

**America Connects to Europe (ACE)
(SCI - 0962973)
Year 5 Quarter 2 Quarterly Report
1-June-2014 through 31-August-2014**

Jennifer Schopf – Principal Investigator

(Prepared by, Jennifer M. Schopf, Alice Jackson)

Summary

During the quarter of June 1, 2014, through August 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 Lee becoming a full time staff member, ongoing work with a variety of application groups, the decision to not place the Ixia tester in MAN LAN, and GEANT's decision to terminate their Paris-New York circuit.

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. GEANT has decided to discontinue this circuit in October, 2014.
- 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%)

After many months of negotiations, Andrew Lee shifted to full time status for the International Networks project this quarter.

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 gave the opening keynote at the 2014 Environmental Data Summit (<http://environmentaldatasummit2014.deltacouncil.ca.gov/>), held in Sacramento on June 4-6, which is part of the California Delta Science project. At this meeting, she made contacts with water researchers interested in data sharing with Europe and Asia, as well as with researchers interested in the upcoming Lower Mekong Valley water resource workshop. Following this workshop, she met with members of the ESnet team to discuss ongoing monitoring and measurement efforts strongly related to what is trying to be rolled out on the ACE links.

Gopu took the opportunity to meet Big Data scientific researchers at conferences he attended as part of other responsibilities he has at IU. In June 22-27, 2014, Gopu got a chance to interact with scientists from PANSTARRs and LSST at the SPIE2014 conference held at Montreal, Canada.

Schopf helped co-organize the Focused Technical Workshop on Global climate science, held in Boulder July 13-16 (<http://meetings.internet2.edu/2014-cc-climate/>), jointly with ESnet, NOAA, and Internet2. Several talks were highly relevant to the data transfers that TransPAC is starting to see from these communities. Following this, she continued ongoing collaborations with members of the Woods Hole Oceanographic institute who are beginning to look at data sharing with several European and Asian collaborators.

Schopf, Lee, and Smith helped run the Lower Mekong Water Resource workshop (<http://internationalnetworking.iu.edu/archives/LMI/index.html>) in Hanoi, Vietnam, August 18-22. This weeklong meeting brought together networking people with water resource researchers from the US and Asia, but also offered opportunities to explore data sharing with Europe.

4. Software and Systems Work

A. Tool Development

This quarter we determined that our many months of negotiations with Internet2 to place the Ixia tester at MAN LAN were ultimately unsuccessful. Basic information about co-location and costs were not forthcoming. Instead, we are now exploring upgrading our TransPAC Los Angeles PoP and placing the tester there.

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.

For the Lustre over 100G project, we continued testing with the hosts in Aachen and Dresden, but on their regular research network as well as on the IU internal network. We are working with BLASTN as the example application and worked on understanding its behavior and I/O needs. BLASTN is a fairly complex application and understanding and predicting it's behavior is not trivial, the primary work this quarter was to develop an application that reads and writes a user specified amount of data in specific intervals.

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

Conversations have stalled with the Europeans to get a maddash in place over the ACE links, This is in part because of the need for VLANS, and discussions about whether or not the information from the maddash would be representational of the actual behaviors seen by end users over the link. These discussions are continuing, albeit slowly.

Conversations also 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, and it is increasingly looking like this will not be an option even if we use our own equipment to gather this data. 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

Support for application use of the 100G ANA link continued to move slowly. Gopu continues to reach out to groups moving large data sets at various meetings. These discussions included:

- EBI: We facilitated additional experiments between the University of Chicago and EBI. Mike Sullivan has been involved in this discussion. EBI provided two VMs while the UC folks had several resources on their side. This project is ongoing, and may lead to a demo at SC in November.
- PANSTARS: We re-initiated contact at an astronomy meeting, and hope to see progress in the next quarter.
- LSST: We re-initiated contact at an astronomy meeting, and hope to see progress in the next quarter.
- GeoScience: Several geoscientists seemed interested in our work at various meetings this quarter, but follow on did not lead to any successful uptake yet.
- Belle2/DANTE: We continued to meet periodically with our DANTE colleagues, and kept up with progress on testing by the Belle2 project.
- ICT-BioMed: Exploring a possible use-case with this group.
- LHC-One: Lee met with this group and continues to offer support.
- Open Science Grid and Europe continue, mainly via conversations with Rob Quick about a couple of groups he works with out of Europe. The project is investigating upgrading their links in the EU to take advantage of the increased trans-Atlantic bandwidth.
- LIGO: We continue to follow leads provided by Scott Korrander to try to get uptake with the project.
- GlobusOnline: Following up from last quarters meeting, there was interest by Raj Kettimuthu to investigate this as a protocol available to our contacts. This lead has not panned out because there are very few (if any) Globus endpoints with 10G connectivity.

