xk26IFhmk/flow-data-for-circuits?orgId=2&from=1601524800000&to=1617249599000&var-Sensors=TransPAC%20Seattle%20sFlow&var-country_scope=All&var-is_net_test=no

Table 2: Top Ten Flow Pairs on TransPAC-PacWave 100G circuits, 0:00:00 October 1, 2020 - 23:59:59 March 31, 2021. Graph can be found at: https://portal.netsage.global/grafana/d/xk26IFhmk/flow-data-for-circuits?orgId=2&from=1601524800000&to=1617249599000&var-Sensors=TransPAC%20Seattle%20sFlow&var-country_scope=All&var-is_net_test=no

Source	Destination	Total Vol. ↓	Largest Flow	# Flows
National Library of Medicine	National University of Singapore	134.2 TB	211.2 GB	110.6 K
University of Chicago	City University of Hong Kong	111.9 TB	55.2 GB	116.9 K
National Library of Medicine	A*STAR	78.6 TB	625.2 GB	99.1 K
Stanford University	China Education and Research Network Center	77.3 TB	385.7 GB	123.5 K
National Library of Medicine	City University of Hong Kong	76.2 TB	184.9 GB	77.1 K
National Library of Medicine	Chinese University of Hong Kong.(The)	61.1 TB	239.2 GB	144.0 K
University of Hawaii	WIDE Project	58.8 TB	52.9 GB	11.3 K
University Corporation for Atmospheric Research	Academia Sinica	50.3 TB	56.1 GB	28.4 K
National Aeronautics and Space Administration	CERNET2.IX at Shanghai Jiaotong University	39.1 TB	205.6 GB	2.4 K
Verein zur Foerderung eines Deutschen Forschungsnetzes e.V.	Academia Sinica Grid Computing Center	38.8 TB	12.7 GB	13.7 K

6.D Trouble Tickets

During Quarter 1 and 2, there were two scheduled maintenance events, shown in Table 4, and three unscheduled maintenance events and one brief unknown outage, shown in Table 5.

Table 4: Scheduled Maintenance for TransPAC equipment and circuits, October 1, 2020 - March 31, 2021.

Ticket Number	Cust Impact	Ntwk Impact	Title	Maint Type	Source Impact	Current State	Start Time (UTC)	End Time (UTC)	Duration
CHG 0046759	3-Mod	3-Mod	TransPAC SEAT-TOKYO	Software	Vendor	Closed	2020-10-22 05:27:45	2020-10-22 06:55:45	0 days 1 hr 28 min
CHG 0049444	3-Mod	3-Mod	TransPAC SEAT-TOKYO	Circuit	Vendor	Closed	2021-02-18 15:03:26	2021-02-18 15:46:01	0 days 0 hr 42 min

Table 5: Unscheduled Outages for TransPAC equipment and circuits, October 1, 2020 - March 31, 2021.

Incident Number	Cust Impact	Ntwk Impact	Title	Outage Type	Source Impact	Current State	Start Time (UTC)	End Time (UTC)	Duration
INC 0066726	2 - High	2 - High	TransPAC SEAT-TOKYO	Unann. Maint.	Vendor	Closed	2020-10-06 15:08:39	2020-10-06 16:01:41	0 days 0 hr 53 min
INC 0071221	2 - High	2 - High	TransPAC SEAT-TOKYO	Unann. Maint.	Vendor	Closed	2020-12-08 08:17:40	2020-12-08 12:05:00	0 days 3 hr 47 min
INC 0074598	4 - Low	2 - High	TransPAC SEAT-TOKYO	Undet	Vendor	Closed	2021-01-26 01:24:47	2021-01-26 01:24:48	0 days 0 hr 0 min

6.E Downtime and Availability

Table 6 lists the downtime for the project circuit for Quarter 1 and 2.

Table 6: Downtime and availability for TransPAC circuits, October 1, 2020 - March 31, 2021.

TransPAC Backbone Circuits	Down Time	Q 1 & 2 Availability
TP2-SEAT-TP-TOKY-100GE-01522 (100G TransPAC-PacWave circuit)	6 hr 50 min	99.83%

8. Security Events and Activities

IN@IU maintains a set of publicly available documents that detail the policies and procedures for security incidents that may occur during the life of the TransPAC project. These documents were developed during the TransPAC4 project collaboratively with Trusted CI and are updated and reviewed at least quarterly. The full set of documents can be found online at <https://internationalnetworks.iu.edu/about/policies.html>

IN@IU also contracts with the GlobalNOC to manage and secure all network and server hardware owned by the TransPAC project. This mitigates risk of missing a critical patch while our small team is traveling and allows the GlobalNOC's security hardening policies to be fully enforced. IN@IU as part of the Indiana University (IU) system has access to and implements recommendations and requirements outlined by IU's security policies.

There were no security incidents to report in Quarter 1 or 2.

9. Milestones and Progress

Table 7 shows the Work Breakdown Structure for the full project timespan of five years. Table 8 details the Year 1 deliverables. Both of these were submitted as part of the Project Execution Plan.

