



Advancing
Innovation

STEP-1: National Network Overview

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Outline

- Research and Educational Networks
- Internet2
- International Peerings
- ACCESS CONECTnet
- ACCESS Networking Services

Research and Education Networks

Regional Networks

- Regional Research and Education Networks (RENs) collaborate to develop, deploy and operate advanced cyberinfrastructure that enables innovation in research and education
- Design and operation based on organizational needs and mandates
- Not all regional networks are the same and need to support their charters individually
- Advance their direct public service mission
- Non-profit U.S. RENs provide advanced network services and applications to over 1000 universities and thousands of other educational and community anchor institutions such as K-12 school, libraries, and municipal entities.
- Provide more access to a broader set of expertise and knowledge than any single organization working on its own.

The Quilt

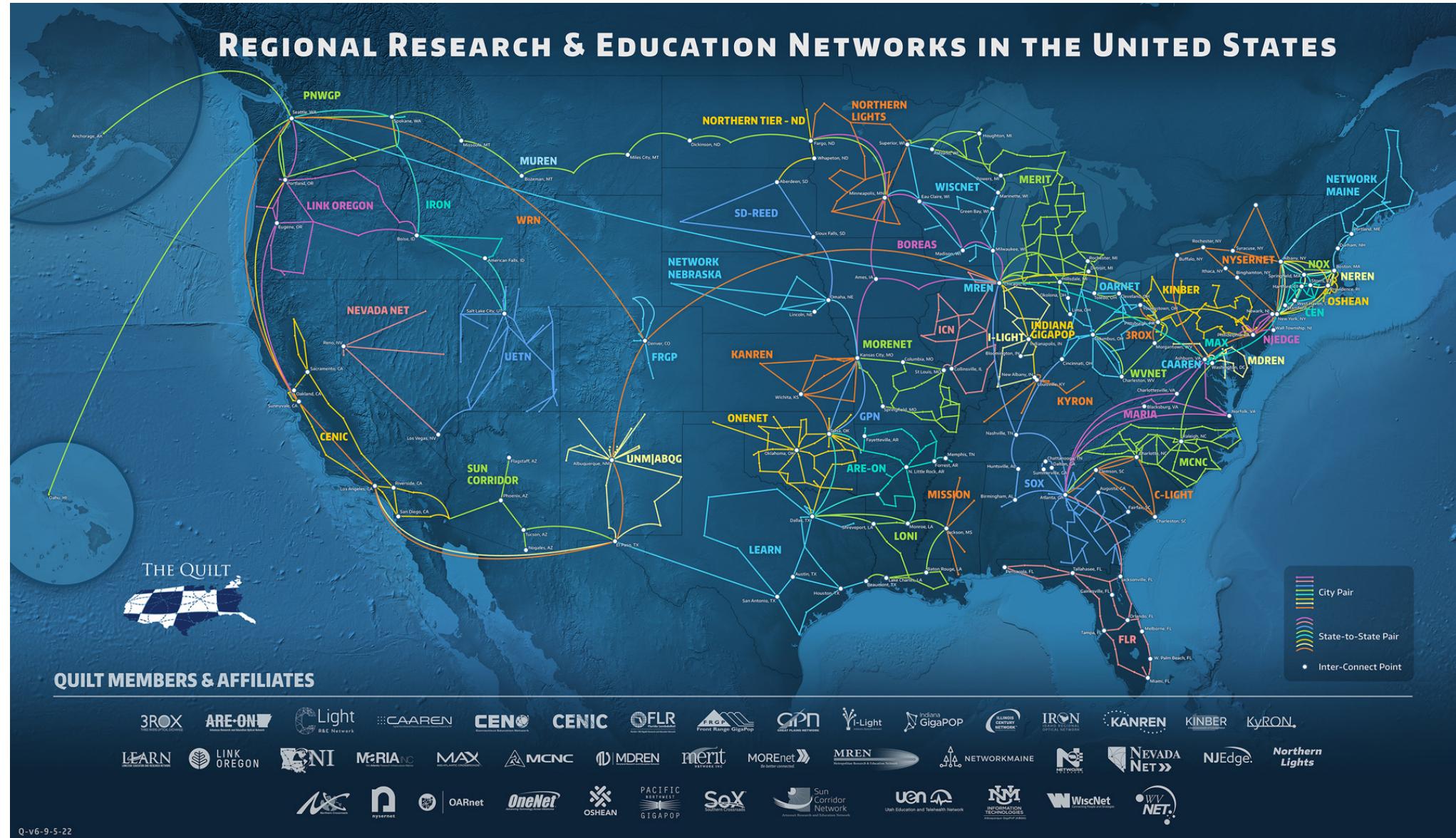
- Consortium that delivers a collaborative environment for regional network member engagement.
- Underpin the missions of regional RENs as critical infrastructure to advance our country's scientific discovery, education, cultural knowledge, healthcare, and public service.
- Advocate nationally for the role of RENs in our country's broadband ecosystem to further our public service missions.



