

America Connects to Europe (ACE) (SCI - 0962973) Quarterly Report 1-March-2014 through 31-May-2014

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(Prepared by Alice Jackson, Jennifer M. Schopf)

Summary

During the quarter of March 1, 2014 through May 31, 2014, the America Connects to Europe (ACE) project continued its collaborative and engineering activities to support international research. This report outlines collaborations, software and systems work, operational activities, and usage statistics for the project. Highlights include senior network engineer, Brent Sweeny awarded the 2014 Internet2 President's Leadership Award; PI, Jennifer Schopf investigating opportunities to collaborate with University of Hawaii and with Woods Hole Oceanographic Institute; and ongoing work to support application use of 100G trans-Atlantic testbeds.

1. ACE Overview

The America Connects to Europe (ACE) project supports a series of circuits and services between the US East coast and Europe. In the current set up, these circuits are:

- Three 10G circuits between WIX (McLean, VA) and Frankfurt. These circuits are lagged together and load balanced for performance, and sometimes they are reported on as a single unit. Two of these links are funded by NSF, the third is an in-kind contribution by GEANT.
- Three 10G circuits between MAN LAN (New York City) and Amsterdam. These circuits are lagged together and load balanced for performance, and sometimes they are reported on as a single unit. One of these links is funded by NSF, the other two are in-kind contributions by GEANT.
- One 10G circuit between Paris and New York to connect Internet2's ION service to GEANT's AutoBAHN service and provide bandwidth on demand services for researchers. This circuit is fully funded by GEANT.
- One 10G circuit between StarLight in Chicago and Amsterdam for use in SDN experiments. This circuit is fully funded by NSF.

These circuits are used in production to support a wide variety of science applications, including but not limited to physics (LHC), astronomy (e-VLBI), and biomedical research (GENIUS). In addition, through a supplement to the award, the ACE project is now directly supporting application use of 100G testbeds and tool development for 100G links. Overall, this award supports tool development, software defined networking (SDN) experimental work, and measurement and security activities.

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

2. Staffing

Prior to this quarter, project staff consisted of:

- Jennifer Schopf, Director
- Andrew Lee, primary ACE senior network engineer (50%)
- Arvind Gopu, application support staff (50%)
- Abinahav Thota, 100G Lustre support (50%)
- Robert Henschel, 100G consultant in IU Research Technologies (10%)
- Dan Doyle, International and 100G PerfSonar support (25%)
- Michael Johnson, International and 100G PerfSonar support (25%)
- Scott Chevalier, primary contact for GlobalNOC support desk (25%)
- Alice Jackson, administration (5%)
- Dale Smith, network consultant (5%)

We are currently in negotiations to increase Lee to a full time staff member for the International group, in part as a replacement to John Hicks, who left in January 2014.

3. Collaborations, Travel, and Training

ACE staff continued to grow collaborations in Europe over the quarter with the goal of better understanding collaborative science use of the ACE links and supporting use of emerging network technologies.

Schopf, Sweeny, and Smith participated in the Internet2 Global Summit meeting held in Denver, Colorado (April 6 – 10). Sweeny was presented with the 2014 Internet2 President's Leadership Award. Sweeny and Schopf attended the Jet meeting that was held concurrent to the Global Summit meeting. Schopf ran a panel session entitled "Real Use of 100G Networks: The Good, the Bad, and What to Expect When You Go Beyond a Demo." Various side meetings took place to discuss support of TransPAC. In addition, there was a focused meeting on setting up an international end-to-end testing and support service with ESnet and Internet2, with ongoing conversations to follow.

Schopf met with Jason Leigh at University Hawai'i Manoa (April 24-25), to discuss opportunities related to visualizing monitoring data related to international network measurements. While there, she also discussed collaboration opportunities with David Lassner and Gwen Jacobs. In addition, Alan Winery spent an hour getting her up to speed on his work with using inexpensive nodes for perfSonar data collection, which is of interest to several European and African possible partners for ACE going forward.

Schopf presented at the CC:NIE PI workshop held April 30 – May 1 on the Role of Campus Infrastructure in International Science Projects.

May 23 – May 24, Schopf visited her previous collaborators at the Woods Hole Oceanographic Institution to investigate the possibility of collaborating over the use of TransPAC and ACE links for better data transfers for large scale oceanographic and climate data sets. Part of this discussion also included gauging their interest for an upcoming Internet2/ESnet Cross Connect meeting on International Climate Science, to take place in June, which members of ACE are helping to plan. The work with WHOI is ongoing.

