

# NEAAR

## Award #1638863

### Year 5 Quarter 1

#### 1 June 2020 through 31 August 2020

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## Summary

The Networks for European, American, and African Research (NEAAR) project supports circuits and network services between the US and Europe, in addition to extensive training and science engagement activities to support US collaborations with researchers in Europe and Africa. This report outlines collaborations, science engagement, operational activities, and usage statistics for Year 5, Quarter 1 of the project. It covers the period June 1, 2020, through August 31, 2020. Highlights of Quarter 1 include advancing discussions with the Advanced North Atlantic (ANA) Consortium on future procurement coordination and proactively identifying and working to improve end-to-end performance issues on international traffic related to COVID-19 research. During this quarter we were also informed that there will be a follow-on project funded by NSF, the Networks for European, American, African, and Arctic Research (NEA<sup>3</sup>R), and planning for the transition began.

## 1. NEAAR Overview

NEAAR supports the use of 100G networks between the US and Europe with a focus on measurement and science engagement. The NSF funded network for this project is a 100G circuit between New York (ManLan) and London (GÉANT Open). In addition, GÉANT runs a sister circuit that is a 100G between ManLan and Paris. These circuits are used in production to support a wide variety of science applications and demonstrations of advanced networking technologies. In addition, the NEAAR award supports science engagement, application outreach, measurement tool deployments, training workshops, and security activities.

## 2. Staffing

At the beginning of Year 5, funded project staff included:

- Jennifer Schopf, Director
- Edward Moynihan, NEAAR Coordination and Science Engagement Specialist
- Hans Addleman, Network Engineer
- Scott Chevalier, perfSONAR Specialist

- Doug Southworth, perfSONAR Specialist and Analysis
- Antoine Delvaux, perfSONAR Consultant
- Heather Hubbard, Project Support

No staffing changes occurred during Quarter 1.

### 3. Conferences, and Workshops

NEAAR staff participate in various meetings to support their role in collaborations in Europe and Africa. Due to COVID-19 related travel restrictions, there was no travel during Quarter, although virtual meetings still took place. Virtual meetings attended in Quarter 1 included:

- Chevalier and Southworth attended the perfSONAR All Hands Meeting June 15-18, 2020, <https://internet2.edu/past-events/perfsonar-day-2020-events/#perfsonar>, where they learned about future perfSONAR development plans and acted as moderators for several presenters.
- Schopf attended the PEARC'20 meeting, July 27-31, <https://pearc.acm.org/pearc20/>, where she learned about US Domestic CI developments that may play a role in our continuing work with Europe and Asia.
- Moynihan attended the TICAL 2020 conference, virtual, Aug 31-Sept 4, 2020, <https://tical2020.redclara.net/>. He attended and participated in sessions on supporting the Vera Rubin Observatory, the Bella project, and on supporting COVID-19 research collaborations.

Additionally, NEAAR had planned to attend the following meetings that were cancelled:

- TNC 20 Conference, in Brighton, UK, June 8-12, 2020, <https://tnc20.geant.org/>.
- NIH ACE Board Meeting, in Nairobi, Kenya, June 22-25, 2020.

## 4. Project Coordination

### 4.1 Internal Partner Collaborations

The primary collaborators for the NEAAR project are GÉANT, representing European interests, the three regional R&E networks in Africa, and SANReN, the National Research Network of South Africa. The NEAAR partners hold calls focused on the project objectives when needed but also meet at major R&E networking conferences whenever possible. In Quarter 1, we had planned to host a face-to-face project meeting at TNC20, but the conference was cancelled. Instead, we met with each partner individually via video conference.

We continue to work with our project partners and to adjust project coordination as necessary due to the changing international conditions caused by the pandemic. In Quarter 1, this included:

**GÉANT** – We met virtually multiple times with GÉANT staff throughout Quarter 1 to ensure project alignment and to discuss future plans. Moynihan also attended GÉANT’s virtual Task Force on Research Engagement meeting.

**South African National Research Network (SANReN)** - In Quarter 1, we met with SANReN staff to review the tools we were using to better understand and improve performance and to further discuss adding their international circuits to NetSage. They have now worked out their internal issues and are ready to move forward. At the end of Quarter 1, NetSage staff are working with SANReN engineers on the deployment.

**UbuntuNet Alliance (UA)**– In Quarter 1, we met multiple times via videoconference with UA CEO Dr. Matthews Mtumbuka and with UA staff to discuss the timing of AC3 circuit deployments, how NEAAR can align with AC3 to support US-African research collaborations, and future collaborative activities.

**WACREN** - Our year-long support for the port fees for WACREN’s 10G circuit landing at the GÉANT Open Exchange in London came to an end in August. No one has requested renewing this support.

## 4.2 Coordination with IRNC partners

**IRNC AMI** - Collaboration with the IRNC AMI awardee, NetSage, continues in Year 5. Data for the NEAAR circuit is archived in the NetSage framework, including SNMP, perfSONAR, and sampled flow data. The New York exchange point site includes rack space for monitoring equipment and a perfSONAR node is collecting data there. We continue to work with NetSage to create visualizations that allow us to understand interesting traffic patterns as well as automatically identify changes in performance behavior on the NEAAR circuit.

We also continue to work with NetSage to populate the Science Registry that allows flows to be tagged and identified by science domain, project, location, and educational institution endpoints. An increase in the number of Science Registry tagged flows gives NEAAR staff the ability to target specific science for deeper analysis, as well as better understand the NEAAR circuit use cases of our partners.

**IRNC NOC** - The IRNC NOC continues to provide Tier 1 support services including monitoring the state of the NEAAR circuit and the installed equipment in New York. Using NEAAR funding, the IU GlobalNOC supplies Tier 2 and Tier 3 services for the project, as well.

**IRNC Backbones** - In Quarter 1, we met virtually with staff from the Americas Africa Research and eduCation Lightpaths (AARCLight) project to share NetSage data on flows

from the ALMA project to data archives in Europe and Asia. We are also coordinating with AMPATH to ensure support for the Vera Rubin Observatory (VRO).

**IRNC Engage** - We continue close coordination with the NSRC on our training efforts and engagements working with NRENs in Africa.

