

ESnet Update for ESCC

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Director, Energy Sciences Network

Director, Scientific Networking Division

Lawrence Berkeley National Laboratory

ESCC July 2013

Monday July 15, 2013



Topics



- 1) highlights of past six months
- 2) announcements, initiatives, and projects

Topics



- 1) highlights of past six months
- 2) announcements, initiatives, and projects

Overall trend: Smoother Sailing



2012

We put the finishing touches on ESnet5, and started connecting your sites at 100G.

We've begun to fill job openings.

We launched our Science Engagement team.

We're re-tooling internal processes.

We're building stronger ties to sites.

We've completed our operational assessment review.

And the innovation continues.

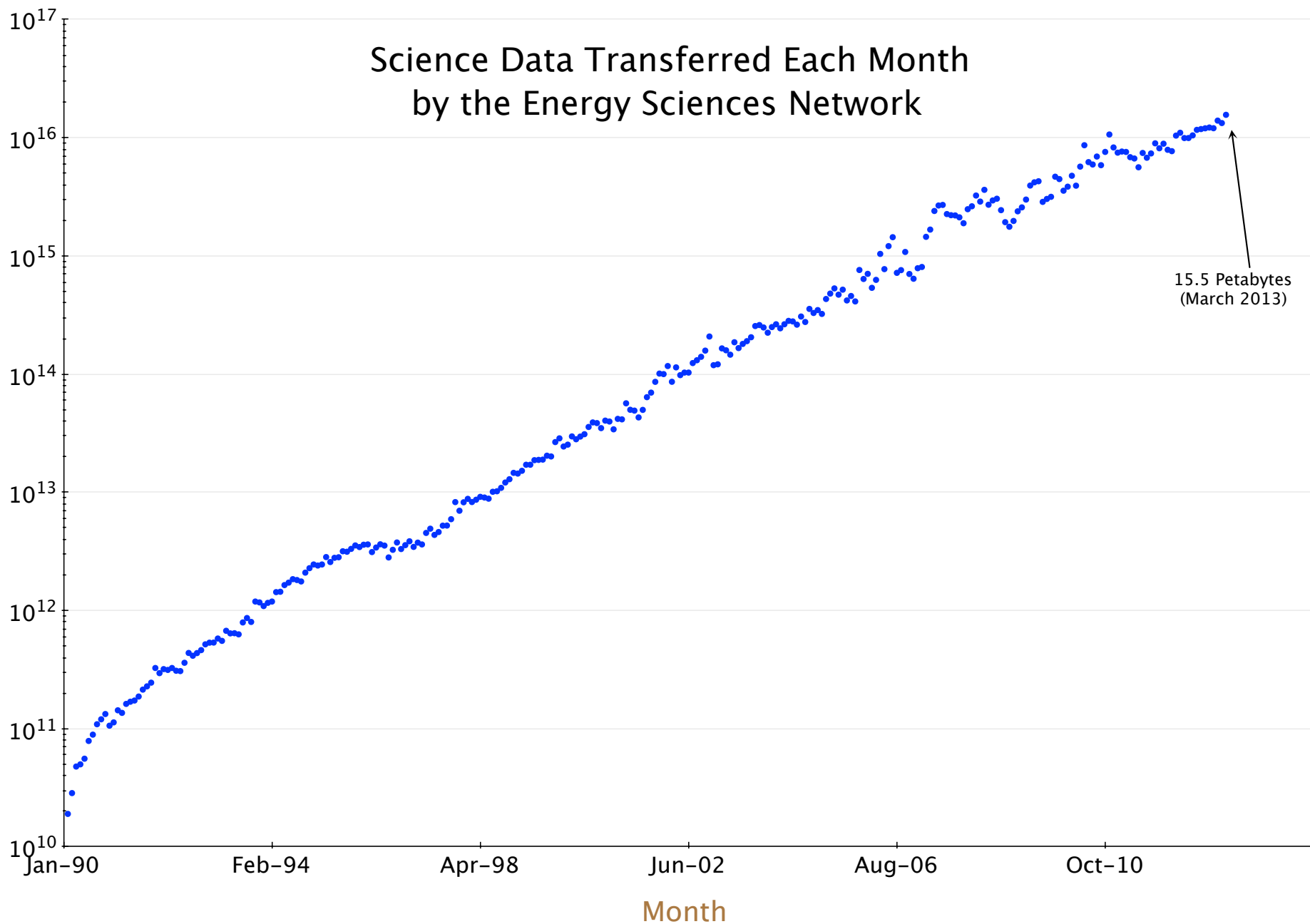


2013

7/15/13

Science Data Transferred Each Month by the Energy Sciences Network

Bytes Transferred



Science Data Transferred Each Month by the Energy Sciences Network

Bytes Transferred

1.6×10^{16}

1.4×10^{16}

1.2×10^{16}

1×10^{16}

8×10^{15}

6×10^{15}

4×10^{15}

2×10^{15}

0

Jan-90

Feb-94

Apr-98

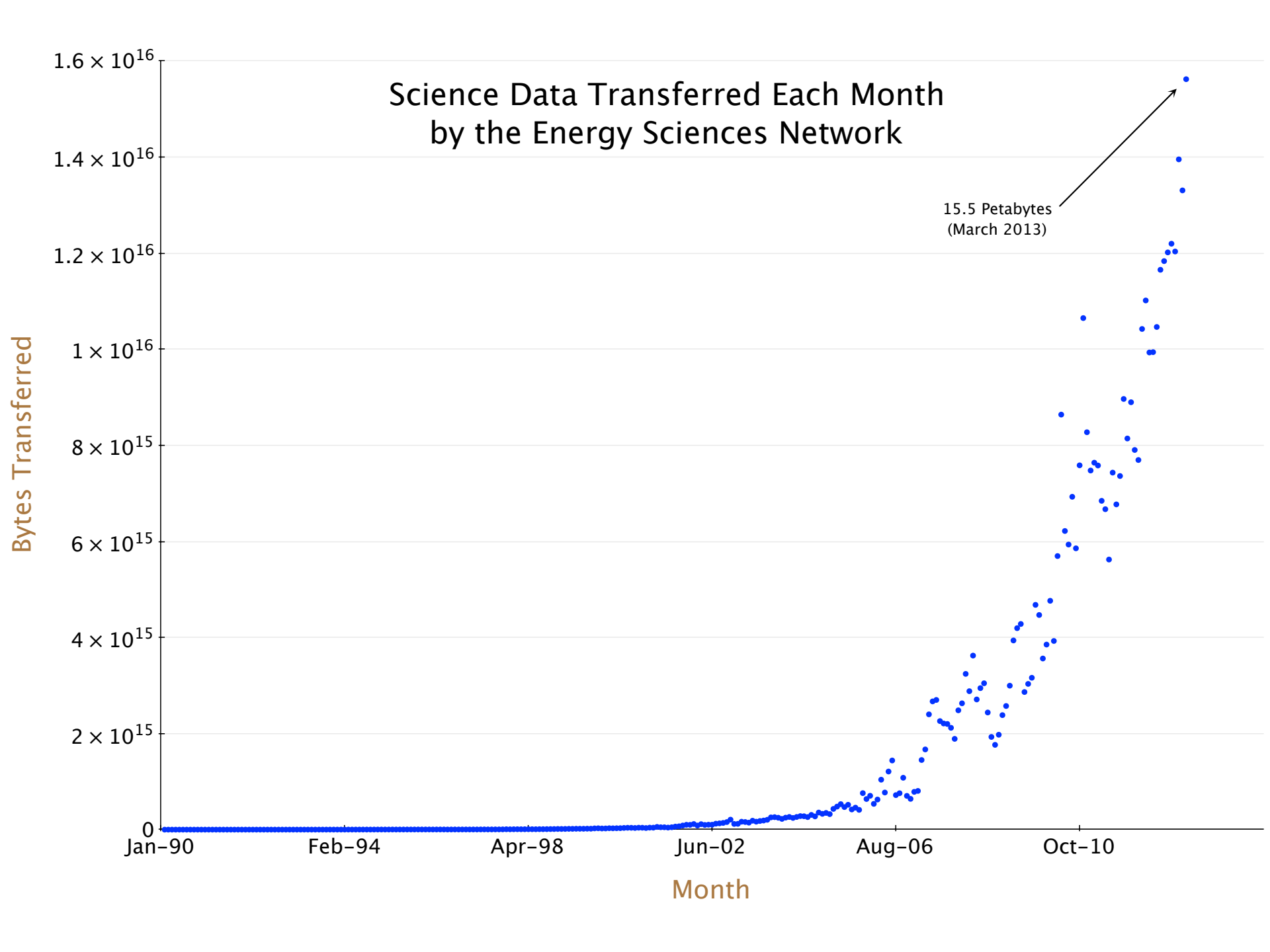
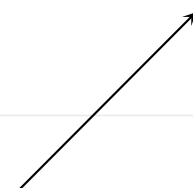
Jun-02

Aug-06

Oct-10

Month

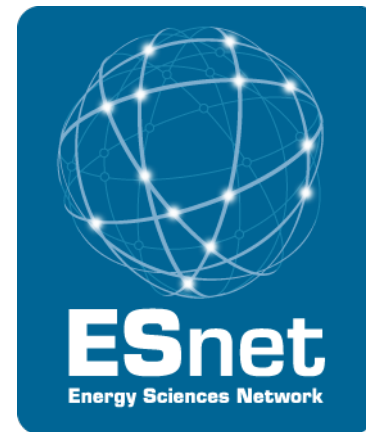
15.5 Petabytes
(March 2013)





Filling Staff Vacancies

- Susan Lucas, Division Deputy for Business Operations
- Brooklin Gore, Group Lead for Infrastructure
- Mark Kulawik, Infrastructure Team