Sweeny and Schopf attended the TERENA Networking Conference (TNC2014) in Dublin, Ireland (May 17-22). This meeting primarily focuses on European networks, and held substantive conversations with many of our European colleagues. Sweeny presented his work in BGP Path Hinting. Additional conversations with ESnet took place defining their upcoming plans for 100G trans-Atlantic circuits in the near future.

Arvind Gopu attended the Globus Online conference held at Argonne National Laboratory (April 15-17). This proved to be an excellent opportunity to discuss potential tests using the Globus Online protocol (pending hardware availability) but also a chance to listen to talks by leaders in the scientific community about their projects including data transfer and networking needs.

4. Software and Systems Work

A. Tool Development

The development of GlobalNOC tools, funded in small part by ACE, continued this quarter with patches and upgrade to existing tools. No new tools were developed.

Negotiations continue with Internet2 as to the costs and conditions of placing the Ixia tester at ManLan. If this matter is not resolved in the next quarter we will explore alternative plans.

As part of the larger PerfSONAR development team, Doyle and Johnson worked on testing and documenting new releases of the toolkit. The IU team also has shifts for the "Person of the Week", whose function is to be responsible for monitoring the various user support lists and ensuring that a response is given in a timely manner, whether escalating to others developers or handling the question personally. Some development work provided fixes to bugs and enhancements to visualizations in the UI to support 3.4.1 release of perfSONAR.

On the Lustre over 100G side, we continued testing with the hosts in Aachen and Dresden, but on their regular research network. Dresden had to return their borrowed hardware, leaving us without the clients to use the 100G link. We selected BLASTN as the example application and worked on understanding its behavior and I/O needs. Work is ongoing and we hope to have some initial numbers for comparison in the next reporting period.

B. Software Defined Networking (SDN) Activities

Currently, the ACE network supports SDN and OpenFlow as part of our partnership with Internet2 and GÉANT. There is currently an Inter Domain Controller (IDC) at MAN LAN, which makes it possible to create dynamic circuits through MAN LAN using OSCARS. This will enable us to provide Layer 2 Virtual Circuits dynamically instead of relying on static services. US researchers using the Internet2 ION facility are able to create dynamic circuit to Europe using the ACE networks.

C. Measurement Activities

Despite best efforts on the US side, a maddash of ACE traffic using the new combined PerfSONAR release was not possible in time for the TERENA due to political issues within GEANT. The hope is that this will be up in place over the next quarter.

Conversations continue with Internet2 and DANTE/GEANT to collect flow data on the ACE links. On the Internet2 side, we are dealing with strong concerns about the privacy

of the data, even though it will be anonymized. On the EU side, they are still putting in place the proper collectors but have agreed to share some data as soon as their systems are fully in place.

D. Application Support over 100G

Arvind Gopu (and other colleagues from IU Research Technologies) attended the Globus Online conference, which resulted in a possible project with the Globus Online team to investigate the use of 100G networks and potential tests using the Globus Online protocol (pending hardware availability). In addition, new contacts were made with several projected to use Globus Online internationally to meet their data transfer and networking needs. Foremost among these were Michael Sullivan (Internet2) who indicated an interest in exploring if the ICT-BioMed project could collaborate with us.

Conversations continue with:

- DANTE/Belle2
- LHCONE
- PanSTARRs

Leads that have not resulted in an ongoing collaboration this quarter include:

- Ongoing discussions with Open Science Grid and Europe, conversations with Rob Quick about a couple of groups he works with out of Europe have resulted in the discovery that the EU end of the link did not have 10G+ network needs.
- LIGO discussions that began in October 2013, who then put us in touch with Stuart Anderson resulted in no response after 4 pings
- Blue Brain project (Felix Schurmann) – initial contact at SC'13, no response after 4 pings

The International Center for Advanced Internet Research (iCAIR) at Northwestern University and its partner organizations have utilized the ACE Link between the StarLight International/National Communications Exchange Facility in Chicago, Illinois and the NetherLight facility in Amsterdam, Netherlands. This layer 2 10 Gbps path supported multiple projects during the quarter – details will be included in the final report.

5. Operational Activities

A new Customer Service project was generated to assist with post-mortem analysis and allow for better tracking of staff communications of complex troubleshooting events. This project is aimed at continuous improvement of service processes.

During this period a contractual agreement was reached with a local and international vendor (TATA communications and Internet2) to provide better support for hardware services overseas.