### 4.3 Other Collaborations

**Advanced North Atlantic (ANA) Consortium** - The ANA consortium consists of CANARIE, Internet2, GÉANT, NORDUnet, SURF, ESnet, and NEAAR. In Quarter 1, we continued our formal participation in the ANA leadership and engineering activities. We also initiated virtual discussions on plans and options for renewing the original circuit contracts and on the potential for pursuing longer term investments in the North Atlantic. We also maintain a NetSage dashboard for the consortium, available at <https://ana.netsage.global/>

**Collaboration Asia Europe-1 (CAE-1)** - CAE-1 is a consortium of six R&E networks: Australia's Academic and Research Network (AARNET) (Australia), GÉANT (Europe), NORDUnet (European Nordics), Singapore Advanced Research and Education Network (SingAREN) (Singapore), SURFnet (Netherlands), and TEIN\*CC/Asi@Connect (Asia-Pacific). They have collaborated to fund and support a 100G circuit from Singapore to London that went live in May 2019. In Quarter 1, we began working with SingAREN and other CAE-1 partners to look at traffic flows on the NEAAR circuit originating in Europe and destined for Asia to see if these flows should instead be routed over CAE-1.

**Energy Sciences Network (ESnet)** - We continued our ongoing collaboration with ESnet and continue to actively carry traffic for energy science researchers equally with the rest of ESnet's trans-Atlantic capacity. In Quarter 1, we met with ESnet staff to discuss the deployment of ESnet6 and their future trans-Atlantic connectivity plans.

**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. In Quarter 1, we continued discussion with the GNA-G co-chairs on the possibility of setting up a working group on identifying and fixing routing anomalies.

**HiSeasNet (HSN)** - We met via videoconference with Kevin Walsh from the Scripps Oceanographic Institute (SOI). Walsh manages HiSeasNet, a satellite communications network operated by SOI that supports the US academic research vessel fleet. We are interested in discovering ways to work together to improve network access for science groups in the Arctic. We have started documenting use cases and sharing network performance data from NetSage. We will continue working with HSN throughout Year 5 to determine if we can help improve the data transfer performance.

**NORDUnet** - We met throughout Quarter 1 with NORDUnet staff via video conference to discuss potential collaborations in support of Arctic and European research. We also discussed the upcoming Arctic Connect project, an initiative to build the first Arctic subsea

cable system that will connect northern Norway and Finland to Alaska and Japan, and ways that we might collaborate with NORDUnet to enable US researchers to access this resource.

***NREN Low Earth Orbit Satellite (LeoSat) Working Group*** - We continue to participate in and help lead a working group, established at TNC19, that is exploring the feasibility of NRENs leveraging low Earth orbit satellites to help connect researchers in the Polar Regions and other remote areas of the world. The group includes representatives from IN@IU, NORDUnet, ESNet, Tertiary Education and Research Network of South Africa (TENET), Research and Education Advanced Network New Zealand (REANNZ), Internet2, AARNET, and CANARIE. We are working within this group to better understand and document the science use cases and future cyberinfrastructure needs and to learn how access to these new satellite deployments would support and increase US science in Polar regions. The working group meets quarterly to discuss updates on interactions with LEOsat providers and to discuss potential use cases. In Quarter 1, the Working Group met to discuss updates on Starlink deployments and on use cases in the Arctic.

***The National Institutes of Health (NIH)*** - Schopf is a founding member of the Global Council for the NIH's National Institute of Allergy and Infectious Disease-supported (NIAID) African Centers of Excellence in Bioinformatics and Data Science (ACE). The two current ACE centers are at Makerere University, in Kampala, Uganda, and at the University of Bamako, in Bamako, Mali. ACE sites support the use of high-performance computing and training for the region. The Global Council directs the activities of the centers to ensure uptake is at the regional level. In Quarter 1, we worked with ACE and the Research and Education Network for Uganda (RENU) to re-schedule the planned perfSONAR workshop at the facility in Kampala. The workshop was originally scheduled to take place in July 2020 but is now scheduled to take place in February 2021. Schopf was also planning to attend the NIH ACE Board Meeting, in Nairobi, Kenya in June but this meeting was cancelled due to the pandemic.

***Vera Rubin Observatory Network Engineering Team (VRO-NET, formerly Large Synoptic Survey Telescope (LSST)-NET)*** - We continue to participate in the VRO-NET Network Engineering Team (NET) Working Group.. This group meets monthly to discuss and plan the networking infrastructure for the VRO. Within this working group, we are working with partners to determine if the NEAAR circuit can play a role in providing trans-Atlantic connectivity to the project to support their need to transfer data from the US National Center for Supercomputing Applications (NCSA) in Illinois to Institut National de Physique Nucléaire et de Physique des Particules (IN2P3) in Paris, France. Final decisions on trans-atlantic connectivity are on-hold until a new US data storage site has been determined. This decision was scheduled to be made by the end of 2020 but has been postponed due to the pandemic.

#### **4.4 Transition Planning**

This quarter we were informed by NSF that there would be a follow-on project starting in October 2020 entitled "Networks for European, American, African, and Arctic Research (NEA3R)", and planning for the transition began. That project will support two 100G circuits between the US and Europe, and we will be working closely together to ensure

seamless transition of production traffic as needed. The current NEAAR project is scheduled to end in January 2021, but will likely continue its science engagement activities past that time through a no-cost extension that has yet to be requested.

## 5. Science Engagement Activities

In Quarter 1, the science engagement team worked to adapt its science engagement and outreach efforts to the challenges posed by the COVID-19 related travel restrictions. Although we were not able to do hand's on or face-to-face engagement in Quarter 1, we continued to work with our partners to better understand and support US scientists working in Europe and Africa.

Our Quarter 1 engagements included:

***Academic Model Providing Access to Healthcare (AMPATH)*** - We continue to track AMPATH's plans for deploying new medical facilities in Ghana. We are coordinating with WACREN to ensure connectivity into the Ghanaian NREN (GARNET) and WACREN is available once the facilities are built. These efforts have been postponed until 2021.

***Egyptian University Network (EUN)*** - We continue to use Netsage to track traffic flows between Egypt and sites in Europe and Africa that pass through New York. ASREN procured a new link between EUN and ASREN's PoP in London, which went live at the end of February 2020. This new link was expected to help resolve the issues we identified. Throughout Quarter 1, we were still seeing flows routed via NY and shared this information with ASREN. Discussions on how to help address the issue we are seeing will continue into Quarter 2.

***Roche and SWITCH*** - In Year 4, we set up a VLAN on the NEAAR circuit to support bioinformatics and genetic research for Roche, a Swiss healthcare research organization. In Quarter 1, we re-engaged with representatives from GEANT and SWITCH (the Swiss NREN) to determine if we could identify who Roche is working with in the US and to see if they are getting expected performance on their trans-Atlantic data transfers. At the end of Quarter 1, we continue working with GEANT's Research Engagement office to see if we can learn more about these transfers.