- Paul Porter, Infrastructure Team
- Mike Pfannenstiel, Video / Collaboration Strategy
- Jason Zurawksi, Science Engagement Engineer
- Mary Hester, Science Engagement Coordinator
- Eli Dart [transition from NESG to Science Engagement Team]
- Active recruitments for network engineers, software developers



**ESnet Director & Scientific
Networking Division Director**
Greg Bell

Senior Advisor
William Johnston *

Deputy for Operations
Susan Lucas

**Security and Disaster
Recovery Officer**
Dan Peterson

Program Administrator
Gizella Kapus

Science Engagement
Lauren Rotman

• Shorei Butler
• **Contract
Administrator (under
recruitment)**

Outreach Coordinator
Mary Hester

**Area Lead
Infrastructure, Collaboration, and Identity**
Patty Giuntoli

**Chief Technologist and Area Lead
Network Engineering, Operations, and Research**
Inder Monga

**Audio, Video,
Data Collaboration**

• Michael Pfannenstiel
• Sheila Cisko
• *ACT
Teleconferencing
Services

Infrastructure & identity
Brooklin Gore

• Deb Heller
• Roberto Morelli
• Brendan White
• Daniel White
• Dhiva Muruganantham
• Mark Kulawik
• Paul Porter

**Operations and
Deployment**

• Chris Cavallo
• John Christman
• Scott Mason
• John P. Jones
• Mark Redman
• Scott Richmond
• Cody Rotermund

**Network
Engineering**
Michael Bennett

• Vangelis Chaniotakis
• Eli Dart
• Patrick Dorn
• Chin Guok
• Yvonne Hines
• Joe Metzger
• Kevin Oberman *
• Mike O'Connor
• Michael Sinatra
• Chris Tracy
• **Network Engineer
(under recruitment)**