Table 7: TransPAC5 Work Breakdown Structure Dictionary with status updates for Quarter 1 and 2.

	Summary	Related to Y1 goal	Status
1	Planning / Coordination		
1.1	Establish and support APR coordination	G3	In progress Q1-2 - email list and slack instance created - see Section 4.A
1.2	Revise APR MOU	G3	In progress Q1-2 - see Section 4.A
1.3	Invite additional partners to APR	G3	In progress Q1-2 - see Section 4.A
1.4	Coordination with APR	G3	In progress Q1-2 - see Section 4.A
1.5	Work with partners for Arctic Connect circuit	G4	Planned Year 3
1.6	Additional MOUs	G4	Ongoing- Renewing NICT MOU - see Section 4.A
1.7	Coordinate with FABRIC for experiment support	G5	In progress - see Section 4.B
1.8	General project management		Ongoing
1.9	Project Reporting		Ongoing
1.10.	Documentation and dissemination of best practices as appropriate		Planned Year 2
1.11	Attend domestic and international conferences as feasible		Ongoing - TransPAC staff virtually attended 13 conferences, meetings, or workshops
2	Operations		
2.1	Evaluate circuit capacity and community needs	G1, G2	Ongoing
2.2	Renew current Seattle-Tokyo 100G circuit	G1	Ongoing - new contract expected in Year 2
2.3	Continued operation of Seattle-Tokyo 100G Circuit	G1	Ongoing - see Section 5.A
2.4	RFP and evaluation for Guam-Asia circuit	G2	RFP issued February 2021, responses March 2021- see Section 5.B and

			Appendix A
2.5	Continued operation of Guam-Asia circuit(s)	G2	Waiting on contracting
2.6	Evaluate and update existing POPs and equipment	G1, G2	Ongoing - see Section 5.A
2.7	Work with APR partners to ensure redundancy/availability of links	G3	Waiting on MOU signing
2.8	Update NetSage data collection from TransPAC4	G1, G2	No change from TransPAC4 until new capacity in place
2.9	Add additional data to TP5 dashboards for APR partners	G3	Waiting on MOU signing
2.10.	Continued evaluation and updates to NetSage as appropriate for project	G3	Ongoing
2.11	Evaluate and set-up peerings with partner networks	G1, G2	Ongoing
2.12	Support for partial bandwidth experiments	G5	Planned Year 2
2.13	Support for full bandwidth experiments	G5	Planned Year 2
2.14	Support for route anomaly detection and resolution		In progress - This will be part of the Routing Working Groups charter.
2.15	Deploy and Support BGP resource public key infrastructure (RPKI)		Planned Year 2
3 Outreach			
3.1	Ensure connectivity in support of the Large Hadron Collider	G6	Ongoing - see Section 4.C1
3.2	Analyze genomics traffic and support as effort permits	G6	Planned Year 2
3.3	Analyze geoscience traffic and support as effort permits	G6	Planned Year 2
3.4	Analyze astronomy traffic and support as effort permits	G6	Ongoing - see Section 4.C.3
3.5	Evaluate top talkers for inclusion in NetSage science registry		Planned Year 2

3.6	As time permits, work with large data transfer end users to improve performance	G6	Planned Year 2
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Table 8: TransPAC5 Submitted Goals for Year 1, with status updates for Quarter 1 and 2.

Y1 GOALS	Objective	WBS #	Status
Goal 1	100G Seattle-Tokyo transitioned to TransPAC 5 support by 31 October 2020		
MS 1.1	Extend current 100G circuit contract for 100G between Seattle and Tokyo with PacWave/PNWGP for 5 years (life of project)	2.2	Ongoing - Currently month to month contract with Pacific Wave while they negotiate with TATA. New contract expected in Year 2.
MS 1.2	Extend contracts for Seattle colocation and port fees	2.2,2.3	Currently month to month contract with Pacific Wave while they negotiate with TATA. New contract expected in Year 2.
MS 1.3	Ensure continuation of Tokyo port support with WIDE	2.2,2.3	Currently month to month contract with Pacific Wave while they negotiate with TATA. New contract expected in Year 2.
MS 1.4	Put in place GNOC contract to start with deployment	2.2	Completed - January 1, 2021 but currently paid by TransPAC4
MS 1.5	Update full NetSage infrastructure for 100G circuit from TP4 set up from previous IRNC deployment to GlobalNOC NetSage Managed Service	2.1	On hold until current IRNC NetSage funding ends.
Goal 2	Capacity between Guam and Asia		
NOTES	Plans for connectivity from Guam is now to work jointly with an Asian consortium led by Jun Murai for 100G capacity (IRU) for Guam-Singapore. Meanwhile,	2.4, 2.5	