***Solve Pollution Network (SPN)*** -SPN is a consortium of US universities and international public health organizations focused on the health impacts of pollution in Madagascar. It will be collecting and storing data at many remote locations throughout Madagascar, and needs the capability to move this data seamlessly between the Madagascar data sites and research labs that are primarily based in the US, Europe, and the UK. In Quarter 1, we met via videoconference with Joe Shaw, Indiana University, to discuss updates on their data movement requirements and how their project timeline will change due to the COVID-19 pandemic. We also continue to track the future deployment of a circuit that will connect iRENALA, the Malagasy NREN, to NEAAR partner UbuntuNet Alliance in 2021.

**SURF** - We continued our engagement with SURF staff to look at and begin addressing routing issues we identified on traffic between the Netherlands and Africa that was routed via New York. We are working with SURF engineers to determine what this traffic is and to determine if there is a way to resolve the issue.

In Quarter 1, we also continued to work with NEAAR partners and with the Engagement and Performance Operations Center (EPOC) to proactively identify and fix end-to-end performance issues on international traffic related to COVID-19 research. Using NetSage, we identified increases in data transfers between bioinformatics, genomics, and other COVID-related data sources and looked at performance to ensure these collaborations were getting expected end-to-end performance.

**European Bioinformatics Institute (EBI) and Partners Healthcare Systems (PHS)** - At the end of Year 4, we identified an increase in data transfers between EBI and PHS. We saw an increase from 945GB in January 2020 to 40 TB in February. These increases continued in Quarter 1 with approximately 30TB of traffic each month transferred over the NEAAR circuit. We suspected this data increase was related to the roll-out of the EBI COVID-19 data portal, however, these new data transfers continued to average only 25Mbps. In Quarter 1, we began working with GEANT and with EBI to see if we could improve performance on these transfers. After discussing the issue and networking set-up with EBI engineers, and then running tests on the network path between MIT and EBI, we were able to determine that the issue was not at EBI or on the trans-atlantic circuits. We then reached out to and met with engineers from the Northern Crossing (NOX) exchange to learn more about the set-up of the Longwood Medical Area Network and to see if they could introduce us to engineers at PHS. At the end of Quarter 1, we continue to work with NOX engineers to determine if we can help improve this issue. This work will continue in Quarter 2.

**RENATER and Argonne National Laboratory (ANL)** - In August, we identified an increase in large data transfers potentially related to COVID-19 research between multiple sites behind RENATER (the French NREN) and Argonne National Laboratory. Many of these transfers were averaging under 10Mbps. We reached out to our contacts at Argonne to learn more about these flows and to see if there was anything we could do to improve performance. This work will continue in Quarter 2.

## 6. PerfSONAR Development and Training

### 6.1 perfSONAR for IRNC and NEAAR

The NEAAR project supports a perfSONAR deployment at the ManLan endpoint of the NEAAR circuit that provides periodic testing between several US and European sites. NEAAR participates in the IRNC mesh available at: <http://data.ctc.transpac.org/maddash-webui/index.cgi?dashboard=IRNC%20Mesh>.

NEAAR runs a project-wide MaDDash which includes tests between perfSONAR nodes from the African RRENs and several larger African NRENs. In Quarter 1, we worked with the

UbuntuNet Alliance to add an additional node in Mtunzini, South Africa to the MaDDash, however, due to travel and resource restrictions, this work was delayed and will continue into Quarter 2. The current NEAAR MaDDash can be viewed here:

<https://140.182.50.189/maddash-webui/>

## 6.2 perfSONAR Consortium

IU participates in the perfSONAR consortium, which oversees the production development and support of the perfSONAR toolkit. Chevalier leads the training group. Updates and improvements to the perfSONAR training materials continued throughout this period. Chevalier and Southworth attended the virtual perfSONAR All Hands Meeting in June and gave input into future development plans, specifically regarding the planned transition from the current Esmond database to Elasticsearch. As this transition occurs, portions of the existing technical and training documentation will need to be updated.

## 6.3 perfSONAR Training

Separate from monitoring our own circuit, one of the goals of the NEAAR project is to support the use of perfSONAR more broadly across Europe and Africa. This support, via targeted deployments and training, helps the community understand network behavior and assists in improved data sharing between US researchers and those in the region. By expanding perfSONAR deployments to Africa, we can better understand what American researchers should be experiencing when they move data to those regions.

In December 2019, we finalized plans for hosting a Meshbuilder Workshop with Uganda's NREN, RENU. This workshop was scheduled to take place in Kampala, Uganda July 27-31, 2020. However, in March we postponed the workshop due to COVID-19 related travel restrictions. We are hoping to reschedule this workshop for early 2021.

We also continue to work with our partners to assess future demand for additional perfSONAR workshops among other members of the UbuntuNet Alliance, WACREN, and ASREN. However, these discussions are mostly on hold due to ongoing COVID-19 travel restrictions.

Throughout the year, Chevalier and Southworth provided ongoing support to those NRENs with whom we have led perfSONAR Meshbuilder workshops in the past. Many of those deployments are now active with little further need of direct support and assistance for the purpose of bringing up a functional MaDDash. We are starting to ramp down our support of the previous perfSONAR Meshbuilder workshop attendees since this component is not part of the NEA3R activities. Current meshes include:

- **ASREN** - <http://185.19.231.226/maddash-webui>: We are assisting ASREN staff and member NRENs on the ASREN-wide MaDDash.



- **MoRENET** - <http://ps.dash.morenet.ac.mz/maddash-webui>: We are working with MoRENET engineers to understand why the MoRENET MaDDash is not responding to queries. Progress was made to restore the dashboard and work continues with individual nodes to coordinate in the mesh.
- **UbuntuNet Alliance** - <http://196.32.214.200/maddash-webui/index.cgi?dashboard=Measurements>: The UbuntuNet Alliance MaDDash is stable.
- **WACREN** - The WACREN team is not currently supporting a public MaDDash, but is participating in the NEAAR MaDDash.
- **ZAMREN** - <http://central.perf.zamren.zm/maddash-webui/index.cgi?dashboard=Measurements>: The ZAMREN MaDDash is stable and no further assistance has been requested.