Tools

• Jon Dugan
• Gopal Vaswani
• **Software Developer
(under recruitment)**

**Advanced Network
Technologies**
Brian Tierney

• Andy Lake
• Eric Pouyoul
• Jason Zurawski
• Sowmya Balasubramanian
• **Software Developer
(under recruitment)**

Office of the CTO

• Eli Dart
(Matrixed to SE)
• Jason Zurawski
(Matrixed to SE)



Chin
Guok

Evangelos
Chaniotakis

Andrew
Lake

Eric
Pouyoul

Mary
Thompson

Bill
Johnston

Awards and honors, past 6 months:

- R&D100 Award for OSCARS version 0.6
- Best Paper award, “On How to Provision Quality of Service for Large Dataset Transfers,” *Sixth International Conference on Communication Theory, Reliability, and Quality of Service* (Zhenzhen Yan, Malathi Veeraraghavan, Chris Tracy, and Chin Guok)
- Inder Monga named Research Associate for Open Networking Foundation [plus invitation to keynote CHEP]
- Accepted SC13 Paper: “The Science DMZ: A Network Design Pattern for Data-Intensive Science”
- Accepted SC13 Tutorial with Globus Online
- Accepted SC13 Tutorial on perfSONAR

ESnet Strategic Plan, Part II



Summarized @ TIP in January

- “discovery unconstrained by geography”

Presented to ASCAC subcommittee January 30th

- reception, ranking, recruitment

Final version now online:

<http://www.es.net/about/esnet-strategic-plan/>

Strategic Plan
FY2014-FY2023
ESnet

March 1, 2013



This work was supported by the Director, Office of Science, Office of Advanced Scientific Computing Research of the U.S. Department of Energy under Contract No. DE-AC02-05GH11231.

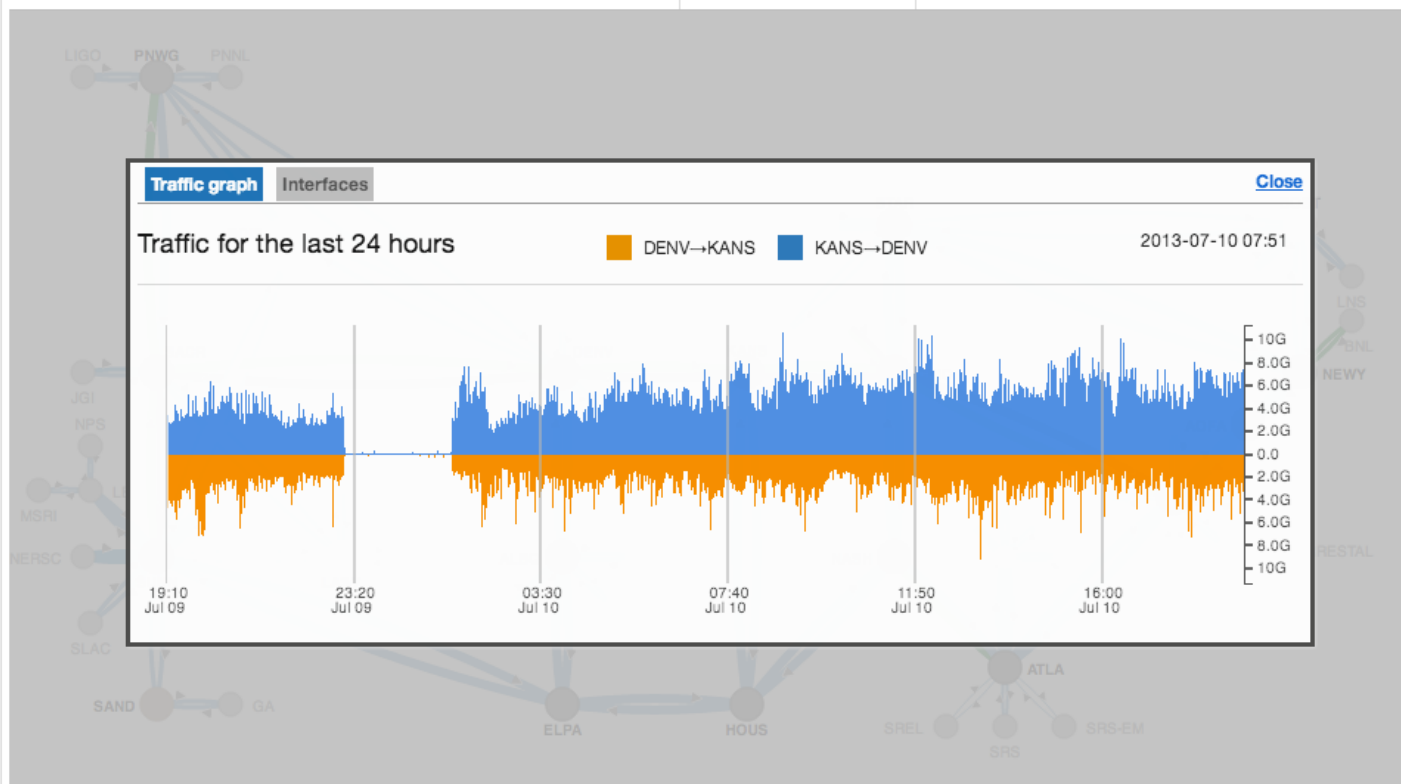
- improved design, colors, mouse-over updates



Tools Team Update: MyESnet Portal



Clicking a link now shows traffic graph, interfaces:



Trans-Atlantic 100G Pilot Circuit



World's first 100G TA circuit (we think)

- ESnet one of six NREN partners (ESnet, Internet2, NORDUNet, SURFnet, DANTE, CANARIE)
- Operationally, economically, symbolically, politically important
- Thank you, Ciena!