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.

5. Operational Activities

The ACE links were generally stable during this time. There were two fiber cuts during the quarter: a 3 day cut in New York which affect the 2 of the MAN LAN-based circuits (ticket 413:127), which was that long because repairs were delayed due to New York department of transportation department limiting access to the location. The second was a week long cut on the Paris circuit (ticket 366:127) due to an undersea cut, which usually results in an outage of this length.

The other significant problem in this quarter is reflected in ticket 386:127, which details that there was instability due to card failure during a maintenance resulting in a replacement card being installed by the vendor (Hibernia).

A. Circuit Procurement

The GEANT team decided that the Paris circuit, one of their contributions to the ACE project, was not being used enough to justify its expense. The current plan is to cease operations in October. All VLANS were moved to the MAN LAN-Amsterdam circuit in July.

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.

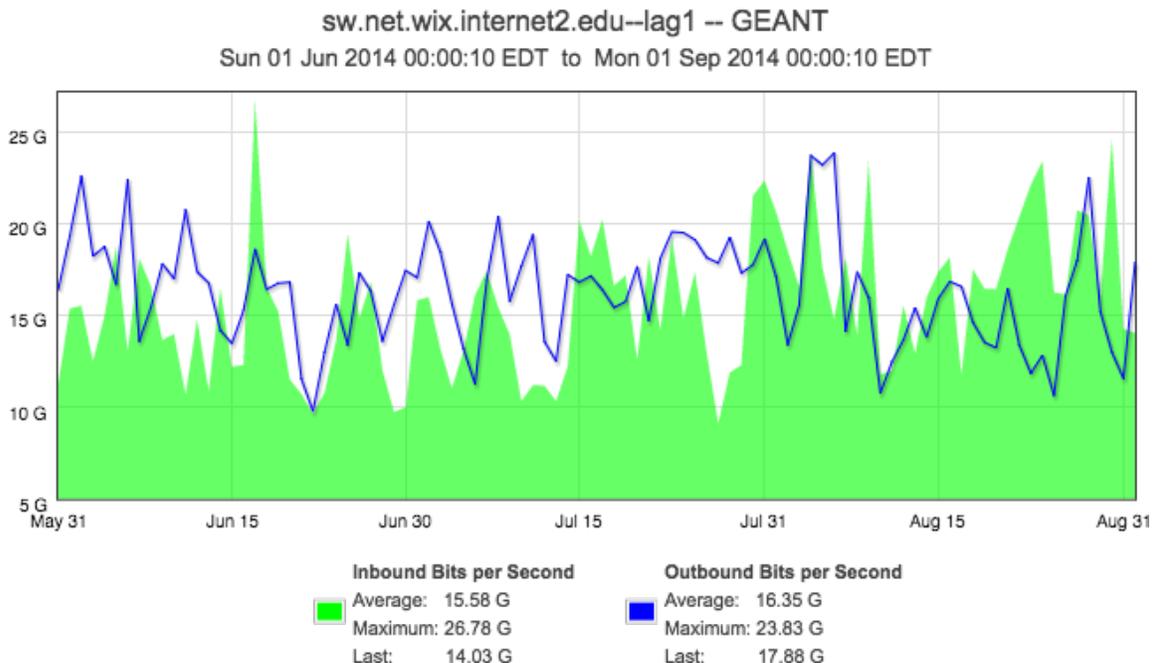


Figure 1. Aggregated traffic using maximum daily values on the 30G Lag between WIX and Frankfurt for June 1, 2014 through August 31, 2014.