## 7. Network Operations

### 7.1 Peering

No new peering activity took place in Quarter 1. We remain open to additional new peerings and hope to discuss future peerings throughout Year 5, including the possibility of new peering opportunities between the NORDUnet network and the NEAAR router that would simplify connectivity for emerging NRENs in Africa.

### 7.2 Routing Anomaly Detection and Resolution

While no new routing anomalies were detected during Quarter 1, NEAAR staff continued work on the routing issues discovered in Year 4. Many of these issues are both political and technical in nature, and thus can take significant time to resolve. We will continue to work with our partners until they are able to bring the discovered anomalies to resolution.

### 7.3 Open Exchange Point Deployment

We remain in close contact with our African partners and continue to monitor the readiness of the African regional RENs and NRENs for future Open Exchange Point (OXP) deployments. There are plans for OXP deployments as part of the AfricaConnect3 project, however, all of the planned AfricaConnect3 infrastructure deployments have been delayed due to the pandemic.

### 7.4 WACREN Port Fees in London

We continue to support the port fees for WACREN's 10G circuit landing at the GÉANT Open Exchange in London. Figures 1 and 2 show the usage statistics for the port and VLAN 1200, the peering with NEAAR, for Quarter 1. The NEAAR funding for this port ended on August 31, 2020.

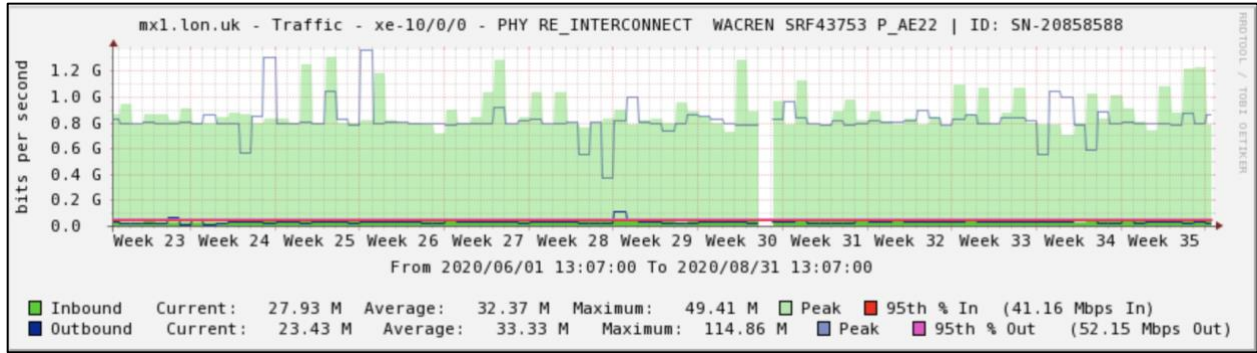


Figure 1: Overall usage of the WACREN Lagos-London circuit from June 1, 2020 through August 31, 2020.

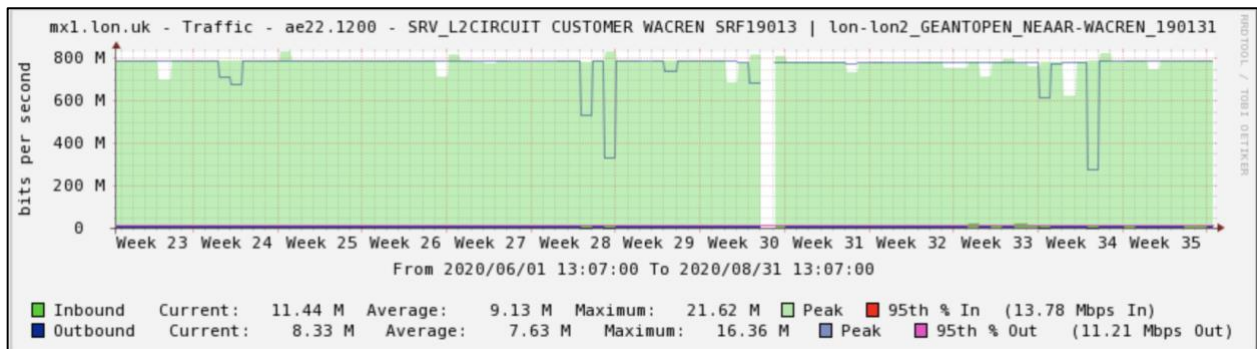


Figure 2: Traffic from WACREN utilizing VLAN 1200 to the NEAAR Peering point in New York across the NEAAR 100G TransAtlantic link from June 1, 2020 through August 31, 2020.

## 7.5 SuperComputing Conference Support

In Quarter 1, we learned that the SC20 conference will be virtual due to the COVID-19 pandemic. There will be no network experimentation or network built during this year's conference, so there will be no need for NEAAR staff to coordinate traffic shifts during the SC'20 timeframe as we have done in the past.

## 8. Circuit Status and Performance

The NEAAR 100G circuit runs between ManLan, New York, and GÉANT Open in London, by way of Dublin, Ireland. We collect SNMP and sampled flow data, which is de-identified. Both are shared with NetSage.

### 8.1. Traffic Graphs

Figures 3 and 4 show the traffic on the NEAAR 100G circuit between New York and London during the period of June 1, 2020 – August 31, 2020. Figures 5 and 6 show the traffic on the GÉANT 100G Circuit between New York and Paris during the period of June 1, 2020– August 31, 2020.