Visualizing Trans-Atlantic Demonstrations



Web page for the demonstration: <https://my.es.net/demos/tnc2013/>

Transatlantic Traffic

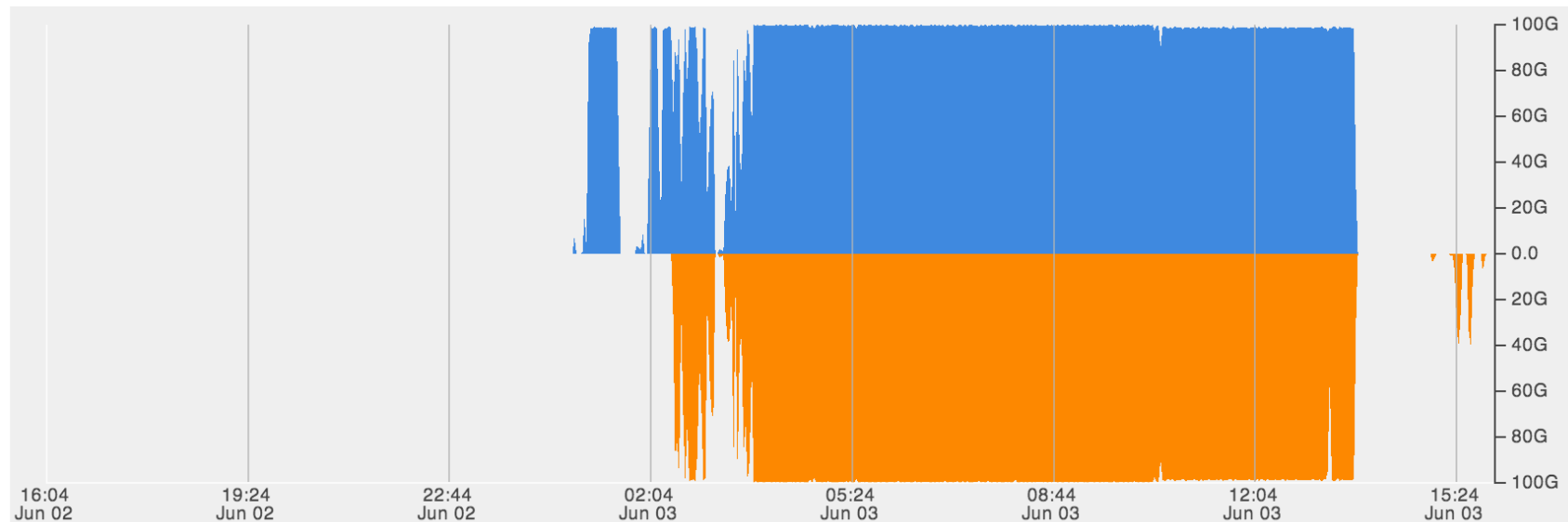
Refresh graph

Time period: All | **24h** | 6h

Amsterdam → MAN LAN

MAN LAN → Amsterdam

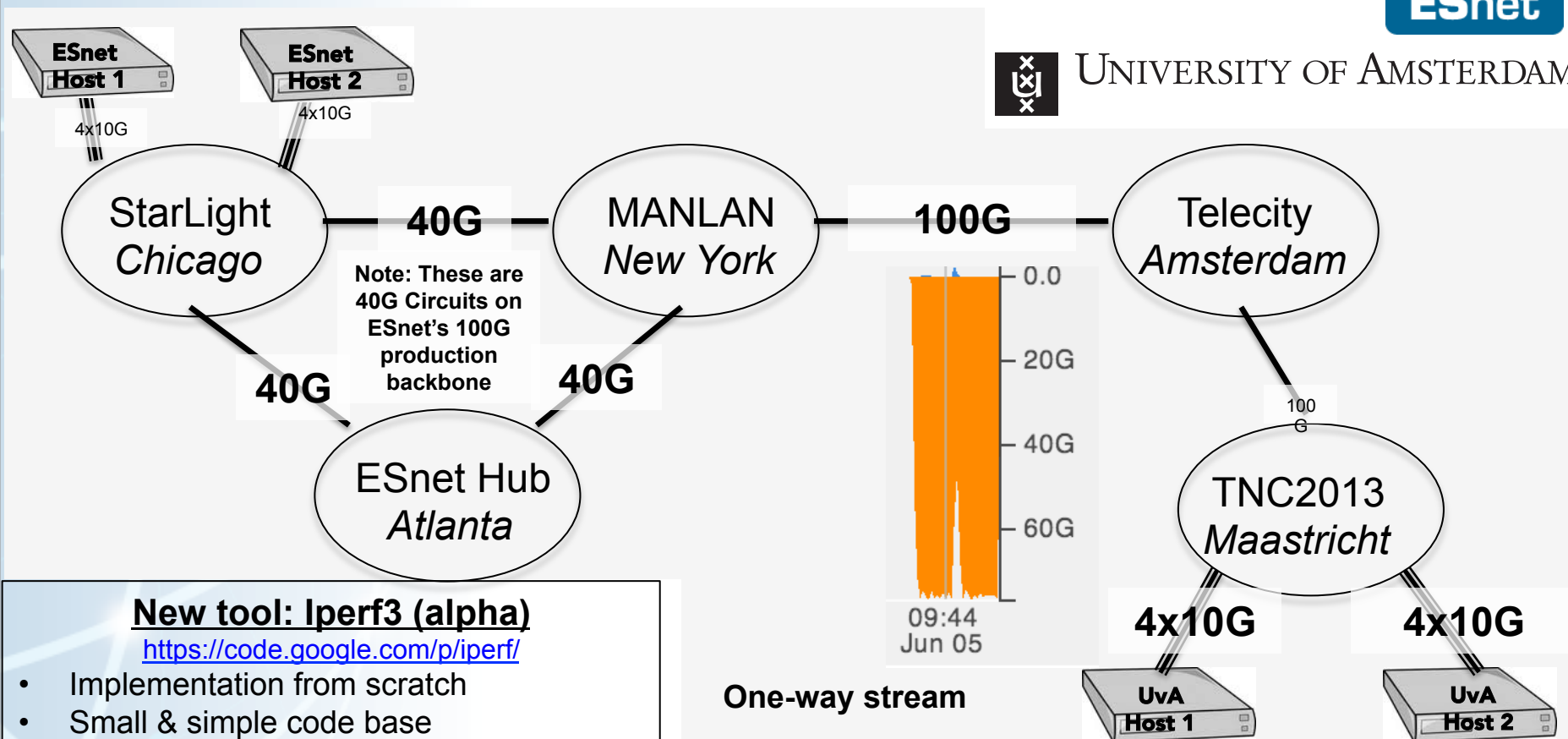
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How many modern servers can fill a 100Gps Trans-Atlantic circuit?