Quilt Values

- **For the Common Good:** The Quilt works for the common good of its membership. It reaches consensus among its members, through identifying and expressing the common views on areas of key importance, while respecting the individual decisions of members related to their specific organizations and business models.
- **Member-powered:** Members set policy, strategic direction, and contribute resources toward accomplishing Quilt goals.
- **Transparency and Trust:** The Quilt is a trusted forum that operates in an open and transparent manner.
- **Collaborate:** All members contribute through collaboration to collectively advance research & education networking by solving problems and learning together as well as developing and exchanging best practices.
- **Inform and Educate:** The Quilt serves as a single point of contact and a national communication point, to engage with partners and to inform and educate the vital role of research and education networks for our country's academic and research goals.
- **Innovate with Agility:** Collaborations among members quickly focus on new ways to evolve, advance and improve the delivery of cyberinfrastructure and applications for member participants.
- **Leverage our Practicality:** Members leverage the collective consortia knowledge, buying power, and practical wisdom, contributing to the value each member provides to their participants.
- **Inclusion and Diversity:** Actively engage in efforts that promote Inclusion and Diversity in our R&E community.





Internet2

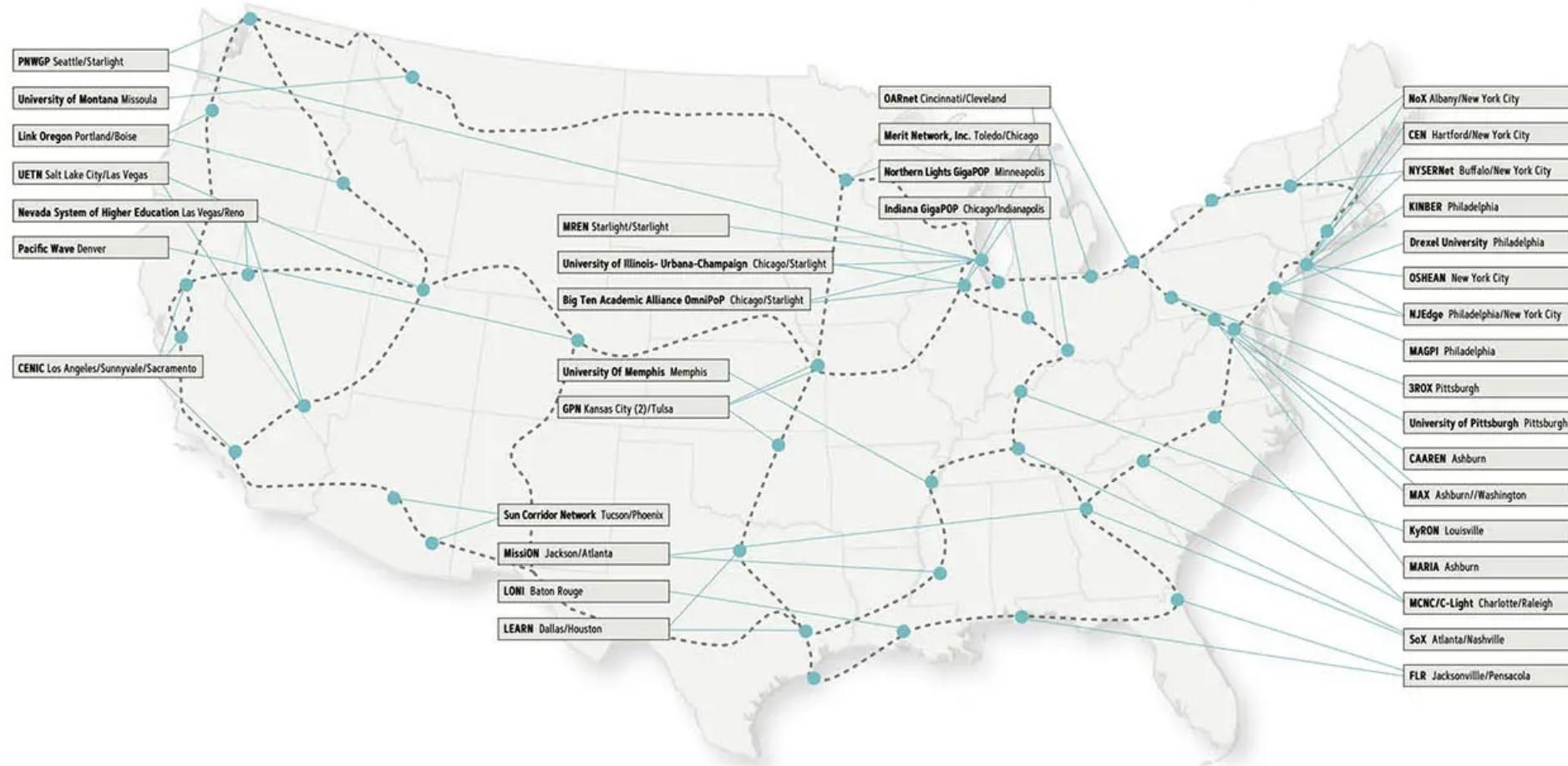
Internet2

- A not-for-profit United States computer networking consortium led by members from the research and education communities, industry, and government
- Provide a secure high-speed network, cloud solutions, research support, and services tailored for research and education
- Community includes higher education, research institutions, government entities, corporations and cultural organizations



Internet2 Network Connections

internet2.edu/connectors 8.2022



Internet2 Services

- Advanced L2/L3 networking services for resilient and dynamic network connectivity
- Security with a suite of identity and access management (IAM) services and community-source software
- Cloud solutions supporting Research and Education
- Research engagement for education, outreach, and training
- Community collaboration to support the national research needs



International Peerings

International Peerings

- Provide research and education connections to support international collaborations
- Provides path diversity and data resiliency
- Encourages further cooperation providing future projects



Florida International University

- FIU major player in international arena
- Support international researchers and collaborations
- AMPATH exchange point for network research between U.S. and international research and education networks
- Rubin Observatory in Chili

