ESnet

ENERGY SCIENCES NETWORK

ESnet WAN Service & Support

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Network Engineering

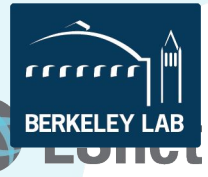
Computing Support for Photon Sciences Workshop

Location: Brookhaven National Lab

Date: 09/24/18

U.S. DEPARTMENT OF ENERGY

Office of Science



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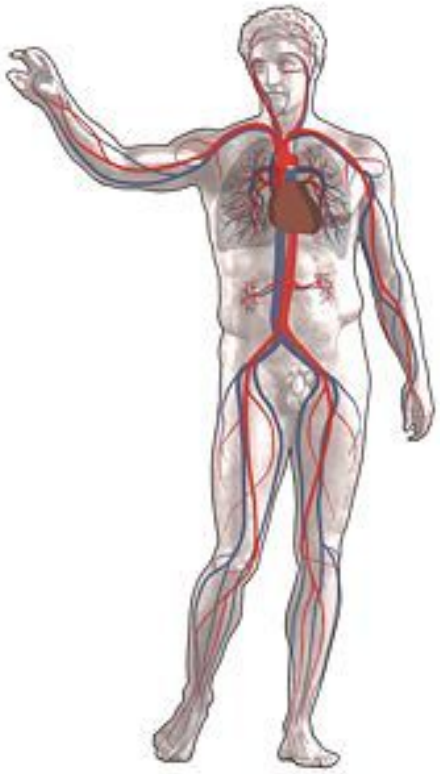
ESnet Facility is the circulatory system of DOE Office of Science



1. ESnet is a **special-purpose high-performance network facility**, funded by the US Congress to support scientific goals of the Department of Energy.
2. We see networking as a means to an end: **scientific productivity.**
3. We aim to create a world in which **discovery is unconstrained by geography.**
4. The program and the project are intertwined but **well-aligned for success**

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ESnet's Mission: DOE's High Performance Network (HPN) Scientific User Facility

Mission of DOE Office of Science:
..delivery of scientific discoveries and major scientific tools to transform our understanding of nature and to advance the energy, economic, and national security of the United States.

Mission of Energy Sciences Network:
Scientific user facility as an instrument to accelerate research and discovery aligned with DOE SC Mission.