UNIVERSITY OF AMSTERDAM



New tool: Iperf3 (alpha)

<https://code.google.com/p/iperf/>

- Implementation from scratch
- Small & simple code base
- New features
 - Reports retransmissions
 - Reports CPU utilization
 - JSON output format

Contributors

ESnet: Brian Tierney, Inder Monga, Chin Guok

UvA: Ralph Koning, Cees DeLaat



Research and Innovation Update [ANTG]

perfSONAR: v3.3 released, which includes:

- completely new lookup service
- perfSONAR dashboard
- centralized mesh configuration management software
- updated base OS from CentOS 5 to CentOS 6

Testbed

- migration from ANL to Starlight
- OpenFlow testbed nodes up at LBL, NERSC, ANL, BNL, NEWY
- much more - detailed update from Brian coming up

Joint work with the Science Engagement team:

- 2 papers (ScienceDMZ, RDMA)
- major updates to “Science DMZ” section of fasterdata.es.net
 - buying/tuning DTN nodes
 - Science DMZ security solutions

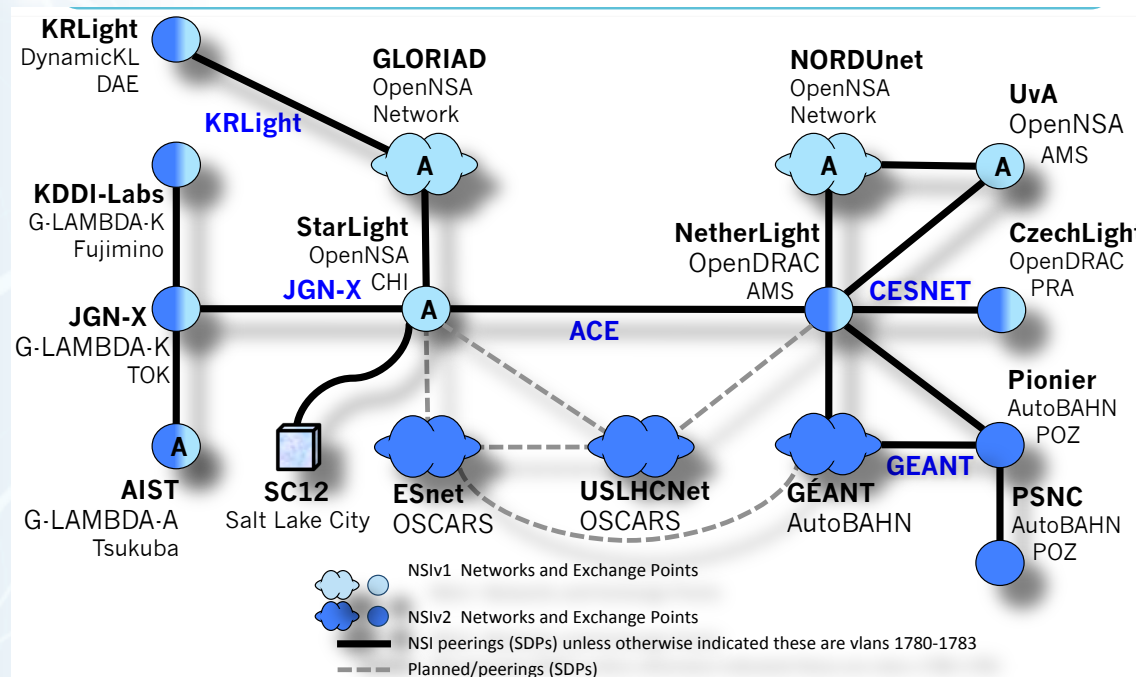
Research and Innovation Update



NSI v2.0 Integration for OSCARS

R&E networks moving to Network Services Interface (NSI) v2.0 for inter-domain connections

- NSI development in OSCARS in progress.
- Joint open source development with SURFnet to build NSI Aggregator



Research and Innovation Update

SDN collaboration involving Google, REANNZ, ESnet selected for demonstration at Open Networking Summit (April).