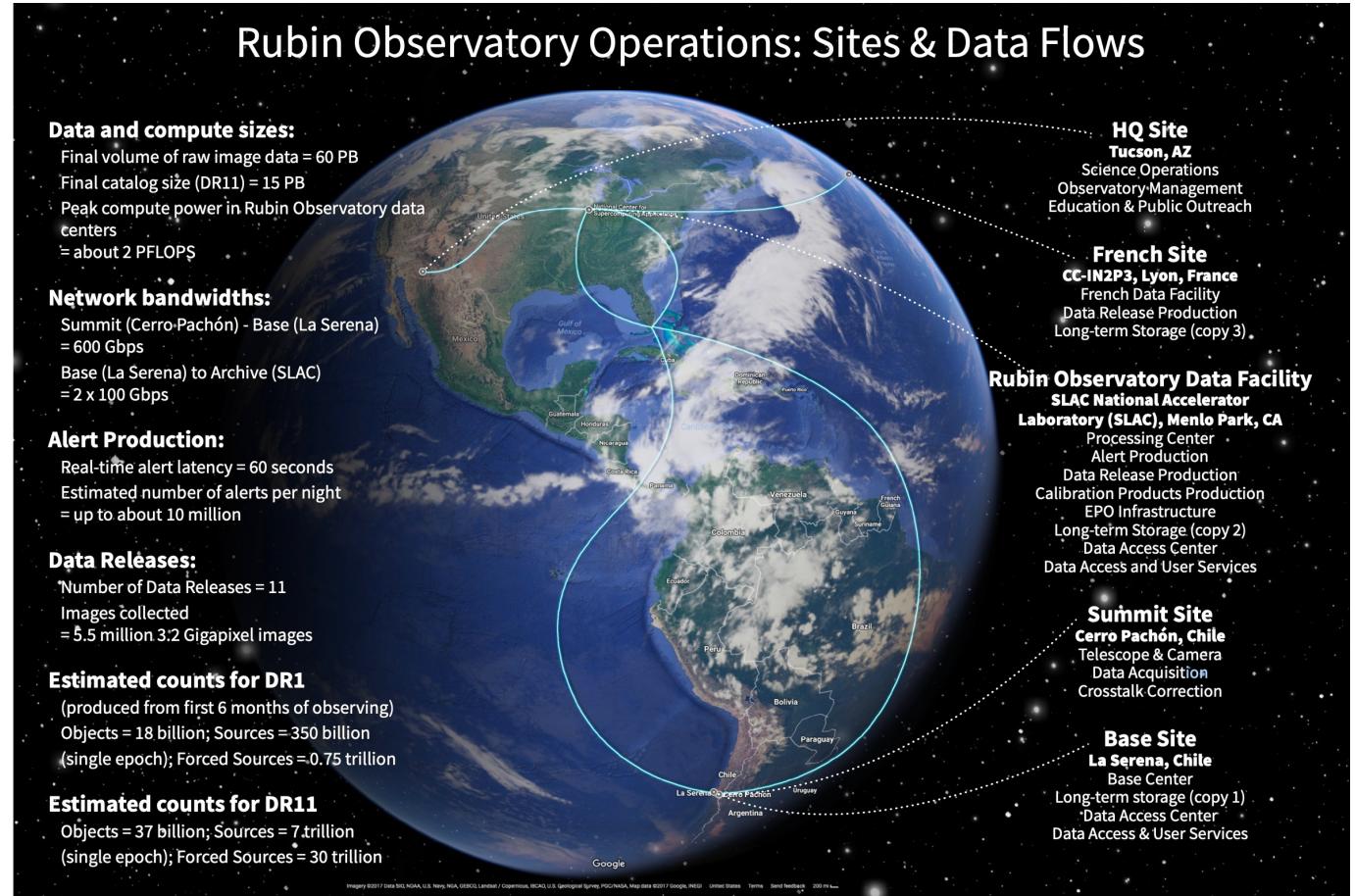


Rubin Observatory



Rubin Observatory Data Flow

- Data generated in Chile
- Redundant regional paths across South America to AMPATH
- Redundant national paths from Miami to data processing facilities

