

Americas and Africa Research and Education Light Paths (AARCLight)

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Introduction

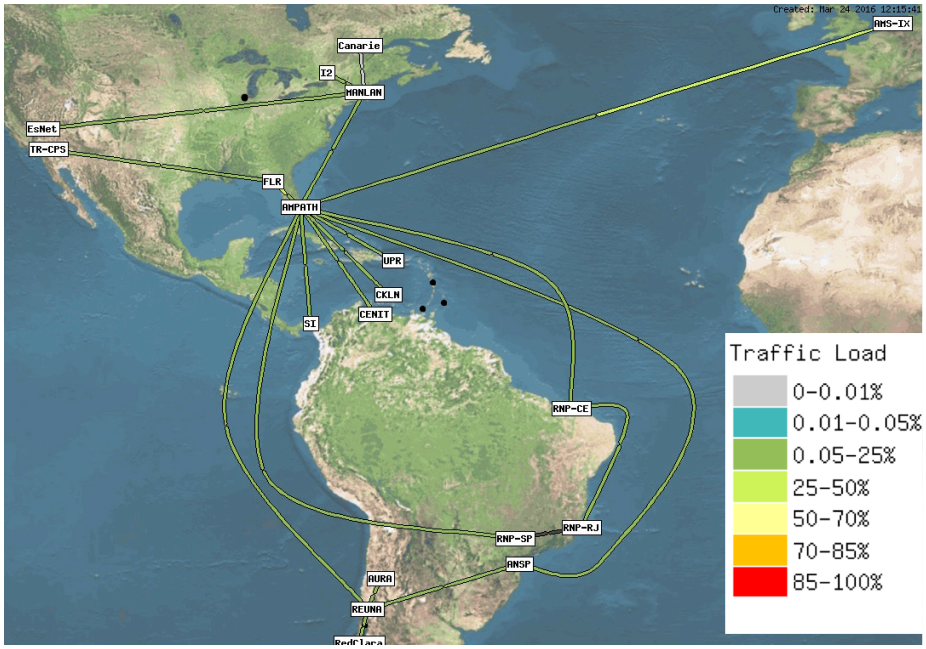
- Dr. Heidi Morgan moved to Information Science Institute (ISI) from Florida International University (FIU) where she was the Director and Co-Founder of the Center for Internet Augmented Research and Assessment (CIARA).
- CIARA fosters a domain-specific tailoring of Internet technologies to support faculty research, and in the process improve graduate education.
- Dr. Heidi Morgan is a Co-Principal Investigator (PI) for several NSF funded projects including: AARCLight, AmLight ExP, AtlanticWave SDX, SwitchOn, and AMPATH IXP.



AMPATH International eXchange Point (IXP)

- AMPATH is an Open R&E eXchange Point (RXP) led by Florida International University (FIU)
- Serves as the premiere interconnection point for network-enabled U.S.- Latin America and Caribbean science research and education.
- Supports science research and education programs of the NSF, DOE, etc.
- Operates 2x100G and multiple 10G circuits in collaboration with FLR, ANSP and RNP