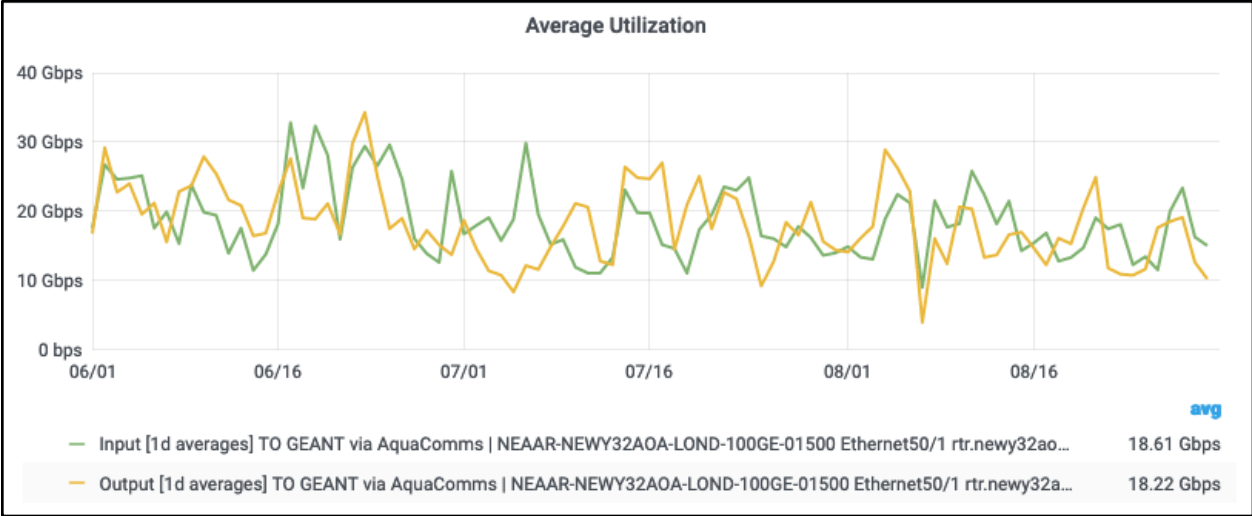


Figure 3: NEAAR New York-London 100G Circuit (NSF-funded) traffic using smoothed daily averages.

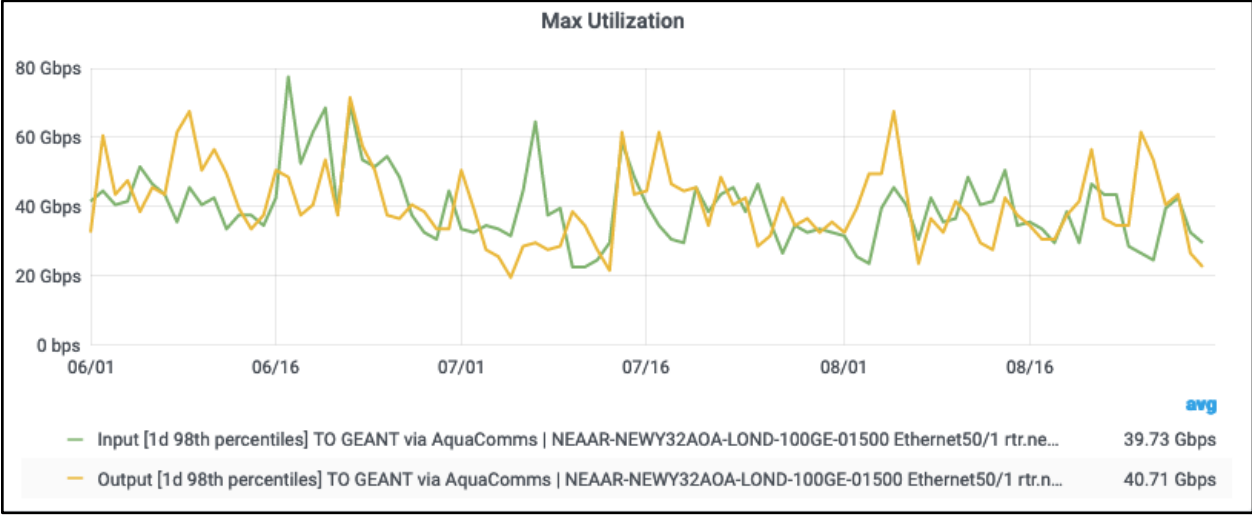


Figure 4: NEAAR New York-London 100G Circuit (NSF-funded) traffic using maximum daily averages.

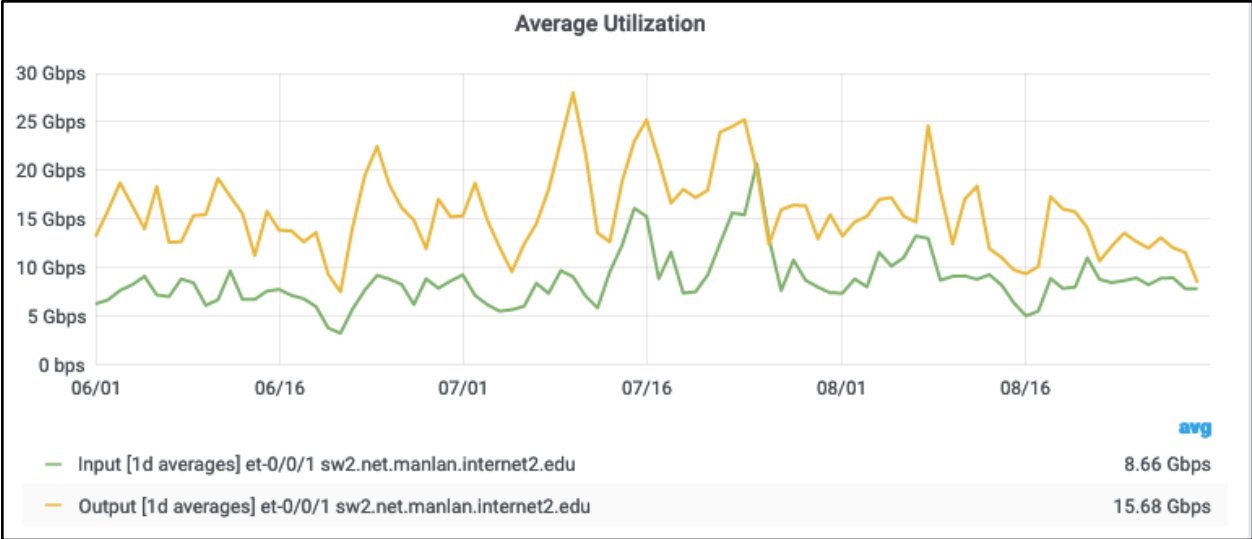


Figure 5: GÉANT New York-Paris 100G Circuit (GÉANT-funded) traffic using smoothed daily averages.