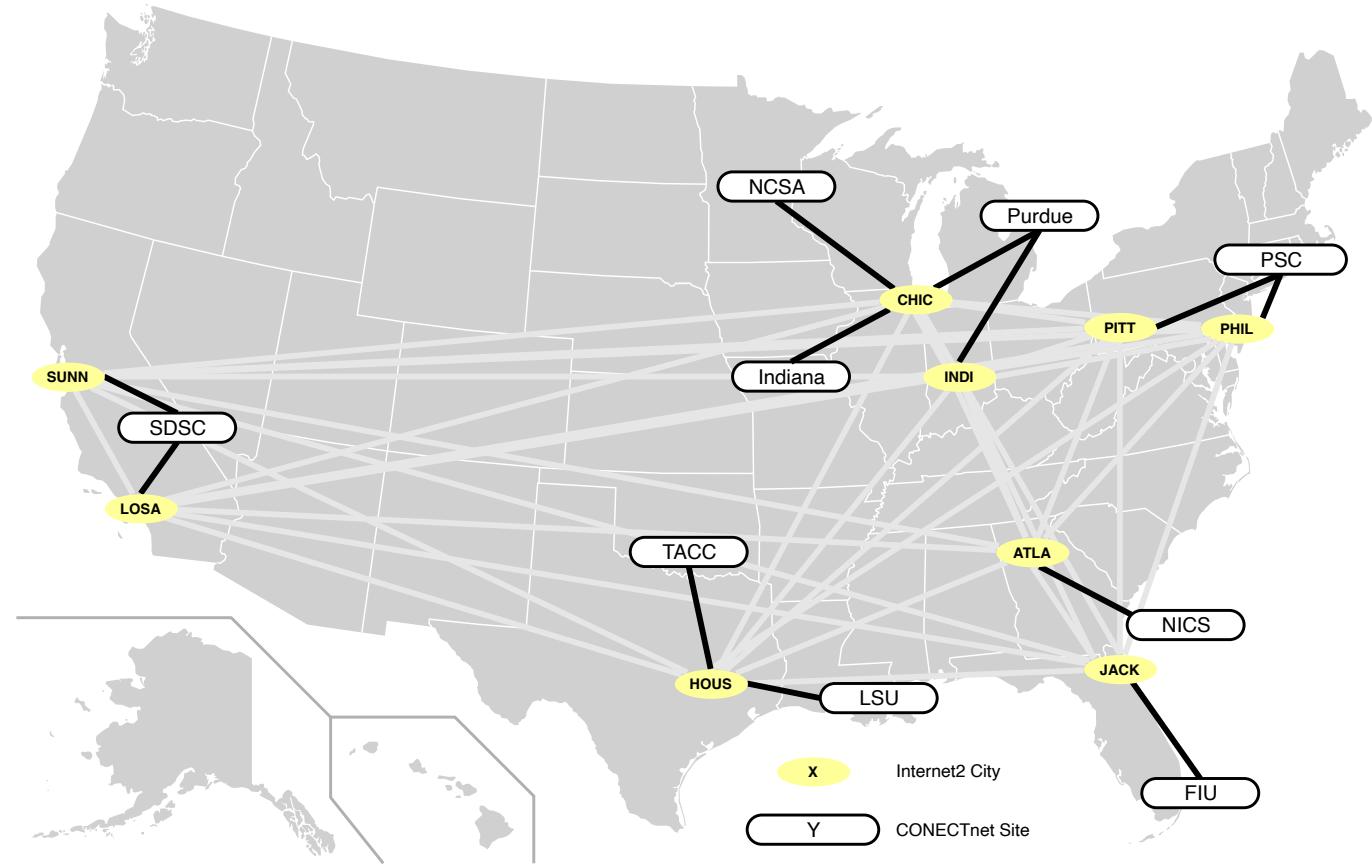


ACCESS CONECTnet

CONECTnet

- Layer 3 VPN provisioned over Internet2
- NDTS team management of L3VPN using Internet2's OESS virtual management framework
- Deterministic troubleshooting and performance data reporting
- Provides ease of deployment and operational efficiency