www.ampath.net



http://measurements2.ampath.net/





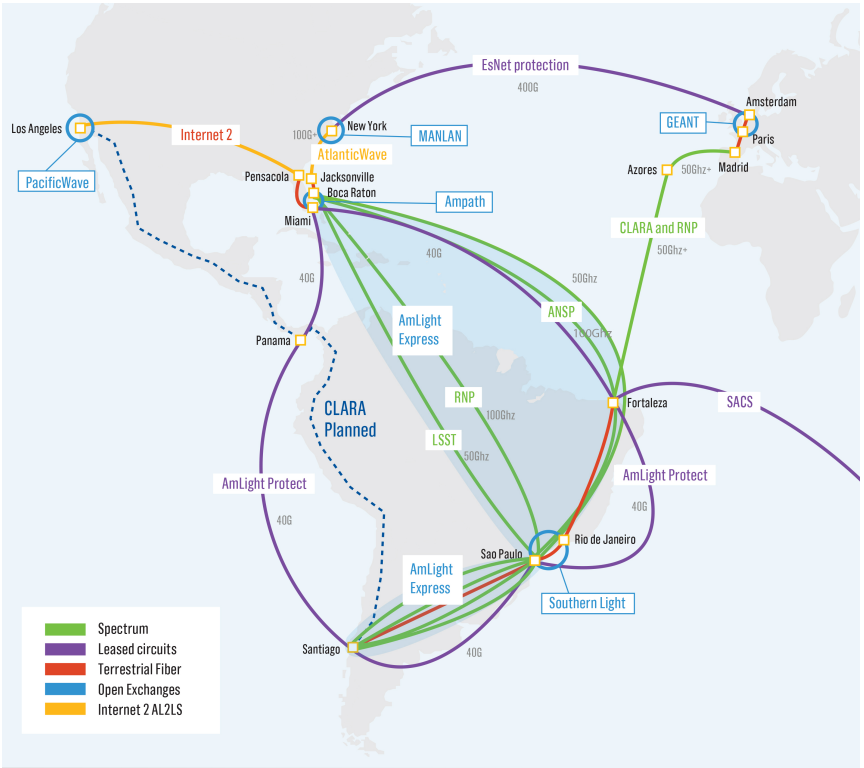
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Americas Lightpaths Express and Protect (ExP)

- AmLight ExP is a hybrid network that uses
  - Optical spectrum (Express) and
  - Leased capacity (Protect)
  - to build a reliable leading-edge network infrastructure for research and education
- Links:
  - 100G Miami-São Paulo, Atlantic
  - 100G Miami-São Paulo, Pacific
  - 4x10G links, landings in São Paulo, Fortaleza, Santiago
  - 240G of aggregate bandwidth capacity
  - 100G ring including Santiago and Fortaleza

AmLight ExP

(NSF Award# ACI-1451018 2015-2020)



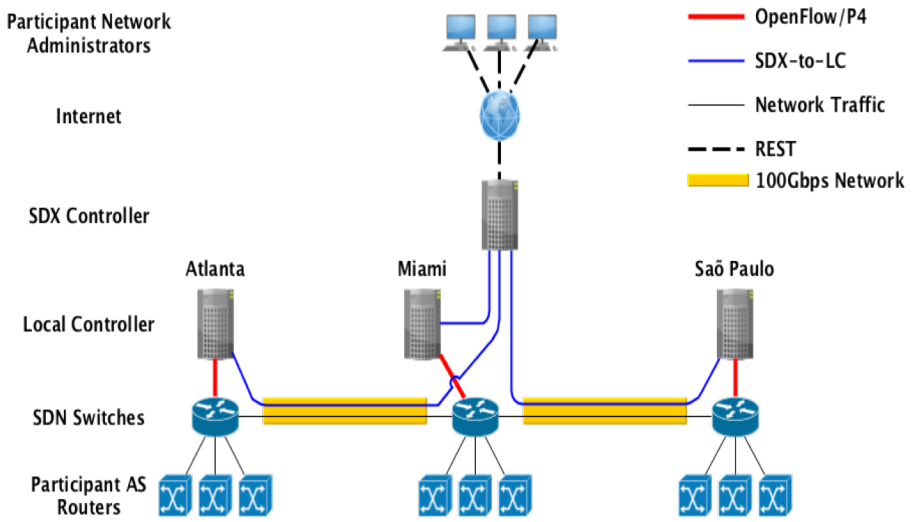
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AtlanticWave-Software Defined Exchange: A Distributed Intercontinental Experimental Software Defined Exchange (SDX)