The Service Desk also performed a Disaster Recovery exercise to showcase the versatility of the support mechanisms in place. During this exercise the service Desk and Engineering relocated services without disruption to support.

A. Circuit Procurement

No new circuits were procured during this period.

B. Traffic Graphs

Figures 1 and 2 shows the aggregated traffic for the three 10G circuits from WIX to Frankfurt. The circuits are lagged together to create a total capacity of 30Gbps. Figures 3 and 4 show the aggregated traffic for the three 10G circuits from MAN LAN to Amsterdam. The circuits are lagged together to create a total capacity of 30Gbps.

In addition to these 4 circuits, ACE supports two other circuits. The New York to Paris link is funded by the GEANT project to support Internet2's ION service to GEANT's AutoBAHN service, and Figures 5 and 6 shows that traffic. The third is a link from Chicago to Amsterdam, which is used as a test-bed for SDN. The usage of the Chicago to Amsterdam link consisted of lightpaths for many diverse projects involving US-funded and Europe-funded projects. The VLAN assignments on this link are presented in Appendix A. Traffic information for this link is not available.

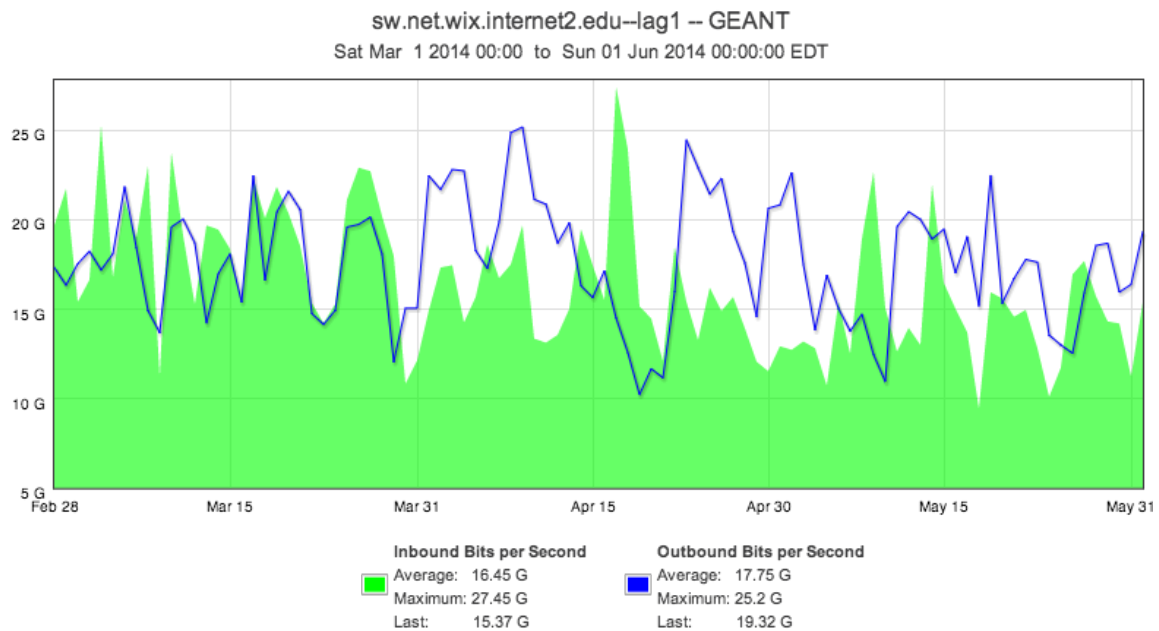


Figure 1. Aggregated traffic using maximum daily values on the 30G Lag between WIX and Frankfurt for March 1, 2014 through May 31, 2014.