Front-Line Assembly

DEMO

First international BGP peering using SDN in production between two national-scale network providers

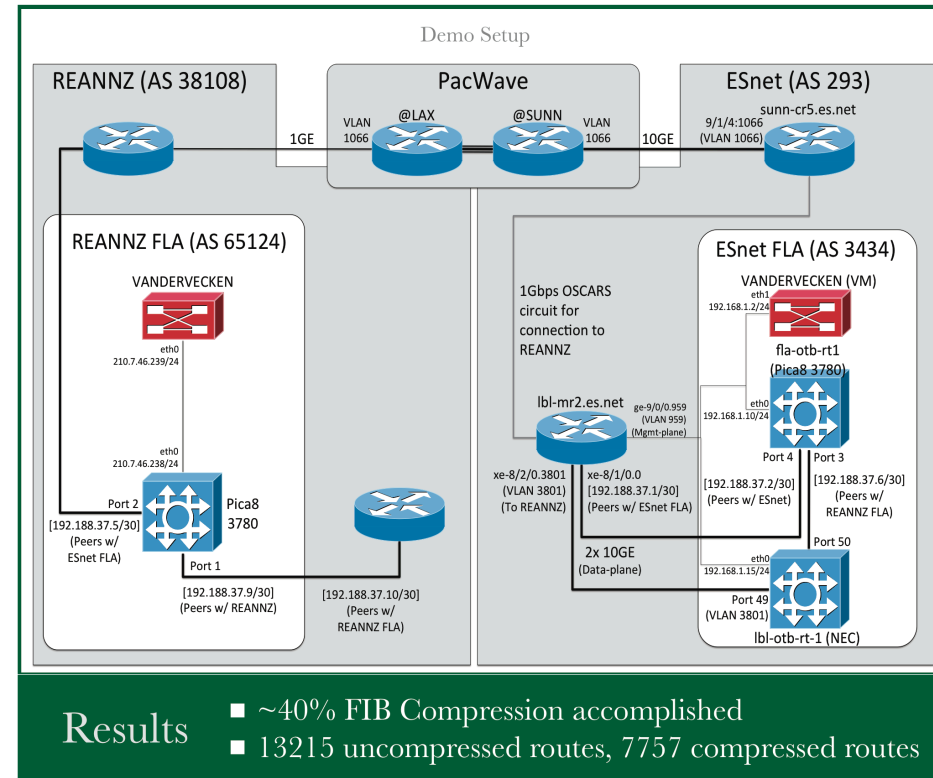
- Innovative FIB compression enables using commodity OpenFlow switches for peering
- Leverages community open-source packages. RouteFlow and Quagga

Insights

- SDN networks can interface with existing Internet
- New techniques need to be developed to scale controller-based networking

Demonstration Team:

Google Network Research – Josh Bailey, Scott Whyte
REANNZ – Dylan Hall, Sam Russell, James Wix, Steve Cotter
ESnet – Inder Monga, Chin Guok, Eric Pouyoul, Brian Tierney
Acknowledgements - Joe Stringer





2013 ESnet Summer Students

Ahmed El-Hassany, Indiana University PhD student

- new Topology Service for OSCARS

Adrian Lara, Univ of Nebraska Lincoln PhD student

- OpenFlow switch testing and network virtualization topics

Henrique Rodrigues, UC San Diego PhD student

- Topics in Layer-1 OpenFlow with Infinera

Luke Lamonica, Univ San Francisco Masters student

- perfSONAR Lookup Service verification and scalability test framework

Andrew Sides, Missouri University of Science and Technology Undergraduate

- web-based perfSONAR Lookup Service search tool

Jin Huang, University of Texas, Arlington

- Analysis of ESnet router interface utilization data

Susmit Shannigrahi, Colorado State University PhD student

- Evaluating Named Data Networking for Large Scientific Data

NESG Update



- Work completed since January
 - ORNL, ANL 100G production links activated (primary IP peering and available for OSCARS circuits)
- Current work in progress (Next six months)
 - BNL, FNAL, LBNL, LLNL, NERSC 100G production link activations
 - DC MAN redundancy
 - ChiExpress fiber and optical node diversity
 - Continued hub cleanup / MX consolidation
 - ANA-100G testing and demonstrations
 - QoS and OSCARS updates
 - Alien wave testing
 - Hiring process for two network engineers

Infrastructure, Identity, Ops & Deployment Updates



Infrastructure: New and exciting since last ESCC:

- Welcome Brooklin Gore as Infrastructure Group Lead (6/28)
- Completed deployment of blade servers, VMware and mass storage at Brookhaven
 - ESnet now has an East Coast data center
 - work progressing to implement VLANs, consolidate servers, and implement resilient services (LDAP, etc)

ServiceNow (SN) updates

- Trained new SN Administrator (Deb), hired process design and SN Admin (Paul)
- Incident: Improved mapping of incident types and subtypes, created resolving groups for Network Services
- Introduced Service Catalogue, working on populating with service flows (VM Request, etc)

Science Engagement Update



Team Vision

Collaborations at every scale, in every domain, will have the information and tools they need to achieve maximum benefit from scientific facilities, global networks, and emerging network capabilities.



Science Data Transport Today

(for small/mid sized collaborations)



“It is estimated that the transfer of multiple terabytes of output to a Core Data Node would take much longer via the internet (by means of normal network hardware and conduits) than via physical disks, which is why the data will usually be transferred using portable hard disks. ”

- *CMIP5 Data Submission website (Climate)*
<http://cmip-pcmdi.llnl.gov/cmip5/submit.html>



Can you move 1TB in 20 minutes? If not, please raise your expectations.

File size				
100TB	13,333.3 Gbps	2,666.7 Gbps	666.7 Gbps	222.2 Gbps
10TB	1,333.3 Gbps	266.7 Gbps	66.7 Gbps	22.2 Gbps
1TB	133.3 Gbps	26.7 Gbps	6.7 Gbps	2.2 Gbps
100GB	13.3 Gbps	2.7 Gbps	666.7 Mbps	222.2 Mbps
10GB	1.3 Gbps	266.7 Mbps	66.7 Mbps	22.2 Mbps
1GB	133.3 Mbps	26.7 Mbps	6.7 Mbps	2.2 Mbps
100MB	13.3 Mbps	2.7 Mbps	666.7 Kbps	222.2 Kbps
10MB	1.3 Mbps	266.7 Kbps	66.7 Kbps	22.2 Kbps
1MB	133.3 Kbps	26.7 Kbps	6.7 Kbps	2.2 Kbps
	1 Minute	5 Minutes	20 Minutes	1 Hour
Time to transfer				