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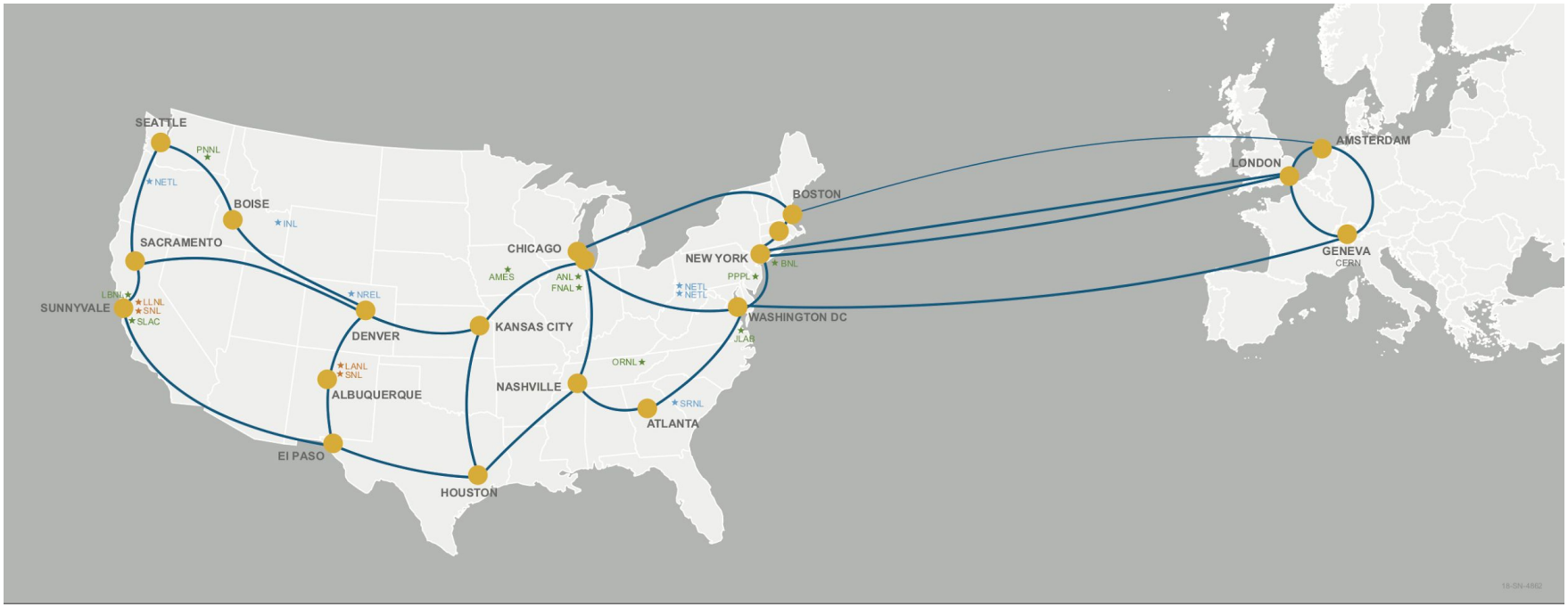
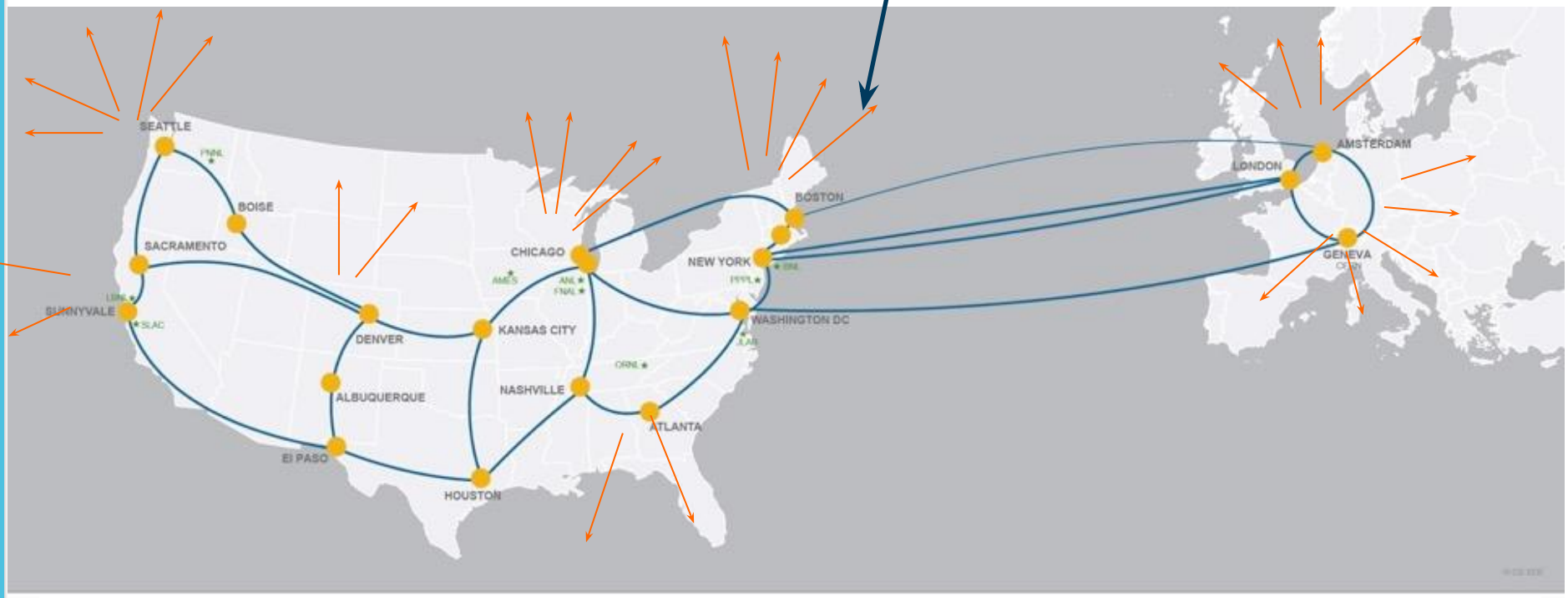
DOE's high-performance network (HPN) user facility optimized for enabling big-data science



ESnet provides connectivity to
all of the DOE labs, experiment sites, & supercomputers

Global partnerships and network connections key to meeting mission

150+ peers, 2.2 Tbps peering capacity.



