The Global Research Platform Workshop

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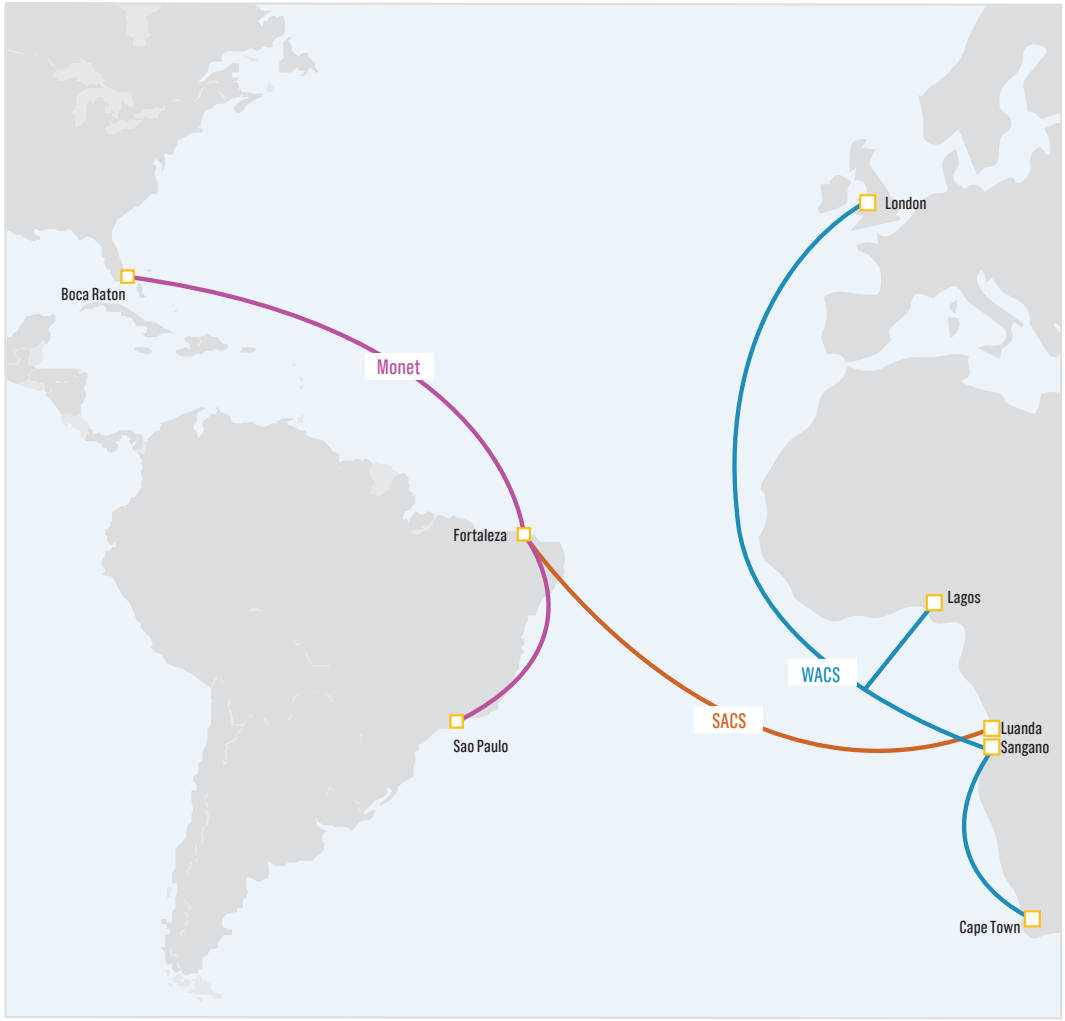
Network infrastructure resources in the Southern Hemisphere

- 225GHz of spectrum on Monet committed in AmLight-ExP project
- 100G of spectrum on SACS is available to the R&E community
- TENET operates >800G of capacity on WACS
- South Atlantic eXchange point (SAX) is under development in Fortaleza, led by RNP
- R&E exchange point in Cape Town operated by SANREN and TENET