File size				
10PB	2,777.8 Gbps	925.9 Gbps	132.3 Gbps	30.9 Gbps
1PB	277.8 Gbps	92.6 Gbps	13.2 Gbps	3.1 Gbps
100TB	27.8 Gbps	9.3 Gbps	1.3 Gbps	308.6 Mbps
10TB	2.8 Gbps	925.9 Mbps	132.3 Mbps	30.9 Mbps
1TB	277.8 Mbps	92.6 Mbps	13.2 Mbps	3.1 Mbps
100GB	27.8 Mbps	9.3 Mbps	1.3 Mbps	308.6 Kbps
10GB	2.8 Mbps	925.9 Kbps	132.3 Kbps	30.9 Kbps
1GB	277.8 Kbps	92.6 Kbps	13.2 Kbps	3.1 Kbps
100MB	27.8 Kbps	9.3 Kbps	1.3 Kbps	0.3 Kbps
	8 Hours	24 Hours	7 Days	30 Days
Time to transfer				

Network throughput required to move y bytes in x time (<http://fasterdata.es.net>).

Science Engagement Strategy



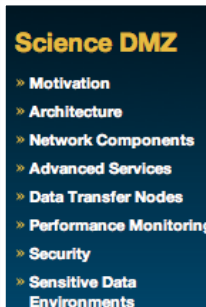
Partnerships

With facilities / research teams / providers, building foundation for lasting, scaling impact.



Education & Consulting

Webinars, workshops, 1:1 data mobility consultations with scientists, support teams.



Technical Communication

Reference designs, case studies, papers, FAQs – tailored for multiple audiences.

Key Accomplishments 2012/2013



Partnerships

- **NUFO:** Data-Focused Annual Meeting, NCEM demo in DC
- **Globus Online:** SC13 Tutorial, Quarterly Webinars, Joint Case Studies, White Paper
- **Enlighten Your Research Competition:** I2, SURFnet, JANET, Funet



Education & Consulting

- **Science DMZ:** OIN Workshops, Forums & Mail Lists, SC13 State of the Practice Paper
- **PerfSONAR:** CCNIE webinars, SC13 Tutorial
- **Life Sciences:** consulting with 4-6 beamline scientists, *Lightsources as Datasources* Workshop, Focused Technical Workshop
- **Climate:** beginning engagement with ARM, EYR submission for ESG, more to come



Technical Communication

- **Website:** Creating new Science-focused ESnet website content
- **Collateral:** New DOE Monthly Update, New tearsheets targeted towards science communities of interest, Case studies, Non-technical documentation

ESnet Science Engagement Team



Lauren Rotman

Science Engagement Group Lead

Eli Dart

Science Engagement Engineer

Jason Zurawski

Science Engagement Engineer

Mary Hester

Science Engagement coordinator

Contact us anytime:

ENGAGE@ES.NET



Topics



- 1) highlights of past six months
- 2) announcements, initiatives, and projects



Overarching Themes for 2013

- return to balance
 - ✓ people still working hard, but have their weekends again (mostly)
 - ✓ chronic under-staffing finally being remedied
- focus on strategy
 - ✓ all effort to be judged against the following test: does it improve science outcomes?
- clarify roles, responsibilities, processes
 - ✓ growing pains
 - ✓ automation, standardization, optimization

RFP for European Extension

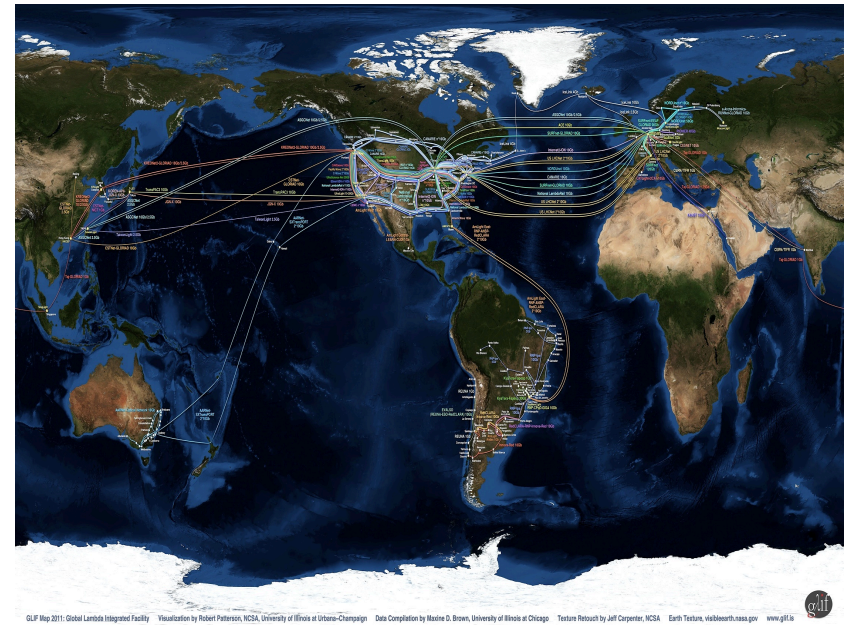


Motivation:

- Provide dedicated network capacity for DOE science that does not entirely depend on goodwill or continued funding from other agencies or networks.
- Assure that ESnet's advanced capabilities for science are available on expanded footprint.
- Support LHC traffic flows.
- Support other science data flows (eg climate, genomics) terminating in DOE complex.

Process:

- RFP released July 10. Mission review Aug 22. To be followed by further reviews, decision.



Reminder: NNSA Relationship has Evolved



We have moved to new direct-funded model for FY13.

- Reduces our distraction, increases efficiency
 - we **had** 20 separate agreements, **now just one**
 - sites didn't always pay in the past, but we think NNSA OCIO will pay ;-)
 - this aligns NNSA model with model for SC
- Allows ESnet to focus on technical / service interface
- Site Coordinator relationship stays the same
- NNSA OCIO developing governance process for coordinating and evaluating capability enhancement requests that have budget implications.