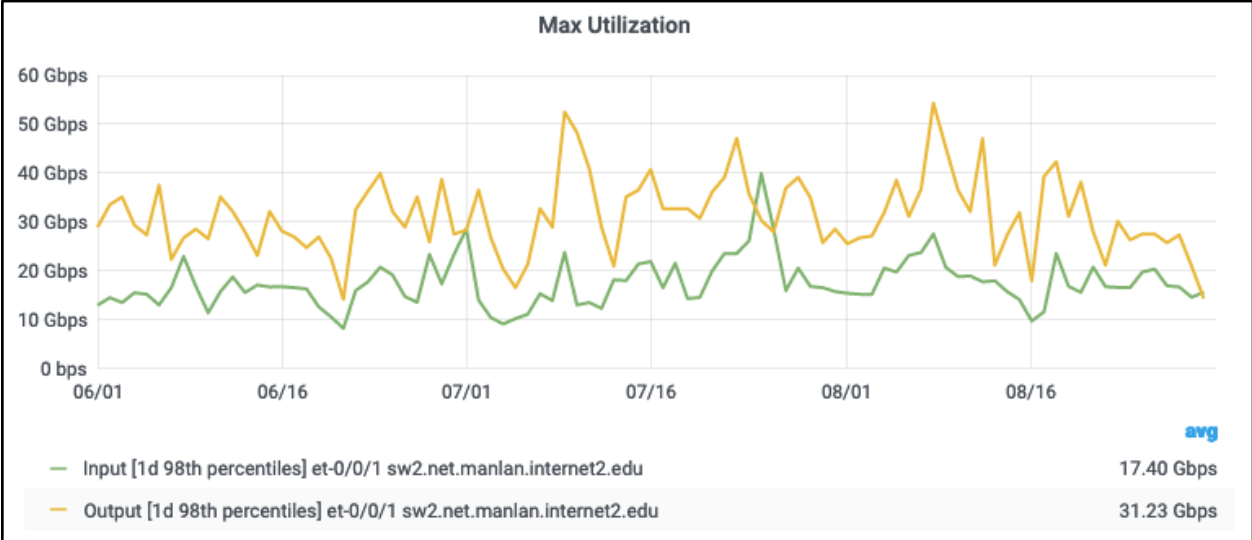


Figure 6: GÉANT New York-Paris 100G Circuit (GÉANT-funded) traffic using maximum daily averages.

## 8.2 Traffic Volume

Table 1 shows the full volume of traffic transferred over the NEAAR circuits during Quarter 1. Over 60 Petabytes of traffic has been transferred over the NEAAR circuits during the three months.

*Table 1: Traffic in terabytes transferred over NEAAR circuits, June 1, 2020 – August 31, 2020.*

	Jun	Jul	Aug	Total
New York-London	6,870	5,790	5,249	17,909
London-New York	6,979	5,788	5,520	18,287
New York-Paris	4,882	6,003	4,526	15,411
Paris-New York	2,358	3,286	2,864	8,508
Total	21,089	20,867	18,159	60,115

## 8.3 Flow Data

NEAAR collects sampled flow data for the 100G link between ManLan and London via sFlow from the NEAAR router installed in New York. This data is aggregated by NetSage, which we use to report our Top Talkers. Top Talkers for Quarter 1 are shown in Figure 7 and Figure 8, as well as the Top 10 Pairs in Table 2.

Consistent with previous quarters, in Quarter 1, energy science transfers were the greatest driver of traffic over the NEAAR circuit. The major sources of this traffic were JISC, Fermilab, Brookhaven, and CERN. However, in Quarter 1, we saw a continued increase in traffic from sources in Germany, including from the German NREN DFN, from the Karlsruhe Institute of Technology, and from DESY. In addition to the US DOE sites, the top destinations in the US were the Northeast Regional Data Center, Princeton University, and MIT. This too is related to high-energy physics, namely LHCONE and ATLAS traffic.

It is likely that the current trend of high volume HEP transfers will continue for the foreseeable future. NEAAR staff will continue to monitor this traffic, along with smaller volume traffic from other science domains.

Source	Total Vol.	Largest Flow	# Flows
<a href="#">Jisc Services Limited</a>	3.2 PB	175.9 GB	4.6 Mil
<a href="#">Brookhaven National Laboratory</a>	2.2 PB	94.2 GB	1.6 Mil
<a href="#">Fermi National Accelerator Laboratory (Fermilab)</a>	2.0 PB	68.6 GB	2.1 Mil
<a href="#">CERN - European Organization for Nuclear Research</a>	536.0 TB	54.8 GB	3.8 Mil
<a href="#">Verein zur Foerderung eines Deutschen Forschungsnetzes e.V.</a>	338.6 TB	141.3 GB	298.1 K
<a href="#">SWITCH</a>	305.1 TB	27.9 GB	205.3 K
<a href="#">Queen Mary and Westfield College, University of London</a>	218.4 TB	96.6 GB	176.3 K
<a href="#">SLAC National Accelerator Laboratory</a>	208.4 TB	40.4 GB	161.1 K
<a href="#">Massachusetts Institute of Technology</a>	182.8 TB	32.1 GB	215.5 K
<a href="#">Entidad Publica Empresarial Red.es</a>	141.1 TB	279.4 GB	162.6 K

Figure 7: Top 10 Sources on NEAR circuits, June 1, 2020 - August 31, 2020.

Destination	Total Vol. ~	Largest Flow	# Flows
<a href="#">Jisc Services Limited</a>	1.8 PB	61.6 GB	1.7 Mil
<a href="#">Brookhaven National Laboratory</a>	1.0 PB	54.9 GB	1.0 Mil
<a href="#">Princeton University</a>	637.5 TB	164.0 GB	1.7 Mil
<a href="#">Boston University</a>	526.9 TB	49.0 GB	372.5 K
<a href="#">BELNET</a>	482.5 TB	16.9 GB	501.4 K
<a href="#">SWITCH</a>	471.8 TB	76.7 GB	218.0 K
<a href="#">National Energy Research Scientific Computing Center</a>	389.7 TB	279.4 GB	312.4 K
<a href="#">Verein zur Foerderung eines Deutschen Forschungsnetzes e.V.</a>	379.7 TB	50.3 GB	399.0 K
<a href="#">CERN - European Organization for Nuclear Research</a>	376.9 TB	32.2 GB	643.2 K
<a href="#">Massachusetts Institute of Technology</a>	301.9 TB	78.9 GB	535.5 K

Figure 8: Top 10 Destinations on NEAR circuits, June 1, 2020 - August 31, 2020.

Table 2: Top 10 Flow Pairs on NEAR circuits, June 1, 2020 - August 31, 2020.