80% of carried traffic originates or terminates outside the DOE complex

Serve all interests: Commercial peers, private peering with popular cloud providers, R&E networks worldwide, regionals, universities, agencies etc.

Flexibility is needed to support increasingly complex, multi-facility workflows

ALS ADVANCED LIGHT SOURCE

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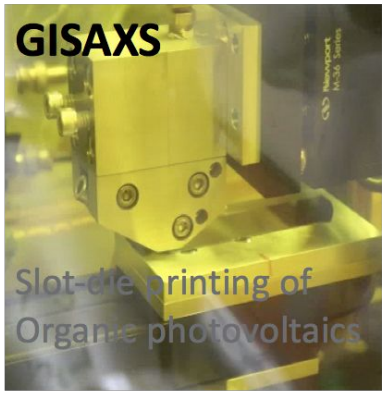

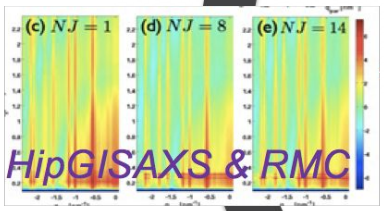

CAMERA Applied Math

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Liu et al, "Fast printing and in situ morphology …". Adv Mater. 2015

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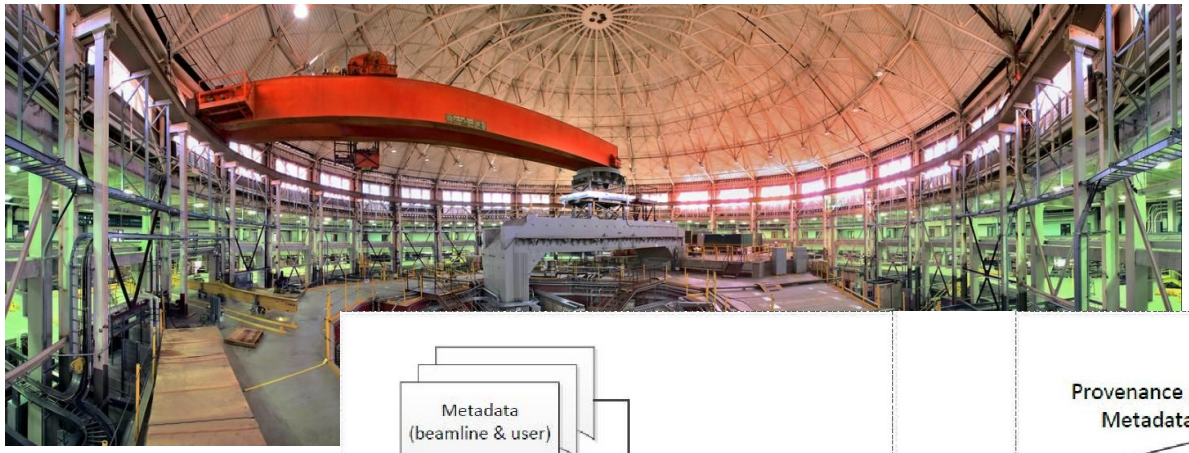
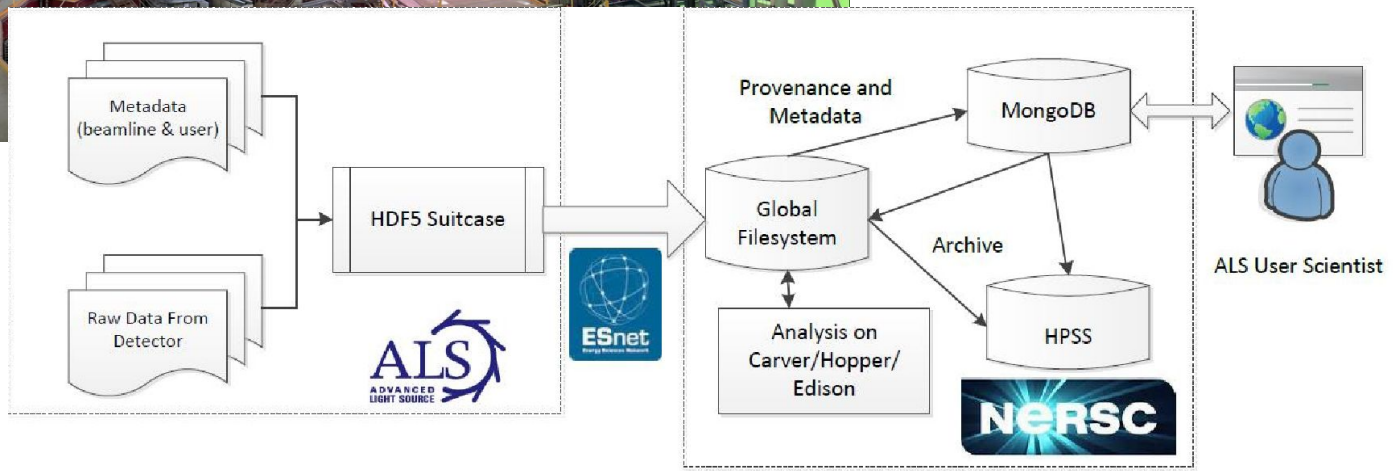
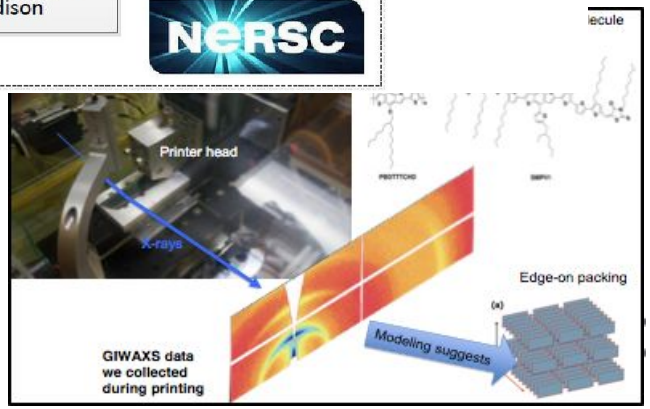
High-performance data movement to access near real-time supercomputing resources