- AtlanticWave-SDX is responding to the demands of big data scientific instruments by developing an international SDX
- Collaborators: Open exchange point resources at SoX (Atlanta), AMPATH (Miami), and SouthernLight (SP, Brazil)
- NSF project to build a distributed international SDX controller led by FIU and Georgia Tech
- Thousands of KM of fiber between each location
- Split controller design
  - Central controller for interacting with users
  - Local controllers at each location

AtlanticWave SDX
INTERNATIONAL DISTRIBUTED SOFTWARE-DEFINED EXCHANGE

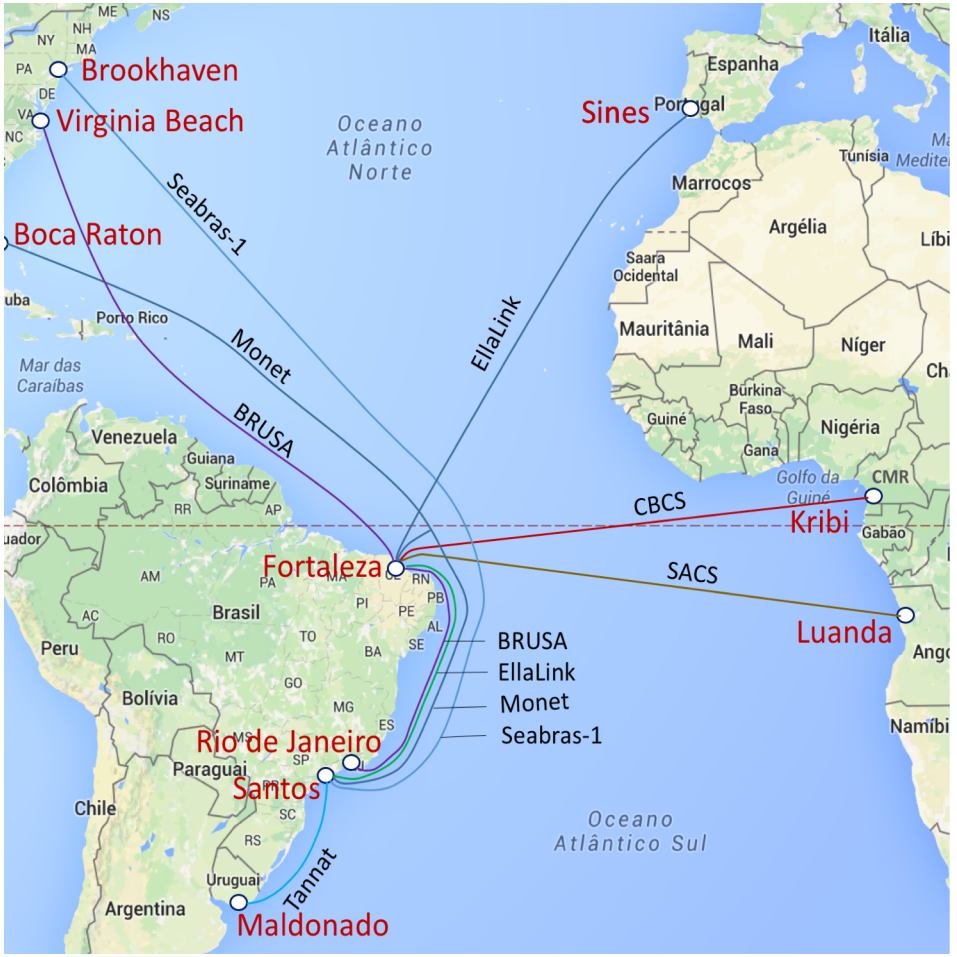
(NSF Award # ACI-1451024 2015-2020)



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Confluence of Opportunities in Southern Hemisphere

- New data-intensive science instruments in the southern hemisphere:
  - SKA in South Africa
  - Large Synoptic Survey Telescope (LSST) in Chile
- New submarine cables in South Atlantic
  - SACS submarine cable to Angola (Q3 2018)
  - South Atlantic Inter-Link (SAIL) to Cameroon (2018)
  - EulaLink submarine cable from Fortaleza to Portugal (2020)
- Network aggregation in the southern hemisphere
  - Fortaleza as a south Atlantic hub
- Leveraging network infrastructure linking the U.S., South America, and Africa