CONECTnet



ACCESS Networking Services

ACCESS Network and Data Transfer Services

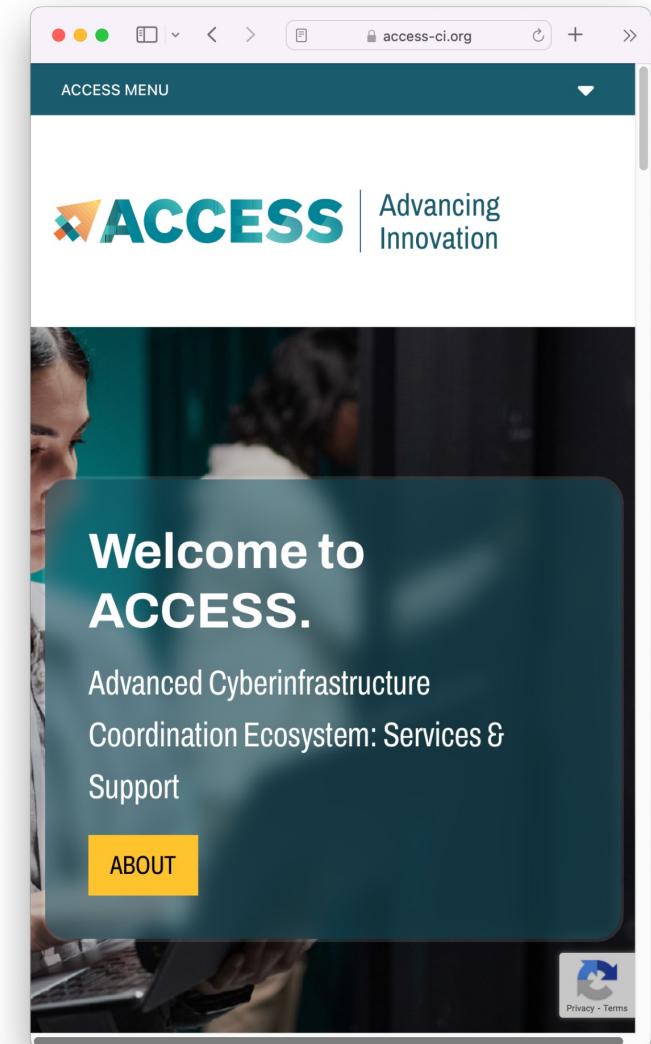
- Develops and implements network architectures and best practices, evaluates data transfer technologies, operates core network-enabling services
- Maintains the ACCESS-wide mesh of perfSONAR network performance measurement nodes
- Collects and shares utilization metrics for the network
- Engages with the national cyberinfrastructure community both at conference and workshops, and in a direct support capacity

ACCESS Networking Services

- CONECTnet L3VPN overlay on Internet2
- DNS for access-ci.org and legacy DNS
- IP Address Management (IPAM) solution for NSF Resource Providers
- perfSONAR test infrastructure
- ACCESS “MaDDash” network performance dashboard
- Internet2 data
- Globus Data Transfer support and coordination
- RP Network Consultation

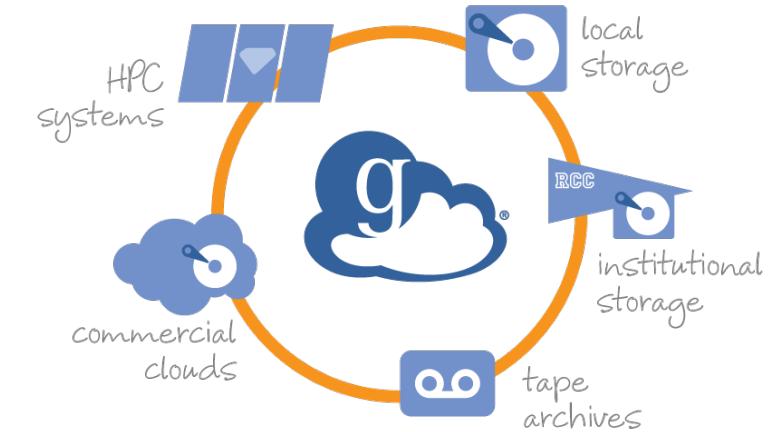
Domain Name Service - DNS

- Operate DNS for access-ci.org and legacy DNS domains via robust IPAM solution
- Distributed and resilient DNS configured
- Intuitive and user-friendly Graphical User Interface
- API support
- DNSsec enabled
- IPv4 and IPv6
- Provided documentation for DNS administration