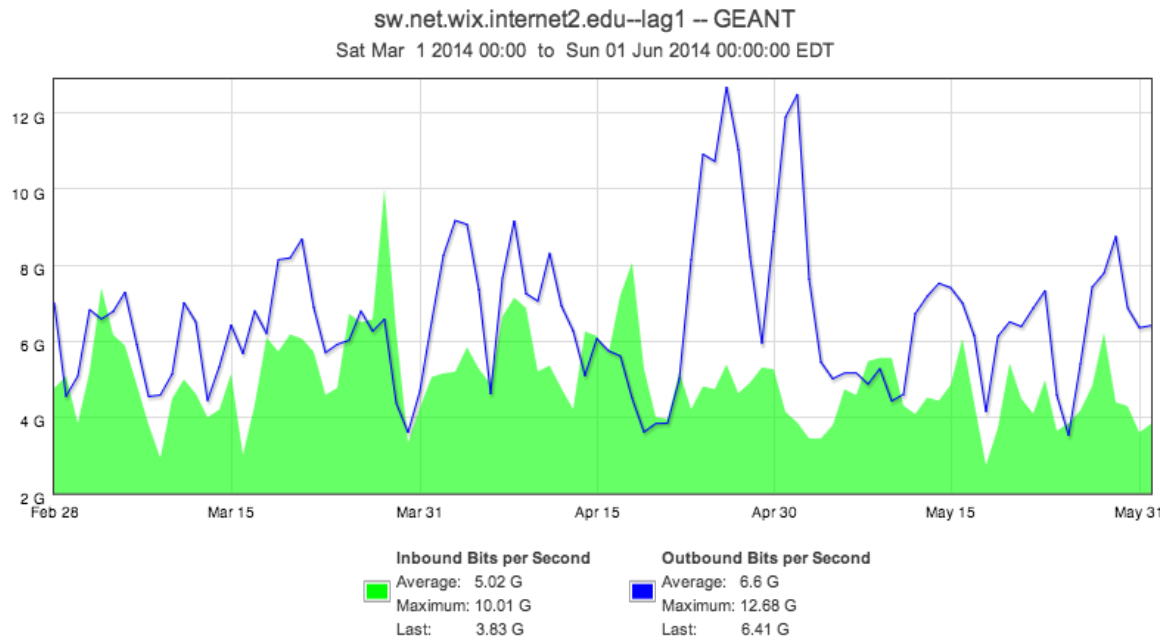


Figure 2. Aggregated traffic using smoothed average daily values on the 30G Lag between WIX and Frankfurt for March 1, 2014 through May 31, 2014.

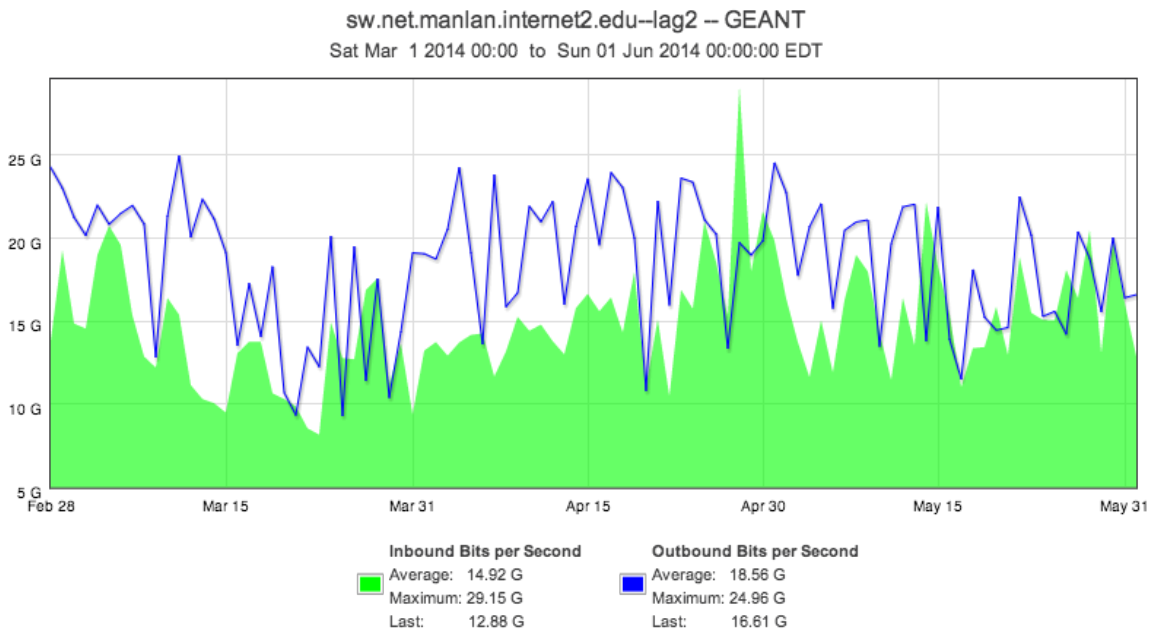


Figure 3. Aggregated traffic using maximum daily values on the 30G Lag between MANLAN and Amsterdam for March 1, 2014 through May 31, 2014.