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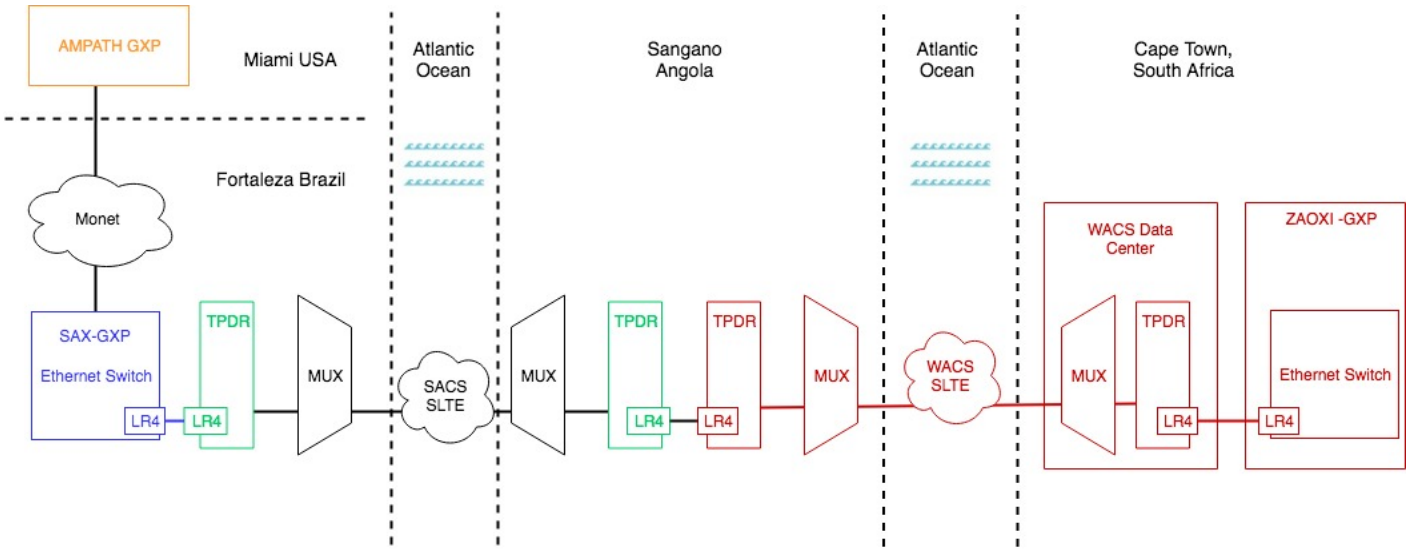
AmLight-SACS

- AmLight-SACS will activate 40GHz of spectrum on SACS
- Establishes a new South Atlantic route
- Creates a new Express connection between the U.S., South America and Africa by
  - Interconnecting SACS to Monet and WACS
- Will be operated by AmLight, RNP and SANREN



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AmLight-SACS Global Exchange Points

AmLight-SACS has worked together to identify and coordinate new facilities in the South Atlantic,

- Interconnecting the REN exchange points AMPATH (Miami), SAX (Fortaleza) and ZAOXI (Cape Town)
- The **SACS** cable, between Brazil and Angola, is operational, and we are activating spectrum for REN network use
- The **WACS** cable, between South Africa and Europe, is operational and connects to **SACS** in Angola
- **SACS** and the **AmLight ExP** cables are to be interconnected at the **SAX GXP** in Fortaleza

We thus have the ingredients to create a resilient South Atlantic REN interconnection,