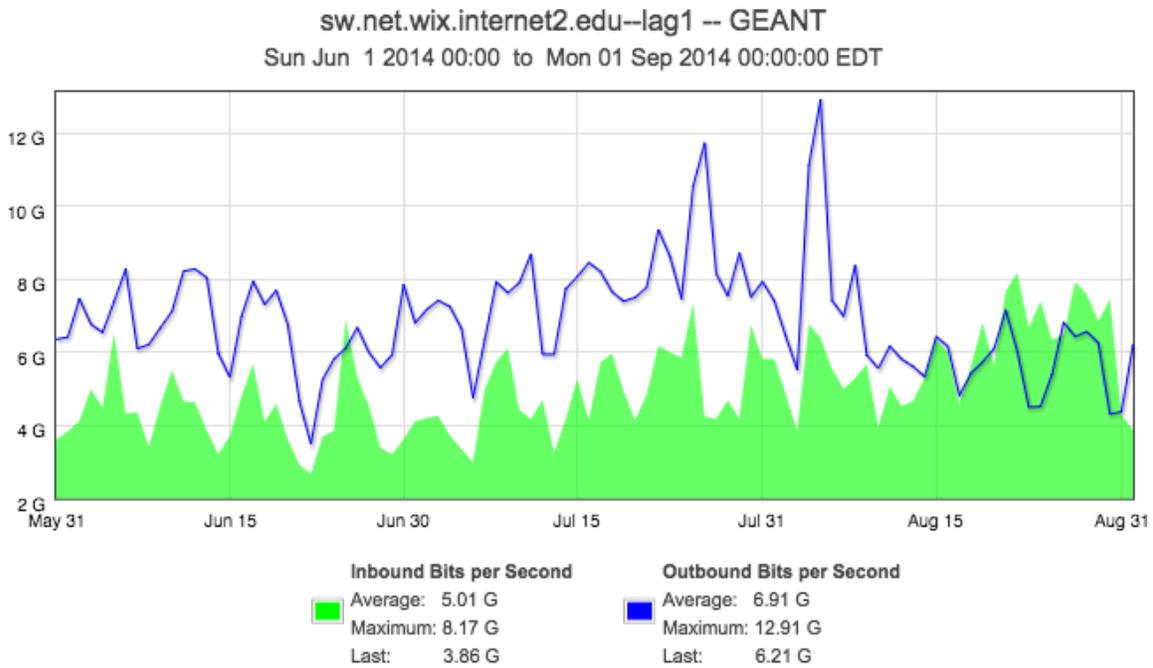


Figure 2. Aggregated traffic using smoothed average daily values on the 30G Lag between WIX and Frankfurt for June 1, 2014 through August 31, 2014.