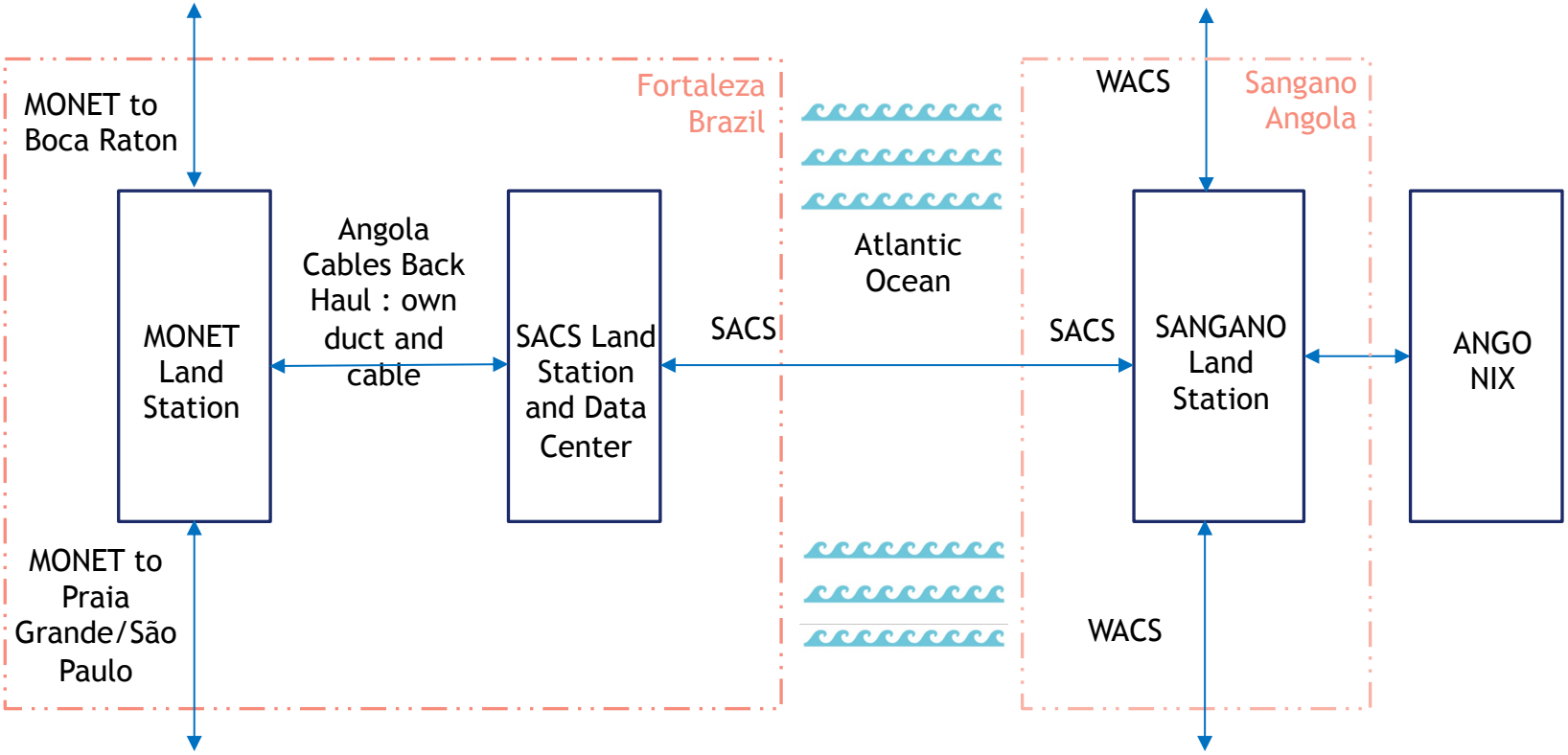
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Opportunities in Angola