sw.net.manlan.internet2.edu-lag2 -- GEANT
 Sat Mar 1 2014 00:00 to Sun 01 Jun 2014 00:00:00 EDT

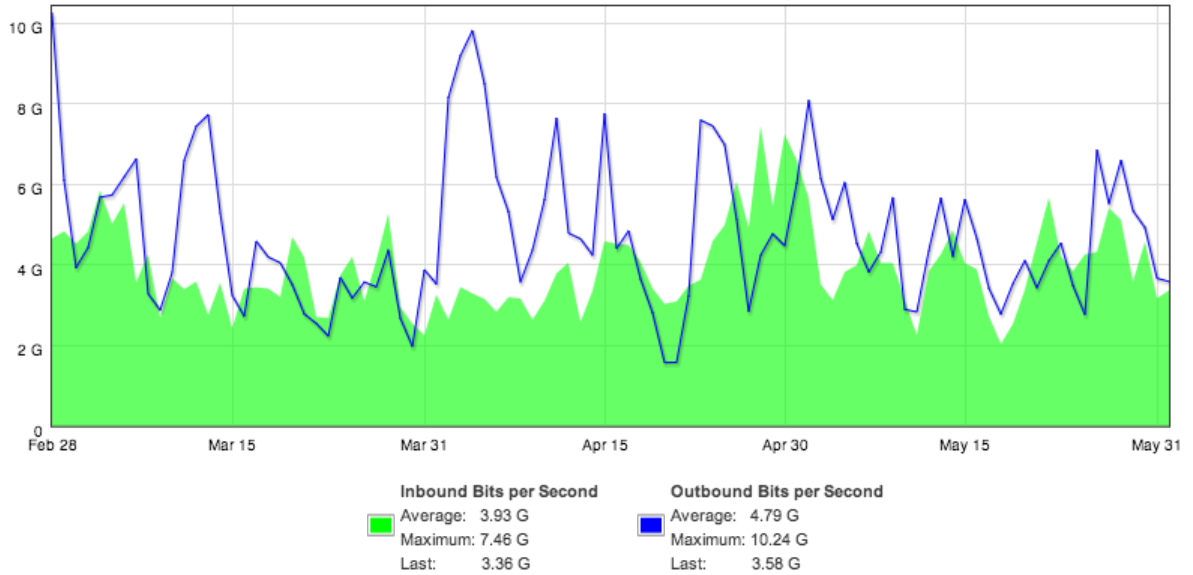


Figure 4. Aggregated traffic using smoothed average daily values on the 30G Lag between MANLAN and Amsterdam for March 1, 2014 through May 31, 2014.

net.manlan.internet2.edu-ethernet1/6 -- GEANT provided circuit to Paris | MAN-NEWY32AOA-PARIS-10GE-01
 Sat Mar 1 2014 00:00 to Sun 01 Jun 2014 00:00:00 EDT