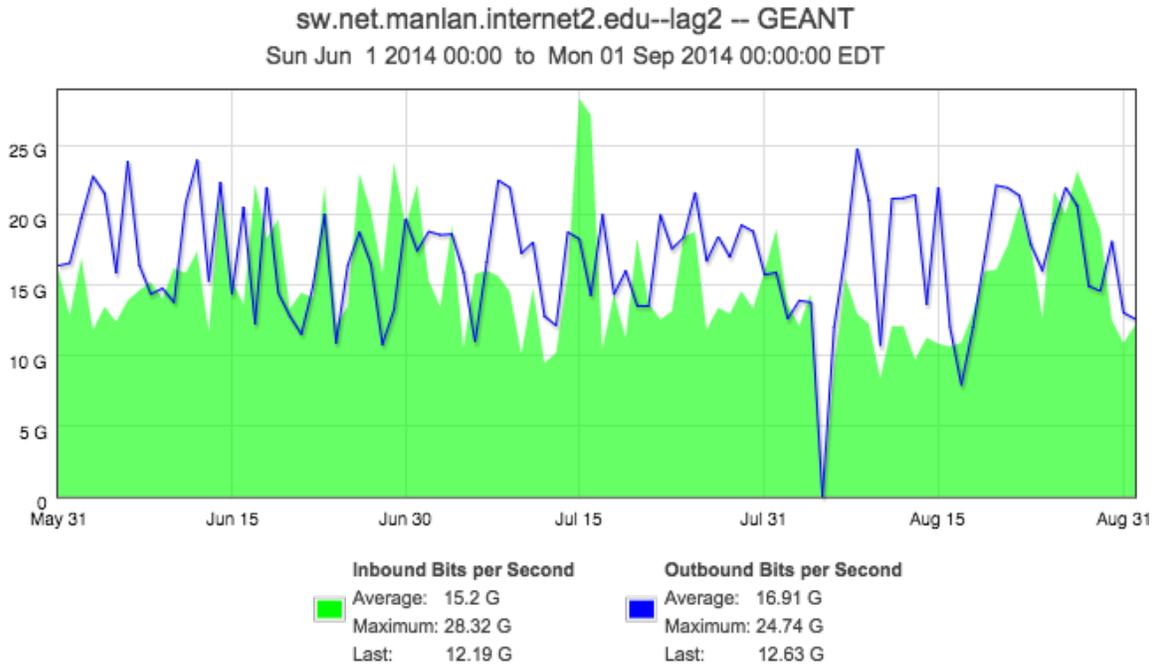


Figure 3. Aggregated traffic using maximum daily values on the 30G Lag between MAN LAN and Amsterdam for June 1, 2014 through August 31, 2014.

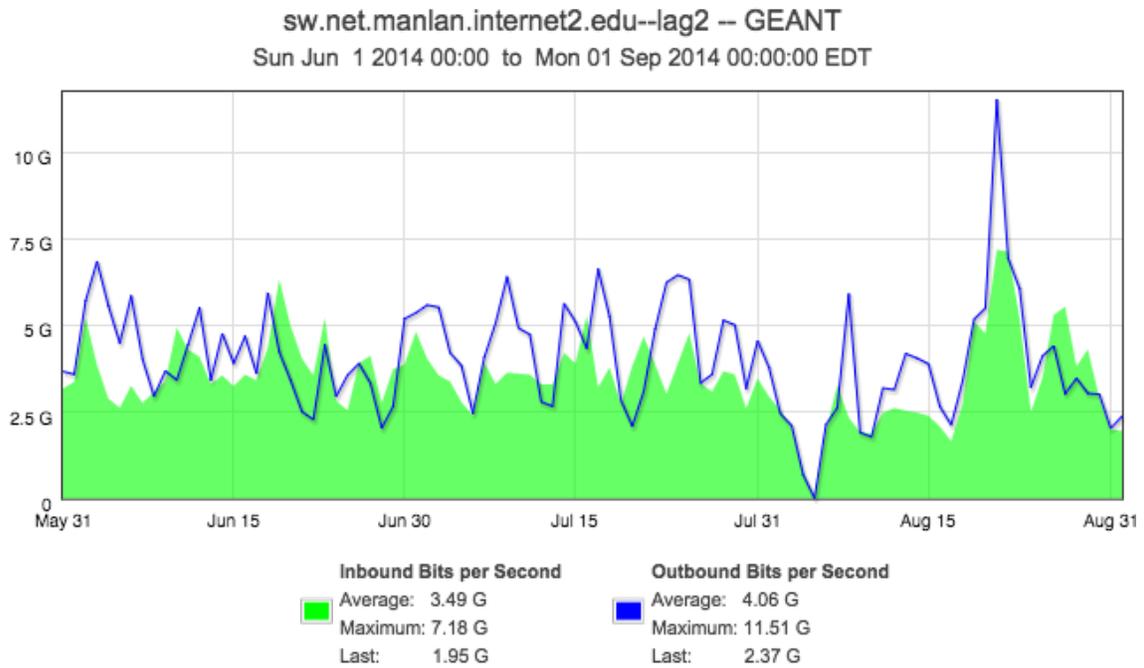


Figure 4. Aggregated traffic using smoothed average daily values on the 30G Lag between MAN LAN and Amsterdam for June 1, 2014 through August 31, 2014.