Source	Destination	Total Vol. ~	Largest Flow	# Flows
<a href="#">Brookhaven National Laboratory</a>	<a href="#">Jisc Services Limited</a>	831.3 TB	61.6 GB	556.1 K
<a href="#">Fermi National Accelerator Laboratory (Fermilab)</a>	<a href="#">Jisc Services Limited</a>	712.1 TB	18.0 GB	849.9 K
<a href="#">Jisc Services Limited</a>	<a href="#">Princeton University</a>	638.3 TB	164.0 GB	1.7 Mil
<a href="#">Fermi National Accelerator Laboratory (Fermilab)</a>	<a href="#">BELNET</a>	493.5 TB	16.9 GB	509.7 K
<a href="#">Jisc Services Limited</a>	<a href="#">Boston University</a>	464.8 TB	49.0 GB	324.6 K
<a href="#">Brookhaven National Laboratory</a>	<a href="#">SWITCH</a>	333.9 TB	76.7 GB	121.5 K
<a href="#">Brookhaven National Laboratory</a>	<a href="#">CERN - European Organization for Nuclear Research</a>	249.2 TB	31.4 GB	308.2 K
<a href="#">Jisc Services Limited</a>	<a href="#">Brookhaven National Laboratory</a>	247.8 TB	54.9 GB	190.2 K
<a href="#">Jisc Services Limited</a>	<a href="#">Massachusetts Institute of Technology</a>	242.0 TB	78.9 GB	224.6 K
<a href="#">Brookhaven National Laboratory</a>	<a href="#">Verein zur Foerderung eines Deutschen Forschungsnetzes e.V.</a>	238.7 TB	45.3 GB	152.8 K

#### **8.4 Trouble Tickets**

During Quarter 1, there were five scheduled maintenance and eighteen unscheduled outages, as shown in Table 3 and 4. These unscheduled outages were mostly brief and due to damaged or bumped fiber.

Table 3: Scheduled maintenance for NEAAR equipment and circuits, June 1, 2020 - August 31, 2020.

Ticket Number	Title	Maint Type	Source Impact	Current State	Start Time (UTC)	End Time (UTC)	Duration
CHG0043211	Maintenance	Circuit	Vendor	Closed	2020-06-18 00:00:00	2020-06-18 05:00:00	0 days 5 hr 0 min
CHG0043399	Maintenance	Circuit	Vendor	Closed	2020-06-19 00:06:56	2020-06-19 05:00:00	0 days 4 hr 53 min
CHG0043610	Emergency Maintenance	Circuit	Vendor	Closed	2020-06-29 23:00:00	2020-06-30 05:00:00	0 days 6 hr 0 min
CHG0043573	Maintenance	Circuit	Vendor	Closed	2020-07-25 22:07:58	2020-07-25 22:50:59	0 days 0 hr 43 min
CHG0044836	Maintenance	Circuit	Vendor	Closed	2020-08-12 22:08:21	2020-08-12 22:20:14	0 days 0 hr 11 min

Table 4: Unscheduled outages for NEAAR equipment and circuits, June 1, 2020 - August 31, 2020.

Incident Number	Cust Imp	Ntwk Imp	Title	Outage Type	Start Time (UTC)	End Time (UTC)	Duration
INC 0058571	2 - High	2 - High	Availability - NEAAR Backbone	Circuit - Bumped Fiber	2020-06-01 21:43:00	2020-06-01 23:35:35	0 days 1 hr 52 min
INC 0059975	2 - High	2 - High	Outage Resolved - NEAAR Backbone	Circuit - Damaged Fiber	2020-06-26 08:55:18 2020-06-26 10:03:24	2020-06-26 09:07:39 2020-06-26 10:23:56	0 days 0 hr 12 min 0 days 0 hr 20 min
INC 0059992	4 - Low	2 - High	Brief Outage - NEAAR Backbone	Hardware	2020-06-26 14:36:59	2020-06-26 14:37:08	0 days 0 hr 0 min
INC 0060035	2 - High	2 - High	Availability - NEAAR Backbone	Circuit - Other	2020-06-27 13:26:42 2020-06-28 04:30:02	2020-06-27 14:34:22 2020-06-28 04:56:02	0 days 1 hr 7 min 0 days 0 hr 26 min
INC 0060182	4 - Low	2 - High	Brief Outage - NEAAR Backbone	Circuit - Bumped Fiber	2020-06-30 09:08:55	2020-06-30 09:34:19	0 days 0 hr 25 min
INC 0060193	4 - Low	2 - High	Brief Outage - NEAAR Backbone	Undetermined	2020-06-30 12:11:00	2020-06-30 12:12:00	0 days 0 hr 1 min
INC 0060455	4 - Low	2 - High	Brief Outage - NEAAR Backbone	Circuit - Bumped Fiber	2020-07-03 11:55:01	2020-07-03 11:55:05	0 days 0 hr 0 min
INC 0060687	4 - Low	2 - High	Instability - NEAAR Backbone	Circuit - Cut Fiber	2020-07-08 11:47:43 2020-07-08 12:02:33 2020-07-08 12:31:02	2020-07-08 11:48:24 2020-07-08 12:02:34 2020-07-08 12:38:49	0 days 0 hr 0 min 0 days 0 hr 0 min 0 days 0 hr 7 min
INC 0061469	4 - Low	2 - High	Brief Outage - NEAAR Backbone	Circuit - Damaged Fiber	2020-07-21 01:02:41	2020-07-21 01:17:31	0 days 0 hr 14 min
INC 0061564	4 - Low	2 - High	Brief Outage - NEAAR Backbone	Circuit - Damaged Fiber	2020-07-22 09:41:14	2020-07-22 09:53:13	0 days 0 hr 11 min
INC 0061651	4 - Low	2 - High	Brief Outage - NEAAR Backbone	Circuit - Cut Fiber	2020-07-23 11:25:29	2020-07-23 11:43:49	0 days 0 hr 18 min
INC 0061790	2 - High	2 - High	Outage Resolved - NEAAR Backbone	Unannounced Maintenance	2020-07-25 04:03:28	2020-07-25 12:10:11	0 days 8 hr 6 min
INC 0061960	4 - Low	2 - High	Brief Outage - NEAAR Backbone	Circuit - Bumped Fiber	2020-07-28 10:10:20	2020-07-28 10:11:45	0 days 0 hr 1 min
INC 0062026	4 - Low	2 - High	Brief Outage - NEAAR Backbone	Circuit - Bumped Fiber	2020-07-29 00:47:25	2020-07-29 00:47:28	0 days 0 hr 0 min
INC 0062266	4 - Low	2 - High	Brief Outage - NEAAR Backbone	Undetermined	2020-08-01 05:39:43	2020-08-01 05:40:00	0 days 0 hr 0 min
INC 0062534	4 - Low	2 - High	Brief Outage - NEAAR Backbone	Unannounced Maintenance	2020-08-05 23:41:32	2020-08-05 23:54:14	0 days 0 hr 12 min
INC 0063260	4 - Low	2 - High	Brief Outage - NEAAR Backbone	Undetermined	2020-08-16 23:03:31	2020-08-16 23:03:36	0 days 0 hr 0 min
INC 0063503	4 - Low	2 - High	Brief Outage - NEAAR Backbone	Circuit - Bumped Fiber	2020-08-19 23:46:57	2020-08-19 23:46:59	0 days 0 hr 0 min



## 8.5 Downtime and Availability

Table 5 shows that there was no reported downtime for core nodes on the project for Quarter 1. Table 6 lists the downtime for the project's circuits. In Quarter 1, the majority of the downtime was due to circuit maintenance.