Example 2: Basic Energy Sciences / Advanced Light Source







High-performance data movement from ALS to NERSC serves as a template for many beamlines needing to leverage near-real time supercomputing resources for discovery

Science DMZ Model

The Science DMZ model describes a performance-based approach

- Dedicated infrastructure for wide-area data transfer
- Purpose built data transfer nodes (DTNs)
- High-performance enterprise network edge
- High-performance data path to the WAN

Proactive operational models that enable performance

- Security is well-matched to high-performance science applications
- Periodic testing to locate issues proactively
  - Integrated test and measurement tools (perfSONAR)

* Dart “ESnet Science DMZ Model 2013”

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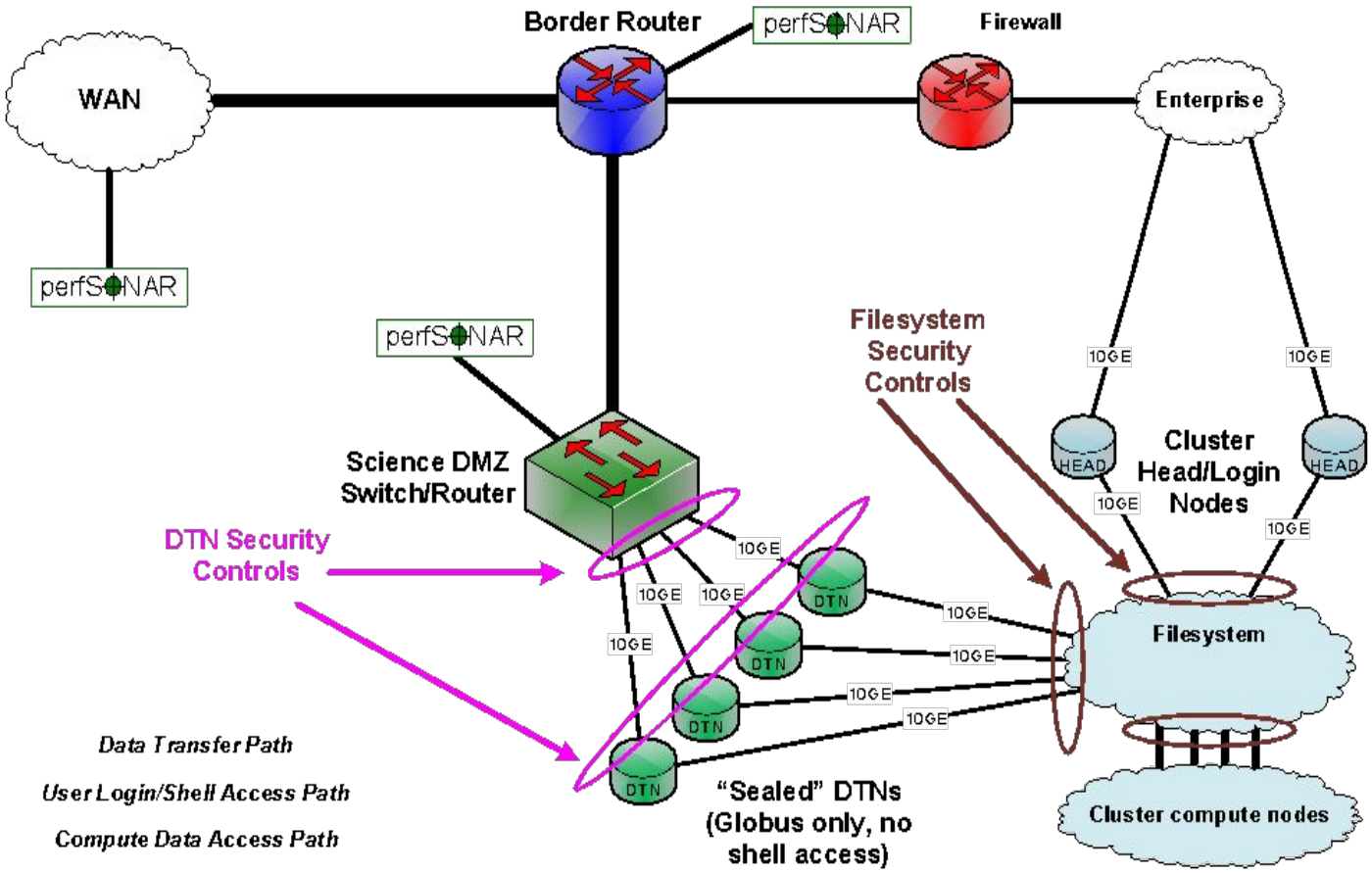
Science DMZ Cluster With DTNs



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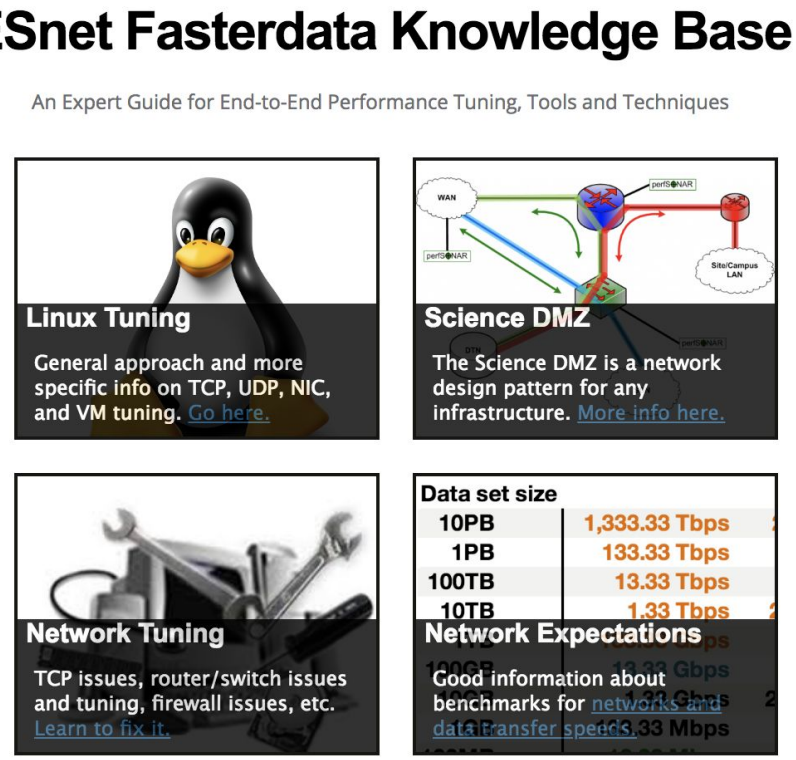
ESnet Science DMZ and Performance Tuning Information