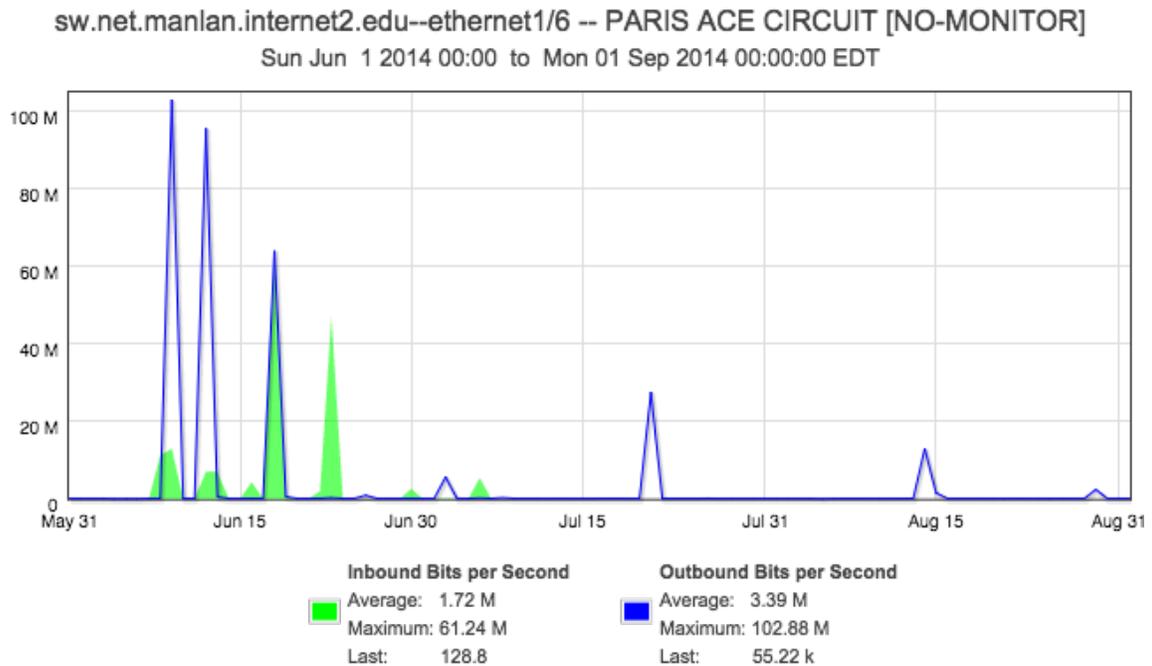


Figure 5. Aggregated traffic using maximum daily values on the 10G circuit between New York and Paris for June 1, 2014 through August 31, 2014. Please note the units on the Y-axis.

sw.net.manlan.internet2.edu--ethernet1/6 -- PARIS ACE CIRCUIT [NO-MONITOR]

Sun Jun 1 2014 00:00 to Mon 01 Sep 2014 00:00:00 EDT

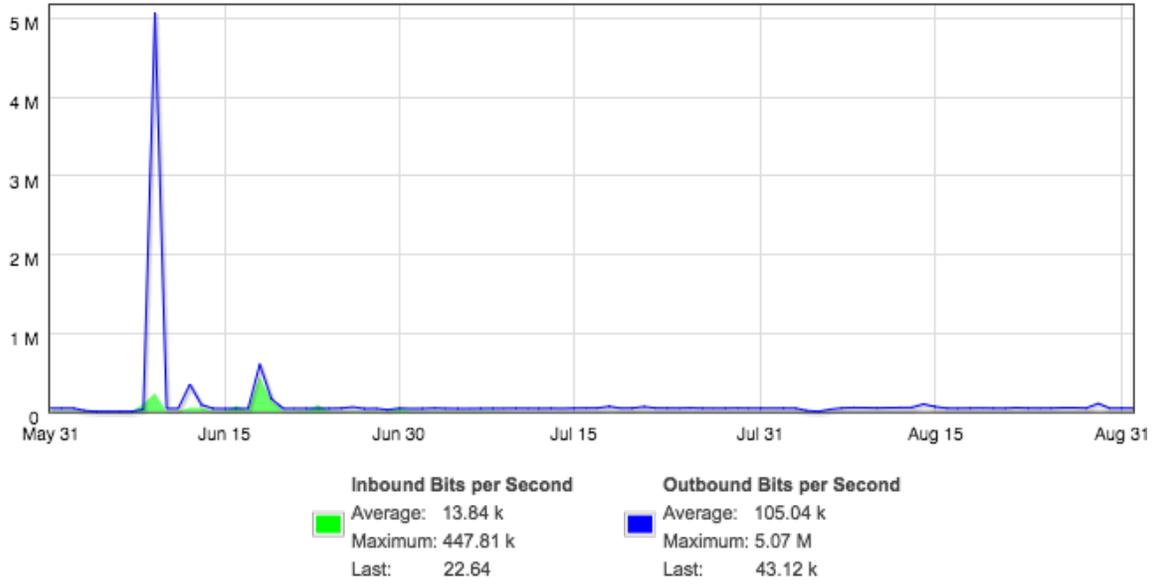


Figure 6. Aggregated traffic using smoothed average daily values on the 10G circuit between New York and Paris for June 1, 2014 through August 31, 2014. Please note the units on the Y-axis.