- SACS creates an opportunity to connect west Africa to the Americas
- Formation of an NREN in Angola
  - Angola resides within the UbuntuNet region
  - The CEO of UbuntuNet, Pascal Hoba, met with ministers of S&T and Education in Angola
  - There is a commitment to establish an NREN
- AfricaConnect3 is being planned
  - If funded, UbuntuNet would include Angola in AC3
- Angola Cables expands South Africa presence with PoP

Opportunities in Angola

- SACS and WACS will be connected at Sangano Cable Station in Angola, also Luanda
- Subsea cable infrastructure, could be an interesting exchanging point to local REN



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About AARCLight

- Project of the U.S. National Science Foundation, Award #OAC-1638990, at FIU
- Aims to define a strategy for research and education network connectivity between the US and West Africa
- Aims to coordinate planning efforts among stakeholders in the U.S., Africa, and Brazil
- Aims to create economies of scale
  - Making use of the offered spectrum
  - Towards serving the broadest communities of interest in research and education

AARCLight Planned Activities

- Establish collaborative partners
- Establish a contract with Angola Cable for Spectrum
- Develop a network design in coordination with AARCLight partners
- Develop a plan to integrate the science disciplines with the network strategy
- Develop a community engagement plan

Science Drivers: South African Astronomical Observatory (SAAO)

- SAAO is a facility of the National Research Foundation
  - Operates under the Department of Science and Technology
- The **Southern African Large Telescope** (SALT) is the largest single optical telescope in the southern hemisphere and among the largest in the world.
- SALT is funded by a consortium of international partners from South Af
  USA, Germany, Poland, India, the UK, and New Zealand
- SAAO Hosted Research Telescopes: BiSON, KELT-South, LCOGT, MONET, SuperWASP-South
- SALT generates 5-50 GB/night, with future instrumentation ~250 GB/night



Science Drivers: South African's MeerKAT radio telescope

- The MeerKAT 64-antenna array radio telescope is being built in the Karoo region
- Collaborators: USA, Canada, India, Japan, China, Australia, France, UK, Italy, Finland, Germany
- MeerKAT is a precursor to the Square Kilometre Array (SKA) telescope
  - Will be merged into the SKA1-Mid array in the early 2020's
  - SKA will be the largest array telescope in the southern hemisphere (2024)
- Currently generates data at a rate of 4.7 GBps



Science Drivers: Square Kilometre Array radio telescope (SKA) South Africa

- SKA will generate ~160 Gb/s
  - (109) bits per second from each radio dish to a central processor
  - High frequency dishes alone will produce ten times the current global internet traffic!
    https://www.skatelescope.org/signal-processing/
  - Phase two will include telescopes from New Zealand, Botswana, Ghana, Kenya, Mauritius, Madagascar, Mozambique, Namibia and Zambia.
- The SKA operation data rate is
  - ~80 Tb/s from the antennas to the correlator
  - ~80 Tb/s from the correlator to the HPC
    http://www.jb.man.ac.uk/research/ska/
- End-to-end network path must provide:
  - High resilience and low delay, multiple paths, high bandwidth and an efficient control plane to act in all status changes -100Gp/s
    http://www.jb.man.ac.uk/research/ska/SADT_Technical_Information_Pack_Rev2.0.pdf





THANK YOU!

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NSF

FIU FLORIDA INTERNATIONAL UNIVERSITY

AMERICA'S LIGHTPATHS AMLIGHT RESEARCH + EDUCATION COLLABORATION

AMPATH PATHWAY OF THE AMERICAS

AmLight ExP International Distributed Exchange Point

AtlanticWave SDX INTERNATIONAL DISTRIBUTED SOFTWARE-DEFINED EXCHANGE

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