http://fasterdata.es.net/

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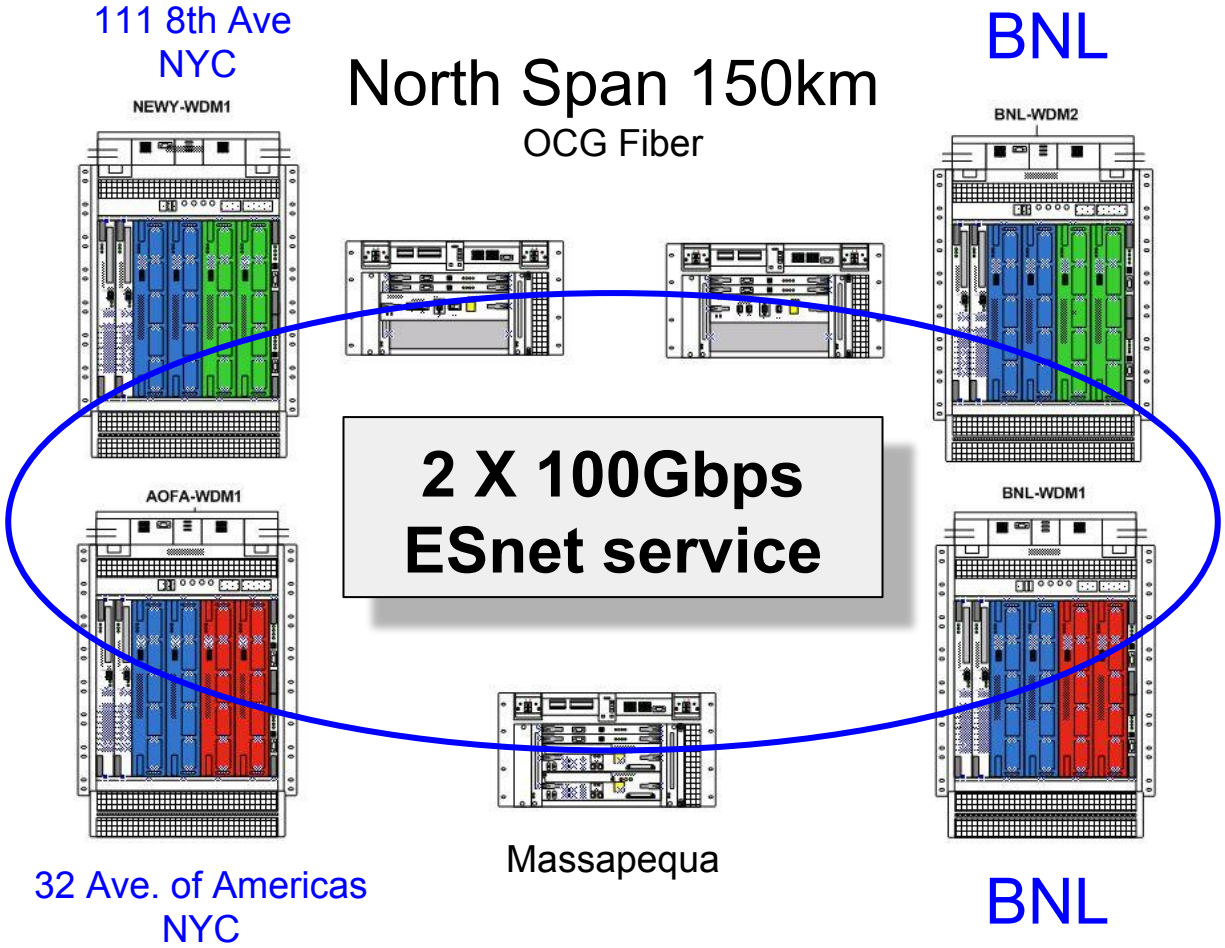
Long Island Metropolitan Area Network (LIMAN)



Diverse by Design

- Two ESnet core hubs in Manhattan
- Diverse fiber paths
- Two BNL ROADMs
- Optically protected 100G waves 50ms switchover
- 4 X 100G provisioned optical capacity