C. Trouble Tickets

During this quarter, there were 15 tickets for unscheduled maintenance, detailed in Table 1, and 6 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 .

Unscheduled Outages Summary

Ticket Number	Customer Impact	Network Impact	Title	Outage Type	Source Of Impact	Start Time (UTC)	End Time (UTC)
366	3-Elevated	3-Elevated	Stability - ACE Backbone MAN-NEWY32AOA-PARIS-10GE-01618	Circuit - Damaged Fiber	Internal	06/03/2014 5:39 AM	06/10/2014 5:28 AM
372	3-Elevated	3-Elevated	Outage Resolved - ACE Customer GEANT Circuit GLOBAL-ACE-WIX-O192-01502	Circuit - Damaged Fiber	Internal	06/14/2014 5:28 PM	06/14/2014 11:44 PM
382	2-High	2-High	Outage Resolved - ACE Backbone GLOBAL-ACE-MANLAN-O192-01500	Unannounced Maintenance	Vendor	06/21/2014 6:49 AM	06/21/2014 7:18 AM
384	3-Elevated	3-Elevated	Outage Resolved - ACE Customer GEANT Circuits GLOBAL-ACE-MANLAN-O192-01505 & GLOBAL-ACE-MANLAN-O192-01501	Undetermined	Internal	06/24/2014 11:43 PM	06/25/2014 1:07 AM
385	3-Elevated	3-Elevated	Outage Resolved - ACE Customer GEANT Circuit MAN-NEWY32AOA-PARIS-10GE-01618	Undetermined	Internal	06/29/2014 11:49 AM	06/29/2014 10:26 PM
386	2-High	2-High	Outage - ACE Backbone GLOBAL-ACE-MANLAN-O192-01500	Undetermined	Vendor	07/02/2014 4:07 AM	07/02/2014 4:16 AM
						07/02/2014 5:30 AM	07/02/2014 5:42 AM
						07/03/2014 5:00 AM	07/03/2014 7:27 AM
400	2-High	2-High	Breif Outage Resolved - ACE Various Backbones (Amsterdam)	Unannounced Maintenance	Vendor	07/21/2014 4:17 PM	07/21/2014 4:22 PM
412	2-High	2-High	Brief Outage Resolved - ACE Backbone GLOBAL-ACE-WIX-O192-01502	Undetermined	Undetermined	07/30/2014 12:56 PM	07/30/2014 1:07 PM
413	3-Elevated	3-Elevated	Outage Resolved - ACE Customer GEANT Circuits GLOBAL-ACE-MANLAN-O192-01505 and GLOBAL-ACE-MANLAN-O192-01501	Circuit - Damaged Fiber	Vendor	08/04/2014 5:43 AM	08/06/2014 8:15 AM
425	2-High	2-High	Stability - ACE Circuits GLOBAL-FRK-WASH2-10GE-01507	Power	Vendor	08/21/2014 7:14 PM	08/22/2014 5:32 PM
429	2-High	2-High	Outage Resolved - ACE Backbone GLOBAL-FRK-WASH2-10GE-01507	Unannounced Maintenance	Vendor	08/28/2014 4:59 AM	08/28/2014 8:00 AM
430	2-High	2-High	Outage Resolved - ACE Backbone GLOBAL-ACE-MANLAN-O192-01500	Unannounced Maintenance	Vendor	08/28/2014 4:59 AM	08/28/2014 8:00 AM

431	2-High	2-High	Outage Resolved - ACE Backbone GLOBAL-ACE-MANLAN-O192-01500	Unannounced Maintenance	Vendor	08/28/2014 4:59 AM	08/28/2014 7:59 AM
432	3-Elevated	3-Elevated	Availability - ACE Customer GEANT Circuit GLOBAL-ACE-MANLAN-O192-01505	Undetermined	Internal	08/31/2014 7:10 AM	08/31/2014 7:35 AM
433	3-Elevated	3-Elevated	Stability - ACE Customer GEANT Circuit GLOBAL-ACE-WIX-O192-01504	Undetermined	Internal	08/31/2014 7:13 PM	09/02/2014 11:17 PM

Table 1. Unscheduled maintenance tickets for the ACE circuits, June 1, 2014 – August 31, 2014.

