INFRASTRUCTURE SESSION

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Goal of the Infrastructure Session

- The goal of the infrastructure session is to:
  - Inform the researchers of the network infrastructure that's available for conducting "at-scale" network experiments
  - Report on the milestones that have been achieved over the past 10 years
- Presentations have been organized to focus on evolution of different levels of the end-to-end network infrastructure:
  - The Campus, Exchange Points and Regional CI
  - National Research and Education Networks
  - State Networks
  - Network technologies to enable future internet research
  - Linking all of these levels together into a coherent coordinated end-to-end network infrastructure
- The outcome we are aiming to achieve with this session is to:
  - Stimulate researchers' interest to propose collaborative research
  - Facilitate pairing US and Brazilian researchers and students to work on challenging problems
  - Conduct at-scale end-to-end experimentation to explore solutions to these problems
  - Foster the formation of meaningful long-lasting relationships between US-Brazil researchers and students, as they trial and prototype their work

Campus, Exchange Points, Regional CI Outline

- Campus Cyberinfrastructure
- Exchange Points
- Regional Cyberinfrastructure

Campus Cyberinfrastructure

- Data intensive science requires
  - High-throughput networks
  - Available bandwidth
- Campus networks must support
  - Multiple business operations
    - Research and Education
    - Business enterprise applications
  - Security for protecting the data of the institution
- Data intensive science applications
  - Experience poor performance on campus networks
  - Campus networks must be engineered to support
    - The data movement requirements of data intensive science
- *How can campus networks be adapted to*
  - *Optimize flows from science applications, while*
  - *Not impacting the operation of the business enterprise?*

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NSF Campus Cyberinfrastructure Program

- NSF Campus CI program has invested in the improvement and re-engineering at the campus level to leverage dynamic network services to support a range of scientific data transfers and movement
  - Campus Cyberinfrastructure - Network Infrastructure and Engineering Program (CC-NIE)
  - Campus Cyberinfrastructure - Infrastructure, Innovation and Engineering Program (CC*IIE)
  - Campus Cyberinfrastructure - Data, Networking, and Innovation Program (CC*DNI)

Campus Cyberinfrastructure Projects at FIU

- CC-NIE Network Infrastructure: FlowSurge: Supporting Science Data Flows towards discovery, innovation and education
  - NSF Award# ACI-1246185
  - FlowSurge has built a Science network by partitioning the campus network with a Science DMZ
  - Deployed Software-Defined Networking technologies to enhance layer2 services
  - Deployed measurement nodes, giving researchers more visibility into the network
- CC*IIE IAM: Secure Access for Everyone (SAFE), facilitating distributed scientific research collaborations
  - NSF Award# ACI-1440728
  - Integrates resources with open-source IAM tools and technologies
  - Collaborates and coordinate multi-institutional resource
  - Leverages InCommon federation standards-based IAM tools

Campus Cyberinfrastrucure

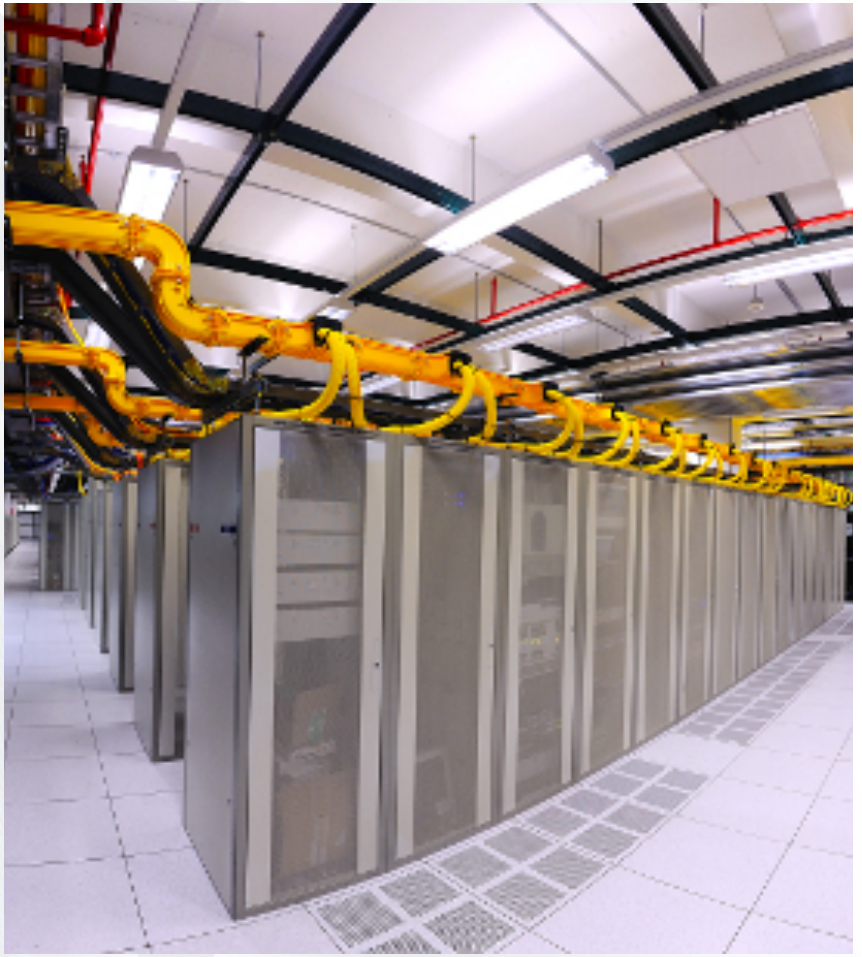
- Campus Cyberinfrastructure – Data, Networking, and Innovation Program (CC*DNI), NSF 15-534
- CC*DNI covers seven areas:
  - Data Infrastructure Building Blocks
  - Data Driven Networking Infrastructure for the campus and researcher
  - Network Design and Implementation for Small Institutions
  - Network Integration and Applied Innovation
  - Campus CI Engineer
  - Regional Coordination and Partnership in Advanced Networking
  - Instrument Networking
- Proposal submission deadline is March 24, 2015

