The Energy Sciences Network: Overview and Impact

NERSC Users Group 2016
Berkeley, CA
March 21, 2016

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ESnet is a dedicated mission network engineered to accelerate a broad range of science outcomes.

We do this by offering unique capabilities, and optimizing the network for data acquisition, data placement, data sharing, data mobility.
Our vision:

Scientific progress will be *completely unconstrained* by the physical location of instruments, people, computational resources, or data.
The basic facts (new or notable):

High-speed international networking facility, optimized for DOE science missions:

- connecting 50 labs, plants and facilities with >150 networks, universities, research partners globally
- 340Gbps transatlantic capacity
- university connections to better serve LHC science
- $35M in FY15, 42FTE
- older than commercial Internet, growing ~twice as fast
- the DOE user facility that serves all others
ESnet is designed for different goals than general Internet.
Elephant flows require almost *lossless* networks.

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Bytes of Science Data Transferred Each Month by the Energy Sciences Network

August 2015: 29.13 PB
80% of ESnet traffic originates or terminates outside the DOE complex.
In a nutshell:

• Data intensity drives network intensity.
• DOE traffic grows exponentially.
• Data ‘point sources’ are more numerous, less expensive.
• DOE data flows typically include universities, other collaborators.
  – only 20% of ESnet data flows are DOE↔DOE
Overview

Impact
Our vision and strategic goals guide impacts.

**vision:**
- Discovery is unconstrained by geography.

**strategic goals:**
1. Improve networking practices globally.
2. Provide information and tools for optimal network use.
3. Pioneer architectures, protocols, applications.
Back to impacts: ‘fasterdata’ knowledgebase

**vision:**

Discovery is unconstrained by geography.

**strategic goals:**

1. Improve networking practices globally.
2. Provide information and tools for optimal network use.
3. Pioneer architectures, protocols, applications.
Observed Challenges to Network Adoption

- Scientists want to do science not IT
- Causes of performance issues are complicated.
- Lack of collaboration between the CIO’s office and researchers on campus.
- User’s performance expectations are low (“The network is too slow”, “I tried it and it didn’t work”).
- Cultural change is hard (“we’ve always shipped disks!”).
ESnet Science Engagement Approach

- Partnerships
- Consultation & Training
- Community Resources
Partnerships

GOALS:

• To initiate an active dialogue between the R&E engineering and domain science communities with the goal of setting longer-term relationship building in motion.
• To give domain researchers or those supporting them on campuses with broad concrete, technical, immediately useful tools and resources for improved data transport and network performance.
• Successful workshops focused on Life Sciences, Climate, Cosmology, and Bioinformatics (coming up in April 2016)
Partnerships: EYR - Global

- The program supports research collaborations with leading-edge network resources and consulting services to accelerate their science.
- Program committee solicits proposals from across the global community for technical and policy evaluations.
- ESnet “sponsored” one of the climate science proposals for the Earth System Grid Federation.
- Information about the program can be found at: https://www.enlightenyourresearch.net
Science Partnerships: EYR- Global

- **International Climate Network Working Group** created in 2014
- **Purpose:** improve data transfer performance between climate data facilities
  - Current tools won’t scale to CMIP6-predicted data volumes
- **Near-term goals:**
  - Participating pilot sites have deployed perfSONAR to baseline performance
    - USA, Netherlands, Germany, Australia and others
  - All sites are working on deploying gridFTP-enabled data transfer nodes (DTNs).
  - Plan to sustain 500MB/sec (4Gbps) disk to disk transfer this year
Training: OIN

- Designed to equip university & lab network engineers with training needed to build next-gen campus networks that are optimized for data-intensive science.
- Focuses on Science DMZ network architectures, perfSONAR, Data Transfer Nodes, and emerging Software Defined Networking techniques.
- Consists of 2 days of presentations and hands-on exercises.
- By the end of the event, attendees have a better understanding of science requirements and tools/strategies that can be used to mitigate problems users may encounter.
“On-boarding”

• ESnet collaborates with Globus to jointly engage with research collaborations of mutual interest.

• Globus is essentially the scientists’ gateway or “on ramp” to ESnet and the R&E network community.
Community Resources: Fasterdata Knowledgebase

ESnet Fasterdata Knowledge Base
An Expert Guide for End-to-End Performance Tuning, Tools and Techniques

Quick Links
Video: The Bro IDS in Science DMZ Environments
NEW! A Brief Introduction to the Science DMZ - Webinar
Linux TCP Tuning
Cisco 6509 Tuning
Globus Overview
NEW! CC*IEEE Sample CI Plans
NEW! NSF IREN Networking Doc
Thank you.

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