	maintaining some of the current Guam-HK capacity in place until that is stable. If the 100G IRU capacity is not in place by mid year 2, we will run an RFP for a 10G&100G capacity between Guam and Asia for a 2+2 year contract		
MS 2A.1	Evaluate options with Asian partners for a 100G IRU	2.4	In progress - see Section 5.B
MS 2A.2	Issue RFP for 10 and 100g connections between Guam and Singapore, Hong Kong, and Daejong for comparison purposes		Completed - RFP issued - see Appendix A. Process ended on March 18 2021. Internet2 picked as awardee.
MS 2A.3	Put in place contract to support 5 years of consortium capacity (Note: NOC and CoLo support will no longer be the responsibility of TP5 for this link)	2.4	In progress - waiting on Internet2 Contract
MS 2A.4	Put in place peering agreements for new capacity		On hold until circuit is live
MS 2A.5	Shift current Guam-HK traffic to new circuit as appropriate		OBE - TransPAC4 Guam-HK circuit will be decommissioned before new capacity is in place.
MS 2A.6	Update full NetSage infrastructure from TP4 set up from previous IRNC deployment to GlobalNOC NetSage Managed Service		On hold until circuit is live
MAS 2B.7	If IRU is not functional by June 2021, renew HK colocation and port agreements to continue Guam-HK connectivity (Note: CoLo in HK only available in 12 month increments)		Decision to decommission TransPAC4 Guam-HK circuits was made previously.

MS 2B.8	If IRU is not functional by December 2021, issue request for quotes for one 10G or 100G leased circuit between Guam and endpoint TBD	2.4	On hold until December 2021
MS 2B.9	Put in place contracts for capacity		In progress - to be completed in Quarter 4 - see Section 5.B
MS 2B.10	Ensure GNOC support for supported contracts and timing		OBE - Internet2 will support his, no separate NOC contract needed for TransPAC5
MS 2B.11	Deploy, test and accept circuit		OBE - Internet2 will support his, no separate NOC contract needed for TransPAC
MS 2B.12	Update measurement and monitoring support for capacity		On hold until the circuit is live.
MS 2B.13	Update peerings and traffic mapping		In progress - Discussing with the partner technical contacts
Goal 3	Asia Pacific Ring (APR) partner set-up by 31 April 2020		
MS 3.1	Contact partners to begin set up of structure	1.1	In Progress - see Section 4.A
MS 3.2	Write new APR MOU draft for partner signing	1.2	In progress - see Section 4.A
MS 3.3	Sign new APR MOU- in person	1.2	On hold
MS 3.4	Sign new APR MOU- virtual	1.2	On hold until MOU is finalized
MS 3.5	Set up regular policy meeting	1.1	On hold until signing takes place
MS 3.6	Set up regular engineering meetings	1.1	On hold until signing takes place
MS 3.7	Set up collaborative space	1.1	Google drive space and slack channel have been set up
MS 3.8	Initial conversations with APR partners to share data via NetSage	1.1, 1.4, 2.10	On hold until signing takes place
MS 3.9	SNMP additions to APR NetSage	1.1, 1.4, 2.10	On hold until signing takes place

MS 3.10	Flow additions to APR NetSage	1.1, 1.4, 2.10	On hold until signing takes place
Goal 4:	Additional partner support by August 2021		
MS 4.1	Define new MOU with APAN with specific deliverables	1.6	Planned for Year 2
MS 4.2	Sign new APAN MOU in person	1.6	On hold- COVID
MS 4.3	Sign new APAN MOU virtually	1.6	Planned for Year 2
MS 4.4	Define new MOU with TEIN with specific deliverables	1.6	Planned for Year 2
MS 4.5	Sign new TEIN MOU in person	1.6	On hold- COVID
MS 4.6	Sign new TEIN MOU virtually	1.6	Planned for Year 2
Goal 5	Establish infrastructure for external experimental support by February 2021		
MS 5.1	Discussions with FABRIC to understand detailed requirements	1.7	In progress - see Section 4.B
MS 5.2	Support for FABRIC	1.7	In progress - see Section 4.B
MS 5.3	Put in place tech for larger bandwidth blocks for experiments	2.13	On hold - specialized technology may not be needed.
MS 5.4	Advertise small BW support	2.12	In progress - Will advertise in conjunction with the APR and RWG
MS 5.5	Advertise larger BW blocks	2.13	In progress - Will advertise in conjunction with the APR and RWG
Goal 6	Establish limited science support by December 2020		

MS 6.1	Let LHCONE know of reduced support, plan for 3rd party involvement	3.1	In Progress - see Section 4.D.1
MS 6.2	Contact Astronomy collaborators (ALMA, e-VLBI, MAST) and plan support, including check-in frequency	3.4	In Progress - see Section 4.D.3
MS 6.3	Contact Bioinformatics (A-STAR, SDMS, HGB) and plan support, including check-in frequency	3.2	Planned for Year 2
MS 6.4	Contact Science Support listed in proposal and let them know the effort was cut	3.6	In progress
MS 6.5	LHCONE support	3.1	In progress - see Section 4.D.1
MS 6.6	Astronomy support	3.4	In progress - see Section 4.D.3
MS 6.7	Bioinformatics support	3.2	Planned for Year 2