Focused Technical Workshop



An experiment.

Intersection of networking and cutting edge life sciences.

World-class speakers.

Not Joint Techs, but something different.

Let's see how this goes.

Show Results

Print version

Export to ical

Netcast

From Now (default)

All Days

In the next 15 minutes

Wednesday July 17

Thursday July 18

Wednesday, 7/17

Location

8:30 AM - 9:00 AM

Welcome and Overview

- Inder Monga , Energy Sciences Network (ESnet)
- Stephen Wolff , Internet2

9:00 AM - 9:30 AM

Keynote: Jay Keasling (Associate Lab Director for Biosciences, LBNL)

9:30 AM - 10:00 AM

Break

10:00 AM - 10:05 AM

Network Infrastructures for Life Sciences: Introduction

Auditorium

- Michael Sullivan , Internet2

This segment, moderated by Mike Sullivan (Internet2), will contain talks from:

- Don Preuss , NIH/NCBI
- Chris Dagdigan , BioTeam
- Bill Barnett , Indiana U, Director of NCGAS
- Miguel de Vos , SURFnet
- KC Wang , Clemson University

10:05 AM - 10:20 AM

Roll em in, Move em out - Moving data at NCBI

Auditorium

- Don Preuss , NIH/NLM/NCBI

A discussion of current NCBI data and network architecture, bottlenecks, future growth and speculations on NIH networking more broadly. Presentation of some new methods for remote I/O, data distribution and cloud efforts to help reduce time to discovery.

10:20 AM - 10:35 AM

IT for Life Science Informatics

Auditorium

- Chris Dagdigan , BioTeam

The BioTeam (www.bioteam.net) is an independent consulting shop with 15+ years of experience "bridging the gap" between life science informatics and high performance IT. Drawing from real world experience and current projects for biotech, pharma, government, nonprofit and EDU clients, this presentation will cover in general terms the ways in which instruments and life science requirements influence the size, shape, scale and configuration of IT infrastructures. Given the workshop focus, specific attention will be given to networking, data management and data movement issues.

10:35 AM - 10:50 AM

The National Center for Genome Analysis Support as a Model Virtual Resource for Biologists

Auditorium

- William Barnett , Indiana University

The rapid increase in the data generated by next generation sequencing (NGS) presents the opportunity to use genomics science to advance healthcare research, and 'omics studies are being applied to a broad range of diseases and conditions. A single next generation sequencer can generate 40GB of data per day and, with instrument costs decreasing, the aggregate output of raw sequence data doubles every 9 months. Further, a single whole human genome can easily require 150 GB of storage. Given this increase in sequencing capability, and growing "big data" challenge, the bioinformatics and computational infrastructure needed to turn sequences into science at academic medical centers has not been able to keep pace. Fortunately, evolving national cyberinfrastructures, originally developed to manage and analyze data from "big science" projects like astronomical observatories or the Large Hadron Collider, provide the scale to handle genomics data. Organizations like the Internet2 have the networks that can support large scale data movement.

The National Center for Genome Analysis Support (NCGAS) has developed the concept of a national virtual genome science core that can provide the analytical support for the next

Broala, a Bro Services Company



We've used Bro for 15 years.

NERSC, LBNL, UCB, many other sites too.

A powerful, flexible, Science DMZ-friendly security tool.

Broala is a new company for support, customization, consulting, sustainability.



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ABOUT US

Broala provides scalable, customized network security solutions based on the open-source Bro network analysis platform. Our services include assessing and guiding your current and future Bro installations, supporting your operations on an ongoing basis, training your staff in all aspects of operating and optimizing a Bro installation, tightly interfacing your existing IT infrastructure with a Bro setup, and developing extensions to the open-source code-base that your environments requires.

Who We Are

Our team combines many years of expertise working in network operations, incident response, security assessment, and high-profile academic research; the same unique mix that facilitated Bro's success as an open-source system. The people behind Broala have taken Bro all the way from the first line of code to a system now widely deployed across industries, protecting some of the largest and most critical networks around. We have successfully deployed Bro in operational networks of all types and sizes—we know what works, and what does not.

Our Approach

Our services are driven by customer needs. We work with you to understand the specifics of your setting, including the characteristics that make your environment unique as well as the constraints you operate under. We adapt our solutions to what proves most effective in your particular case, leveraging the best of the open-source world while tailoring it for maximal protection. The game-changing advantage of a Bro deployment lies in its unmatched flexibility to adjust to the specific threats you face. We enable you to fully exploit this potential, now and in the future.

Our Mission

We are dedicated to pushing the capabilities of network-level threat detection beyond what even experts consider possible today, always aiming to keep pace with the extremely sophisticated attacks that today's cyber-infrastructure faces on a daily basis. We strongly believe in the value of keeping the best available technology open and free; for almost two decades now we have been using Bro's open-source model as our vehicle for continuously advancing the state of the art. With Broala, we add to that the individual attention that a community-driven project cannot offer by itself, providing our customers with the commitment, dependability, and support they require for doing their business.

MEET THE TEAM

Seth Hall

FOUNDER

Bro's biggest fan. Broala Manager and engineering lead. Security engineer for ICSI and former incident responder.

Vern Paxson

FOUNDER

Bro's inventor. Broala's scientific counsel. Professor of Networking and Security at the University of California, Berkeley and director of Networking and Security research at ICSI.

Liam Randall

FOUNDER

Brovangelist. Broala Manager and business lead. Long-time security consultant, trainer, and open-source contributor.

Robin Sommer

FOUNDER

Bro's open-source lead. Broala's lead for research & development. Networking and Security researcher at ICSI and affiliated researcher at Lawrence Berkeley National Laboratory.





Thank you.
greg@es.net