Exchange Points

- Provide strategic regional aggregation
- Serve a pivotal role in extending network connectivity nationally and internationally
- Provide regional R&E networking leadership
- Support experimental networking

AMPATH International Exchange Point

- AMPATH is an international exchange point in Miami
- Connects Research & Education (R&E) networks from Latin America and the Caribbean to U.S. and international R&E networks
- Supports science research and education programs of the NSF by
  - Operating multiple 10G circuits in collaboration with ANSP, RNP, RedCLARA, REUNA, and AURA

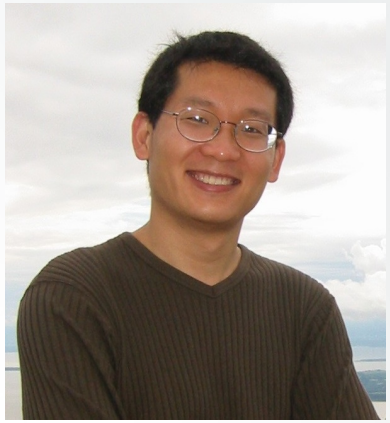


Regional Cyberinfrastructure

- GENI racks
- Florida LambdaRail
- AtlanticWave

GENI Racks: Campus CI Resources

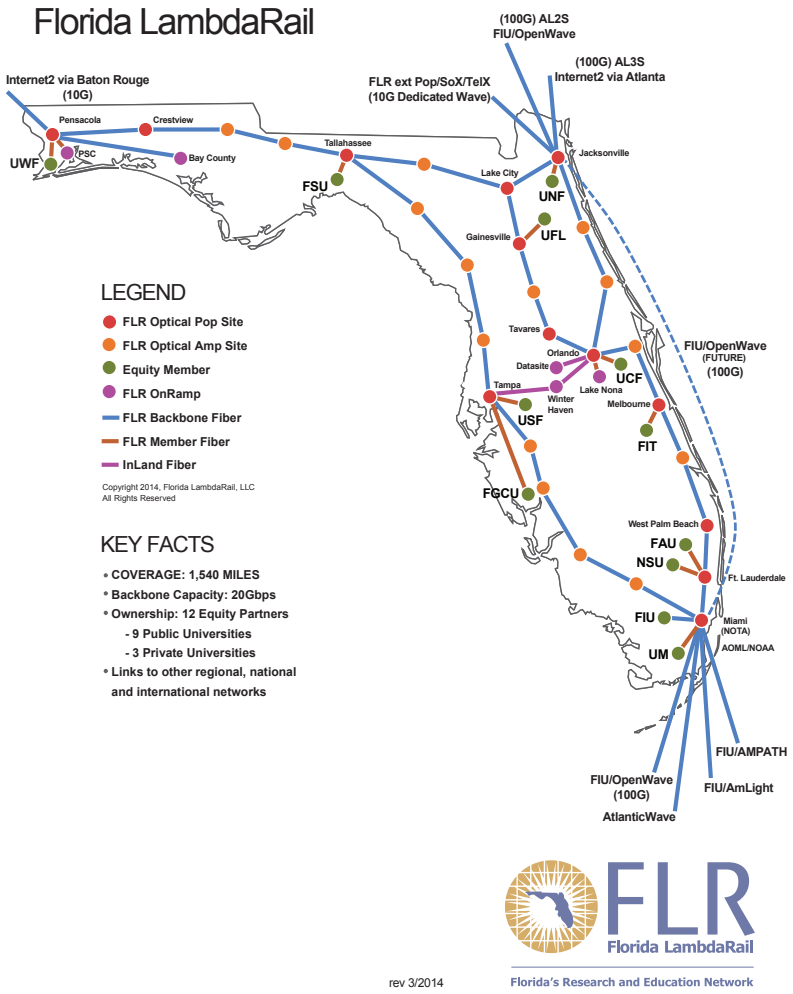
- Jason Liu at FIU
- ExoGENI rack



- Andy Li at UFL
- ExoGENI rack

Florida LambdaRail

- State of Florida optical network for research and education
- 1,540 miles of dedicated dark fiber
- Connects AMPATH in Miami to Internet2 in Jacksonville
- University led governance
- Upgrade to 100G scheduled for 2015



AtlanticWave

- AtlanticWave is a distributed exchange peering fabric along the Atlantic rim
- Facilitates peering services between the U.S. and international networks
- Participating exchange points are:
- MANLAN (NYC), MAX GigaPOP (Washington DC), SoX (Atlanta), AMPATH (Miami)
- Extends to Southern Light exchange point in Sao Paulo
- SDX capability in phases