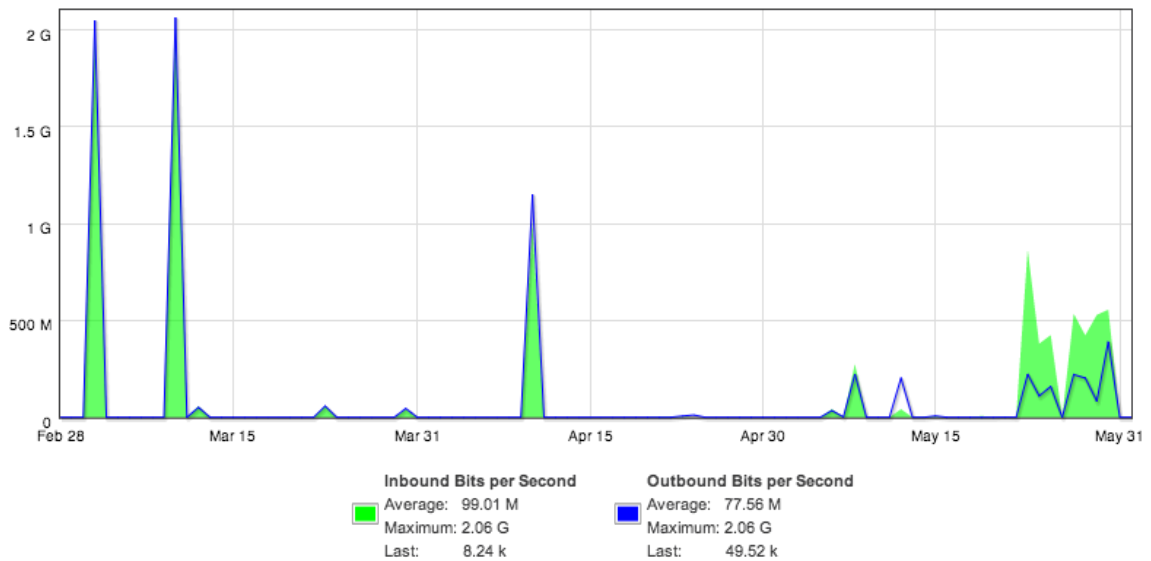


Figure 5. Aggregated traffic using maximum daily values on the 10G circuit between New York and Paris for March 1, 2014 through May 31, 2014. Please note the units on the Y-axis.

Sat Mar 1 2014 00:00 to Sun 01 Jun 2014 00:00:00 EDT

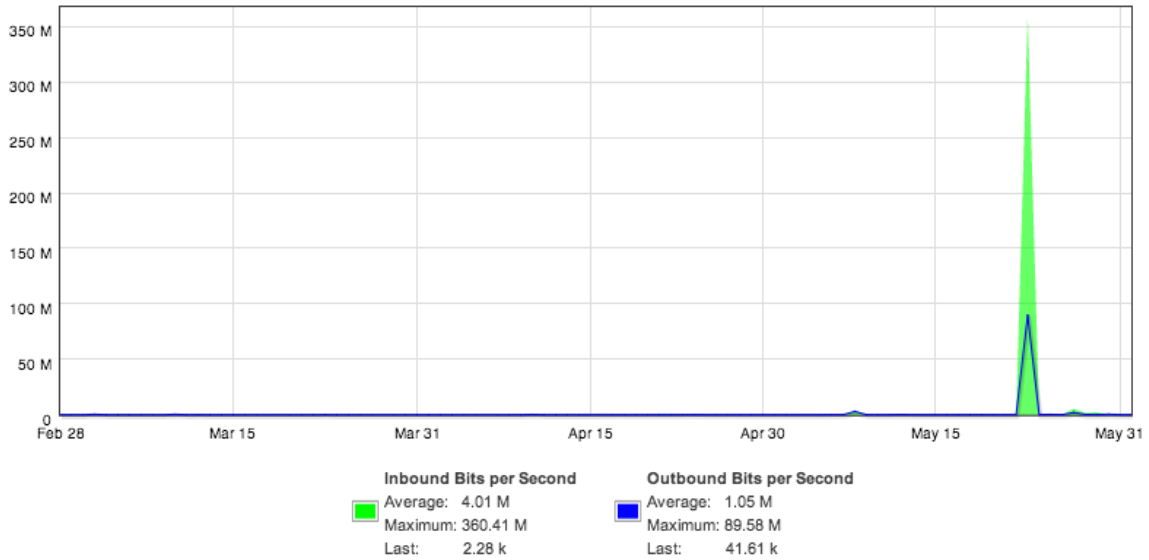


Figure 6. Aggregated traffic using smoothed average daily values on the 10G circuit between New York and Paris for March 1, 2014 through May 31, 2014. Please note the units on the Y-axis.

C. Trouble Tickets

During this quarter, there were 9 tickets for unscheduled maintenance, detailed in Table 1, and 7 tickets for scheduled maintenance, detailed in Table 2. Additional trouble ticket information is available at

https://tick.globalnoc.iu.edu/fp_tools/public_ticket_viewer/index.cgi .

Two unscheduled outages of note. First: “GLOBAL-ACE-WIX-O192-01504” (ticket 330:127) suffered a long stint of downtime close to 36 hours. The service eventually recovered but attempts to inquire with the vendor/customer did result in a full explanation for the outage. Repeated attempts were made to acquire reasons for outages (RFOs), which is common practice. Second: A 12 hour outage was experienced on “GLOBAL-ACE-MANLAN-O192-01505” (ticket 350:127) due to a faulty patch cable in the customer’s location which took extended time to isolate.