* ROADM - Reconfigurable Optical Add Drop Multiplexer

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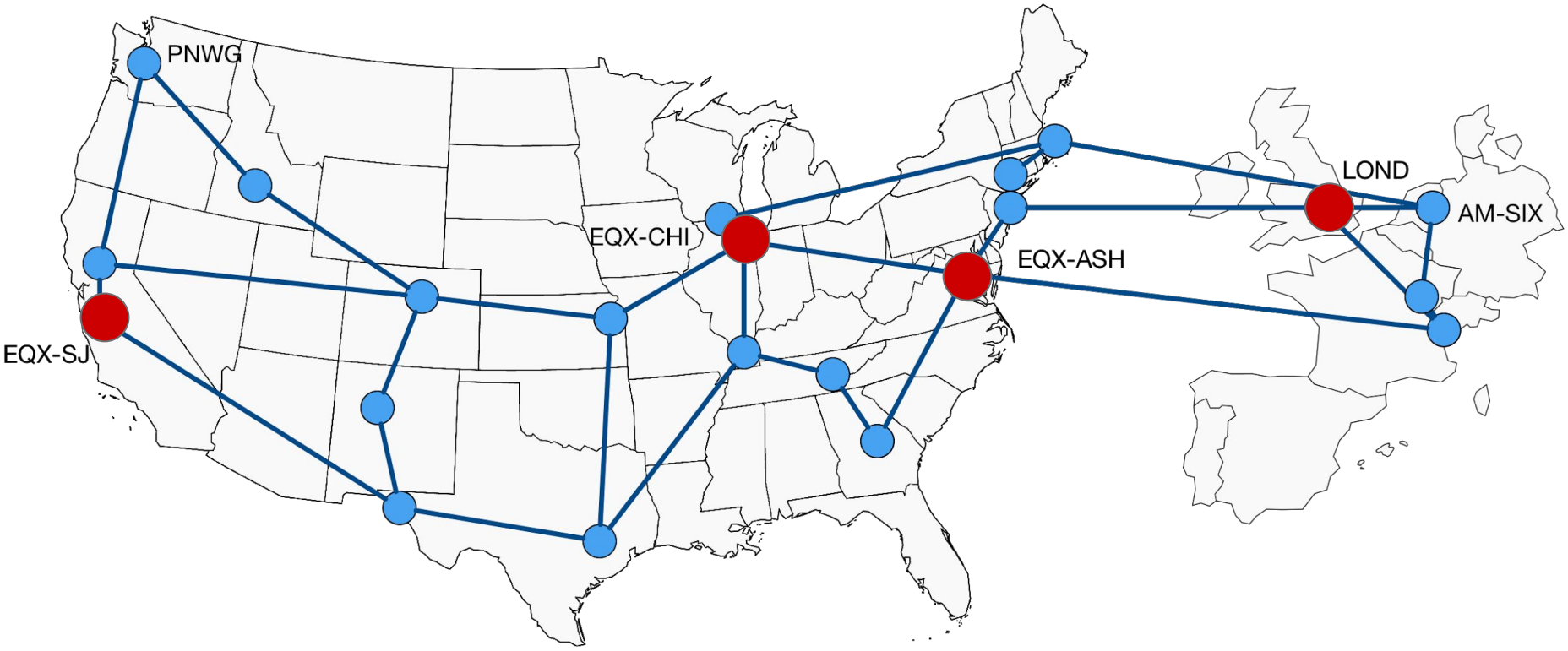
ESnet Commercial Internet Transit Points



Paid Commercial Internet Transit Point

ESnet commercial Internet transit locations are well distributed across the network. However, interconnecting through an R&E exchange point within a region may provide better latency and a more direct path, crossing fewer networks.