*Table 5: Downtime and availability for NEAAR core nodes for Quarter 1.*

NEAAR Nodes	Down Time for Quarter 1	Quarter 1 Availability
dcp.newy32aoa.neaar.net	00 hr 00 min	100.00%
rtr.newy32aoa.neaar.net	00 hr 00 min	100.00%
perf.newy32aoa.neaar.net	00 hr 00 min	100.00%
oob.newy32aoa.neaar.net	00 hr 00 min	100.00%

*Table 6: Downtime and availability for NEAAR circuits for Quarter 1.*

NEAAR Backbone Circuits	Down Time Quarter 1	Quarter 1 Availability
NEAAR-NEWY32AOA-LOND-100GE-01500	1 dy 6 hr 28 min	98.61%
NEAAR-NEWY32AOA-NEWY32AOA-100GE-01501	00 hr 00 min	100.00%

## 9. Security Events and Activities

Basic security measures were maintained throughout Quarter 1, and there were no security incidents to report in quarter 1. The updated IN@IU security documents can be found online at <https://internationalnetworks.iu.edu/about/policies.html>.

## 10. Reporting against Objectives

Below is the list of WBS items for Year 4 and their current status.

- 1 Planning for Technology**
  - 1.5 Discussion of GÉANT Open connections
    - ONGOING - Monitoring WACREN traffic- see Section 7.4, NORDUnet peerings are on hold - see Section 7.1
- 2 Operations**
  - 2.3 Operate Infrastructure
    - ONGOING - circuit was available 99% of this reporting period - see Section 8.4 and 8.5
  - 2.4 Coordinate with IRNC:NOC winner
    - ONGOING - NEAAR continues close coordination with the IRNC NOC - see Section 4.2
  - 2.5 Coordinate with IRNC:AMI winner
    - ONGOING - NEAAR shares measurement data with NetSage and uses dashboards for reporting. We continue to work on flow analysis and the Science Registry - see Sections 4.2
  - 2.6 Network Security
    - ONGOING - Security documents continue to be updated - see Section 9
- 3 Measurement and Monitoring**
  - 3.2 Flow data collection from 100G
    - ONGOING - see Section 8.3
  - 3.5 Routing research and analysis
    - ONGOING - see Section 7.2
  - 3.6 Research to understand performance spikes and anomalies
    - ONGOING - Our analysis continued - see Section 7.2
- 4 Training for Measurement and Monitoring**
  - 4.10. Help support UA PS mesh
    - ONGOING - see Section 6.3
  - 4.11 Help support ASREN PS mesh
    - ONGOING - see Section 6.3
  - 4.12 Help support WACREN PS mesh
    - ONGOING - see Section 6.3
  - 4.17 Small PS node class for RENU - Uganda
    - POSTPONED - Meshbuilder Workshop scheduled to take place July 27-31, 2020 has been rescheduled for February 2021- see Section 6.3
- 5 Other Outreach**
  - 5.1 Attend domestic and international conferences for application identification and relationship maintenance:
    - ONGOING - see Section 3
  - 5.2 Outreach to science applications based on NetFlow information

- ONGOING - We continue to look through flow data and discuss with our partners what application communities would most benefit from more intentional engagement - see Section 4, 7.2, and 8.3
- 5.3 Outreach to science applications based on NSF funding data
- ONGOING - We continue to reach out to NSF awardees - see Section 4
- 5.4 Coordination of science engagement
- ONGOING - We continue to work with global partners on science engagement best practices - see Section 4
- 6 Project Coordination**
- 6.1 Project Management
- ONGOING - We hold regular partner calls and face to face meetings throughout the year - see Section 4.1
- 6.2 Project Reporting
- ONGOING - Reporting infrastructure in place for up to date quarterly reporting; WBS update as part of this report - see Section 11

## 11. Year 5 Quarter 1 Financials

This quarter, expenditures continued to be under what was predicted due to pandemic-related travel restrictions as well as restrictions at IU that meant the expected 3% cost of living increase for salaries did not take place and in fact, there is both a salary and hiring freeze at this time. Because of this, we will be requesting a no-cost extension for the project.

This project supports international network connections and as such spends a significant portion of the budget on circuit contracts with international carriers. During this quarter, \$60,000, 49% of the overall expenditures, was paid to AquaComms, an Irish company for the 100G New York-London circuit.

	Jun-20	Jul-20	Aug-20	TOTAL
<b>SALARIES</b>				
Jennifer Schopf	1,909	1,909	1,909	<b>5,727</b>
Doug Southworth	825	824	824	<b>2,473</b>
Scott Chevalier	377	378	378	<b>1,133</b>
Ed Moynihan	3,005	4,201	4,201	<b>11,407</b>
Hubbard - Staff Support	999	997	997	<b>2,993</b>
Hans Addleman	645	644	644	<b>1,933</b>
Tier 2/3 support	4087	4124	4134	<b>12,355</b>
F&A on Compensation 32%	3,791	4,188	4,188	<b>12,167</b>
<b>Subtotal Compensation</b>	<b>15,638</b>	<b>17,275</b>	<b>17,275</b>	<b>50,188</b>
<b>TRAVEL/OTHER</b>				
Travel - Moynihan ASREN Dec'19	4,252			<b>4,252</b>
F&A on Travel/Other 32%	1,361	0	0	<b>1,361</b>
<b>Subtotal Travel</b>	<b>5,613</b>	<b>0</b>	<b>0</b>	<b>5,613</b>
<b>CIRCUITS</b>				
AE Connect 100G circuit	20,000	20000	20,000	<b>60,000</b>
Nysernet	6,025			<b>6,025</b>
wire transfer fee	60	0	0	<b>60</b>
<b>Subtotal Circuits</b>	<b>26,085</b>	<b>20,000</b>	<b>20,000</b>	<b>66,085</b>
<b>TOTAL</b>	<b>47,336</b>	<b>37,275</b>	<b>37,275</b>	<b>121,885</b>