Unscheduled Outages Summary

Ticket Number	Customer Impact	Network Impact	Title	Outage Type	Source Of Impact	Start Time (UTC)	End Time (UTC)
317	3-Elevated	3-Elevated	Outage Resolved - ACE Backbone Circuit GLOBAL-FRK-WASH2-10GE-01507 and GLOBAL-ACE-WIX-O192-01502	Unannounced Maintenance	Vendor	03/05/2014 6:56 AM	03/05/2014 11:45 AM
318	3-Elevated	3-Elevated	Stability - ACE Backbone Circuit GLOBAL-ACE-WIX-O192-01502	Undetermined	Vendor	03/05/2014 9:28 AM	03/05/2014 12:04 PM
327	3-Elevated	3-Elevated	Brief Outage - ACE Customer GEANT Circuit GLOBAL-ACE-WIX-O192-01502	Undetermined	Internal	03/20/2014 3:36 PM	03/20/2014 3:41 PM
330	3-Elevated	3-Elevated	Availability - ACE Customer GEANT Circuit GLOBAL-ACE-	Undetermined	Internal	03/28/2014 3:54 PM	03/30/2014 5:35 AM

			WIX-O192-01504				
332	3-Elevated	2-High	Outage Resolved - ACE Backbone Circuit GLOBAL-ACE-MANLAN-O192-01500	Circuit - Damaged Fiber	Vendor	03/31/2014 10:01 PM	04/01/2014 4:11 PM
334	3-Elevated	3-Elevated	Availability - ACE Customer GEANT Circuits GLOBAL-ACE-MANLAN-O192-01501 and GLOBAL-ACE-MANLAN-O192-01505	Undetermined	Internal	04/03/2014 9:01 PM	04/03/2014 9:47 PM
350	3-Elevated	3-Elevated	Availability - ACE Customer GEANT Circuit GLOBAL-ACE-MANLAN-O192-01505	Undetermined	Internal	05/06/2014 1:09 PM	05/07/2014 2:21 AM
356	3-Elevated	3-Elevated	Outage Resolved - ACE Customer GEANT Circuit GLOBAL-ACE-WIX-O192-01502	Circuit - Damaged Fiber	Internal	05/16/2014 7:02 AM	05/16/2014 2:41 PM
361	3-Elevated	3-Elevated	Outage Resolved - ACE Customer GEANT Circuit MAN-NEWY32AOA-PARIS-10GE-01618	Unannounced Maintenance	Internal	05/21/2014 10:04 PM	05/22/2014 3:02 AM

Table 1. Unscheduled maintenance tickets for the ACE circuits, March 1, 2014 – May 31, 2014.

Scheduled Maintenances Summary

Ticket Number	Customer Impact	Network Impact	Title	Maintenance Type	Source Of Impact	Start Time (UTC)	End Time (UTC)
314	3-Elevated	2-High	Maintenance Completed - ACE Backbone Circuit GLOBAL-ACE-MANLAN-O192-01500	Circuit	Vendor	03/06/2014 12:17 AM	03/06/2014 3:02 AM
322	3-Elevated	2-High	Maintenance Completed - ACE Backbone Circuit GLOBAL-ACE-MANLAN-O192-01500	Circuit	Vendor	03/22/2014 12:18 AM	03/22/2014 5:11 AM
308	3-Elevated	3-Elevated	Maintenance 2 of 2 Completed - ACE Backbone ACE-AMS-STAR-10GE-01622	Circuit	Vendor	03/22/2014 7:22 AM	03/22/2014 7:54 AM
333	3-Elevated	2-High	Emergency Maintenance Completed- ACE Backbone GLOBAL-ACE-WIX-O192-01502	Circuit	Vendor	04/01/2014 10:13 PM	04/02/2014 12:39 AM
319	3-Elevated	3-Elevated	Maintenance Completed 1 of 2 - ACE Backbone ACE-AMS-STAR-10GE-01622	Circuit	Vendor	04/12/2014 3:00 AM	04/12/2014 4:18 AM
335	3-Elevated	2-High	Maintenance Competed - ACE Backbone Circuit GLOBAL-ACE-WIX-O192-01502	Circuit	Vendor	04/15/2014 2:49 AM	04/15/2014 2:50 AM
344	3-Elevated	3-Elevated	Maintenance Completed - ACE Customer GEANT GLOBAL-ACE-WIX-O192-01504	Circuit	Vendor	05/11/2014 10:32 PM	05/12/2014 12:45 AM

Table 2. Tickets for scheduled maintenance on ACE circuits, March 1, 2014 – May 31, 2014

D. Downtime and Availability

Table 3 shows the reported downtime and availability for the circuits in the ACE project.