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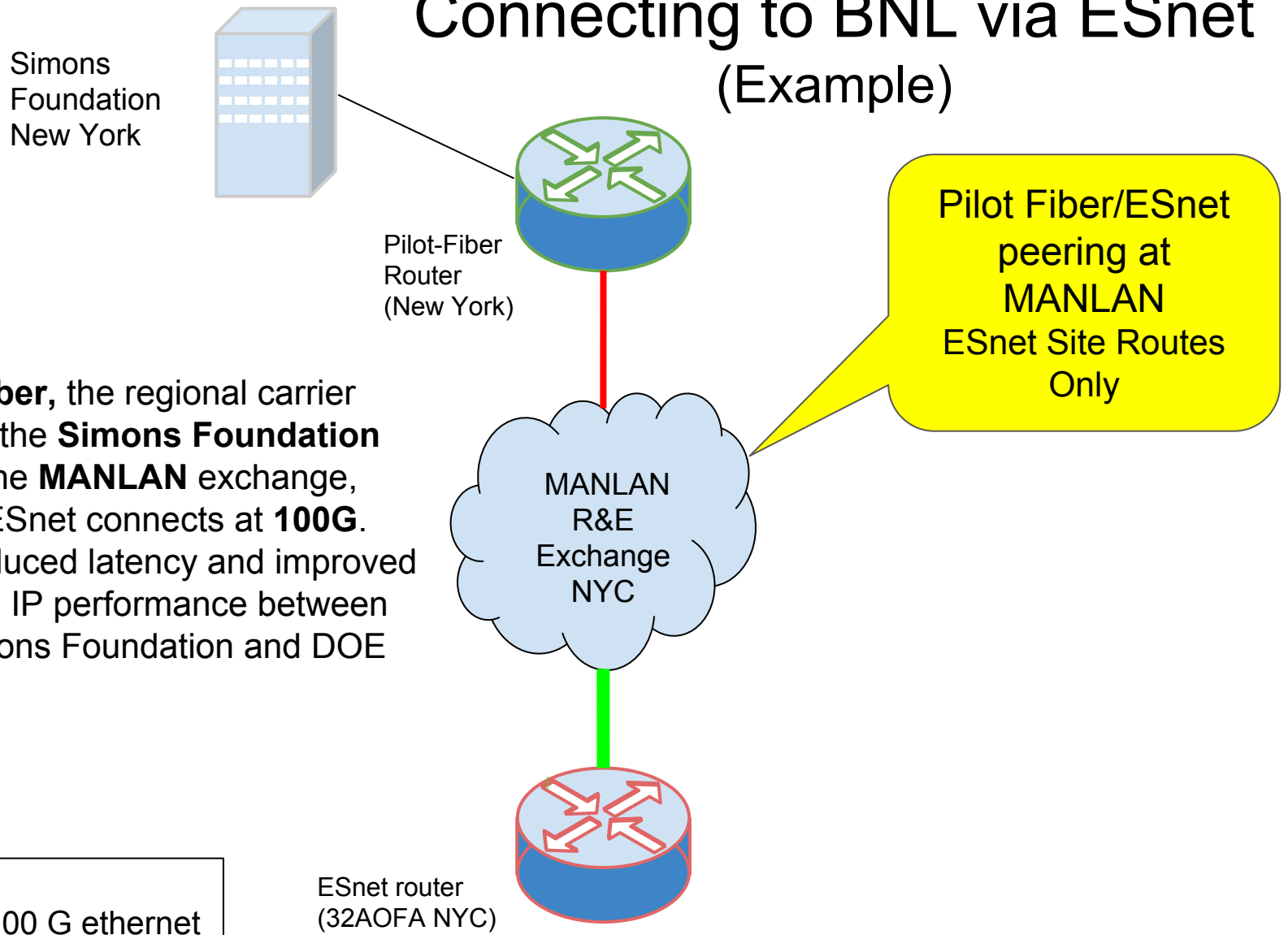
Connecting to BNL via ESnet
(Example)



Pilot Fiber, the regional carrier serving the **Simons Foundation** joined the **MANLAN** exchange, where ESnet connects at **100G**. This reduced latency and improved General IP performance between the Simons Foundation and DOE Labs.

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Peering With ESnet in New York Manhattan Landing (MANLAN)

Manhattan Landing (MANLAN) is a high-performance exchange point in New York City .

- It supports Layer 2 Ethernet connections to facilitate peering among U.S. and international research and education (R&E) networks.
- Located at 32 Avenue of the Americas, New York, NY

It is a collaborative effort of:

- Internet2 – providing program management and operational oversight
- NYSERNet (The New York State Education and Research Network) – providing Manhattan collocation facilities, and metropolitan fiber resources
- The Global Research NOC at Indiana University – providing engineering support and daily technical operation of the MAN LAN exchange point

ESnet peering requests should be initiated by first contacting BNL Network Engineering

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Summary

- ESnet:
  - DOE's special-purpose high-performance network facility
  - A scientific user facility accelerating research and discovery in alignment with the DOE SC mission
  - A high-performance network (HPN) optimized for enabling big-data science
  - Global partnerships connect DOE science to the world
  - Supports multi-facility workflows in many scientific disciplines
    - ie: NERSC supercomputer resources to light sources
- Science DMZ is an important network architecture for high-performance data transfer
- LIMAN provides robust, high-performance connectivity
- R&E exchange points provide attractive regional connection options
- ESnet support is accessed by contacting the laboratory (BNL) network engineering/services organization

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ESnet WAN Service & Support Questions?

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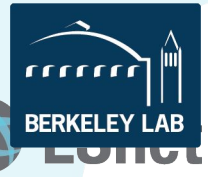

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