Globus File Transfer

- Globus is the recommended file transfer platform for research data management
- Multiple modes of use in the Research and Education ecosystem
 - Globus subscription available providing added features and visibility into file transfers
 - Many larger RPs already have a subscription
 - From the researcher perspective, full Globus functionality is available without an RP Globus subscription
 - The subscription provides central management service functionality. Not all RPs need or want that capability

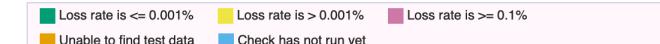


perfSONAR - Network Performance Testing

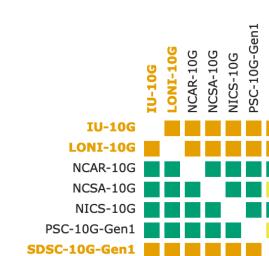
- Using the NSF community standard perfSONAR network measurement toolkit
- Operate perfSONAR test host infrastructure at participating RP sites
- Maintain a perfSONAR performance dashboard of ACCESS Resource Providers and collaborators
- Expanding to additional sites in support of new NSF resources
- Ongoing, flexible, and adaptable

ACCESS CONECTnet perfSONAR Dashboard

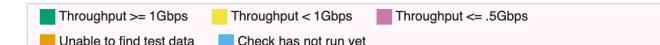
ACCESS CONECTnet perfSONAR - ACCESS CONECTnet perfSONAR - latency_task - Loss



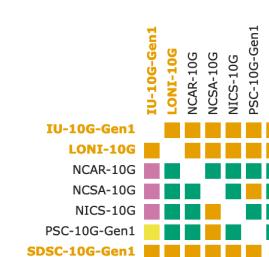
⚠️ Found a total of 3 problems involving 3 hosts in the grid



ACCESS CONECTnet perfSONAR - ACCESS CONECTnet perfSONAR - throughput_task - Throughput



⚠️ Found a total of 3 problems involving 3 hosts in the grid



Network Metrics Reporting

- Working with WAN Network Service Provider (Internet2) to operate CONECTnet
- Adding new connections as they are onboarded to the automatic reporting
- Manage reporting metrics, notifications, and frequency
- Continuing to evaluate collected metrics with an eye for improvement



Stakeholder Community Engagement

- Participate in conferences to collaborate with RPs and researchers
 - PEARC
 - Supercomputing Conference Series
 - Internet2 Tech Exchange Presentations on ACCESS and networking
- NSF FABRIC collaboration
- Researcher Advisory Committee presentations and feedback collaboration on Network and Data Transfer services
- RP Forum presentation and participation on a periodic basis or as needed.

Summary

- There are many regional educational networks across the country and around the world to support scientific discovery and collaboration
- Operational services are elemental building blocks to support the CI community
- Relationships in this ecosystem are essential for effective operation and troubleshooting scientific discovery experiences and challenges

Resources

<https://www.thequilt.net/> - The Quilt, non-profit regional research and education networks collaborate to develop, deploy and operate advanced cyberinfrastructure that enables innovation in research and education

<https://internet2.edu/> - National Research and Education network service provider for advance research

https://operations.access-ci.org/pub/data_n_networking - The ACCESS Networking and Data Transfer Services (NDTS) team provides the CONECTnet ACCESS wide area network and provides efficient and resilient data transfer capability across the ACCESS ecosystem

Questions?