ACE Core Nodes	Downtime	Reporting Period Availability	52 Week Availability
	0 hr 0 min	100.00%	100.00%
Aggregate ACE Core Nodes	0 hr 0 min	100.00%	100.00%

ACE Backbone Circuits	Downtime	Reporting Period Availability	52 Week Availability
GLOBAL-ACE-MANLAN-O192-01500	25 hr 48 min	98.83%	99.03%
GLOBAL-ACE-MANLAN-O192-01501	0 hr 46 min	99.96%	99.99%
GLOBAL-ACE-WIX-O192-01502	17 hr 36 min	99.20%	94.55%
GLOBAL-ACE-WIX-O192-01504	39 hr 54 min	98.19%	99.43%
GLOBAL-ACE-MANLAN-O192-01505	13 hr 58 min	99.37%	99.84%
GLOBAL-FRK-WASH2-10GE-01507	4 hr 49 min	99.78%	99.70%
ACE-AMS-STAR-10GE-01622	1 hr 49 min	99.92%	96.30%
MAN-NEWY32AOA-PARIS-10GE-01618	4 hr 58 min	99.78%	99.94%
Aggregate All ACE Backbone Circuits	109 hr 38 min	99.38%	98.60%

Table 3. Downtime and availability for ACE core nodes and circuits.

6. Security Events and Activities

Basic security measures were maintained during this quarter and no security incidences were reported. Basic security work is included as part of the ongoing funded support ACE receives from the GlobalNOC

7. Reporting against Objectives December 2013-February-2014

The plans listed last quarter included:

1. Overall
 - a. New director to review activities and adjust as needed (ongoing)
 - b. Address need for PerfSONAR data on lagged circuits (Section 4.C and ongoing)
2. Staffing
 - a. Lee shifting to full time engineer for the project (Section 2 and ongoing)
3. Collaboration and Demonstrations
 - a. Attend variety of large scale international meetings (Section 3)
 - b. Plan and implement SDN experiments, and work in multi-domain (Section 4.B)
 - c. Seek out additional end users to support in use of 100G testbeds (Section 3, Section 4.D)
4. Systems and Software Work
 - a. Continue support for OpenFlow implementation (Section 4.B and ongoing)
 - b. Add active monitoring to 60G LAG circuits (Section 4.C and ongoing)

- c. Add passive monitoring to 60G LAG circuits (Section 4.C and ongoing)
 - d. Work towards combined PerfSONAR PS-MDM versioning (Section 4.C)
 - e. Additional Lustre work in support of supplement (Section 4.A and ongoing)
 - f. Placement and experiments using IXIA tester (Section 4.A and ongoing)
5. Operational Activities
- a. Continue full support of 8 circuits (Section 5)

8. Plans for June-2014 thru August-2014

1. Overall
- a. New director to review activities and adjust as needed
 - b. Address need for PerfSONAR data on lagged circuits
2. Staffing
- a. Lee shifting to full time engineer for the project
3. Collaboration and Demonstrations
- a. Attend variety of large scale international meetings
 - b. Plan and implement SDN experiments, and work in multi-domain
 - c. Seek out additional end users to support in use of 100G testbeds
 - d. Use additional monitoring information to increase outreach and support of circuit end users, verifying performance
4. Systems and Software Work
- a. Add active monitoring to 60G LAG circuits
 - b. Add passive monitoring to 60G LAG circuits
 - c. Additional Lustre work in support of supplement
 - d. Placement and experiments using IXIA tester
5. Operational Activities
- a. Continue full support of 8 circuits

APPENDIX A. VLAN assignment on Chicago-Amsterdam Link

The table below shows the VLAN assignment on the Chicago to Amsterdam circuit on the last date of this reporting period.

NetherLight Service ID	VLANs	Description	Global ID
5048VL-EVL-Cinegrid-UvA-IRNC	21		-
5040VL_CNPEK-NLAMS_CSTnet(private – peer)	137	Starlight side vlan 137-Netherlight side vlan 136	
5029VL_NBD-CZPRG-USCHI	440		urn:ogf:network:netherlight.net:5029VL
5030VL_NBD-CZPRG-USCHI	441		urn:ogf:network:netherlight.net:5030VL
5087VL-RP1-loop-IRNC	514		
5086VL-RP1-loop-IRNC	515		
Sc13-autogole-uva-1	1795		
Sc13-autogole-uva-2	1796		
5099VL_SURFnet-StarLight_multipath	2750		
5071VL_NBD_RENCI_UVA	3200-3210		
5150VL_ACE-OpenFlow-tst	3810-3819		

Table 5. VLAN assignment on Chicago-Amsterdam Link