Scheduled Maintenances Summary

Ticket Number	Customer Impact	Network Impact	Title	Maintenance Type	Source Of Impact	Start Time (UTC)	End Time (UTC)
365	3-Elevated	3-Elevated	Maintenance Completed - ACE Backbone GLOBAL-ACE-WIX-O192-01502	Circuit	Vendor	06/07/2014 11:07 AM	06/08/2014 12:52 AM
						06/08/2014 3:13 AM	06/08/2014 3:36 AM
373	3-Elevated	3-Elevated	Maintenance Completed - ACE Customer GEANT MAN-NEWY32AOA-PARIS-10GE-01618	Circuit	Vendor	06/26/2014 10:52 AM	06/27/2014 12:47 AM
378	3-Elevated	3-Elevated	Maintenance Completed - ACE Backbone GLOBAL-ACE-WIX-O192-01502	Circuit	Vendor	07/01/2014 4:01 AM	07/01/2014 4:13 AM
						07/01/2014 6:44 AM	07/01/2014 6:59 AM
375	3-Elevated	3-Elevated	Maintenance Completed - ACE Backbone GLOBAL-FRK-WASH2-10GE-01507	Circuit	Vendor	07/02/2014 1:03 AM	07/02/2014 2:28 AM
376	3-Elevated	3-Elevated	Maintenance Completed - ACE Backbone GLOBAL-ACE-MANLAN-O192-01500	Circuit	Vendor	07/02/2014 1:19 AM	07/02/2014 3:20 AM
383	3-Elevated	3-Elevated	Maintenance Completed - ACE Backbone GLOBAL-ACE-MANLAN-O192-01500	Circuit	Vendor	07/02/2014 11:02 PM	07/03/2014 5:00 AM

Table 2. Tickets for scheduled maintenance on ACE circuits, June 1, 2014 – August 31, 2014

5. Downtime and Availability

Below, Table 3 shows downtime associated with core nodes on the project, while Table 4 lists downtime associated with the projects circuits.

ACE Core Nodes	Down Time	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%

Table 3. Downtime and availability for ACE core nodes.

ACE Backbone Circuits	Down Time	Reporting Period Availability	52 Week Availability
GLOBAL-ACE-MANLAN-O192-01500	17 hr 21 min	99.21%	99.40%
GLOBAL-ACE-MANLAN-O192-01501	52 hr 1 min	97.64%	99.40%
GLOBAL-ACE-WIX-O192-01502	21 hr 2 min	99.05%	94.46%
GLOBAL-ACE-WIX-O192-01504	4 hr 47 min	99.78%	99.37%
GLOBAL-ACE-MANLAN-O192-01505	52 hr 26 min	97.63%	99.24%
GLOBAL-FRK-WASH2-10GE-01507	26 hr 44 min	98.79%	99.40%
ACE-AMS-STAR-10GE-01622	0 hr 0 min	100.00%	96.33%
MAN-NEWY32AOA-PARIS-10GE-01618	192 hr 21 min	91.29%	97.75%
Aggregate All ACE Backbone Circuits	366 hr 42 min	97.92%	98.17%

Table 4 Downtime and availability for ACE 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 March-2014 thru May-2014

The plans list last quarter that have been addressed include:

1. Overall
 - a. New director to review activities and adjust as needed
2. Staffing
 - a. Lee shifting to full time engineer for the project
3. Collaboration and Demonstrations
 - a. Attend variety of large scale international meetings
 - 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

8. Plans for September-2014 thru November-2014

Plans for next quarter include:

1. Overall
 - a. New director to review activities and adjust as needed
2. 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
3. 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
4. Operational Activities
 - a. Discontinue Paris-MAN LAN circuit
 - b. Continue full support of 7 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 6. VLAN assignment on Chicago-Amsterdam Link