- greatly reducing the latency of traffic between the Americas and Africa

AMPATH
Miami

SAX
Fortaleza

ZAOXI
Cape Town

Slide borrowed from Michael Stanton

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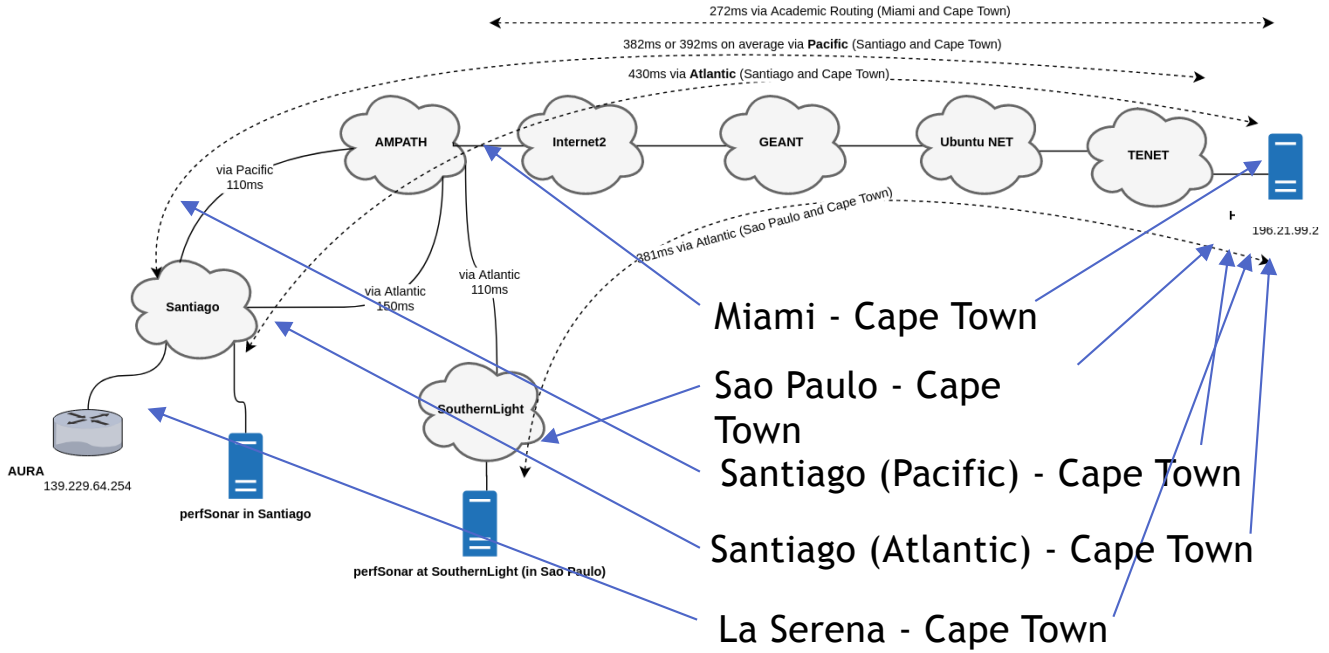
Network performance to the US and Latin America

Current Academic networks transited were TENET, UbuntuNet, GEANT, Internet2, AmLight, REUNA, RNP and ANSP



From Cape Town to:	Currently via TENET, UbuntuNet, GEANT, and I2	Actual via SACS	Possible Improvement
New York	241ms	192ms	126%
Miami	272ms	161ms	169%
Fortaleza, Brazil	336ms	97ms	346%
Sao Paulo, Brazil	381ms	142ms	268%
Santiago, Chile	382ms	143ms	250%
La Serrena, Chile	392ms	153ms	256%

The results from latency measurements taken from the TENET network in Cape Town, traversing research networks UbuntuNet, GEANT, Internet2, AmLight, RNP and REUNA to reach sites in New York (USA), Miami (USA), Fortaleza (Brazil), Sao Paulo (Brazil), Santiago (Chile), and La Serena (Chile).

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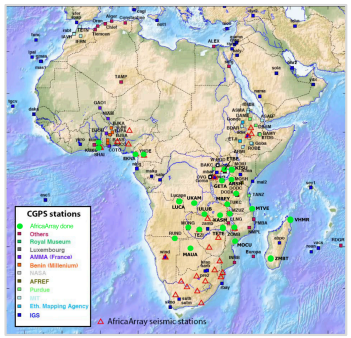
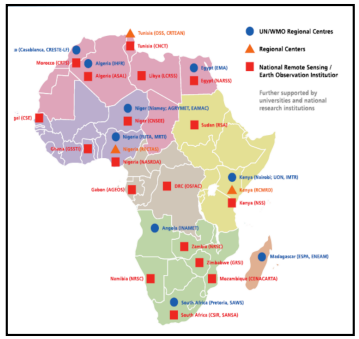
Science Driver collaborations Africa & The Americas

- Astronomy
- Medical
- Other Science Disciplines

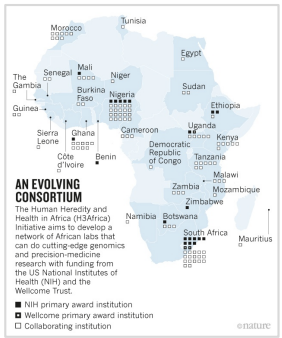
Telescope sites across Africa, with its core in the Northern Cape
Potgieter, P. (2015). GIS in constructing the SKA. Retrieved from https://www.ee.co.za/article/gis-constructing-ska.html



Global Positioning System (CGPS) in Africa. Source: https://www.unavco.org/community/publications_and_reports/reports/reports.html



Earth Observation Institutions
Torman, Y. (2017). AfREN and AfriGEOSS. Paper presented at the AfriGEOSS Symposium 2017, Sunyani, Ghana.



Human Heredity and Health in Africa (H3Africa)
Nordling, L. (2017). How the genomics revolution could finally help Africa. Nature News, 544(7648), 20.

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Science Drivers: South African's radio telescopes MeerKAT & Square Kilometre Array (SKA)

- The MeerKAT 64-antenna array radio telescope in the Karoo region
- Collaborators: USA, Canada, India, Japan, China, Australia, France, UK, Italy, Finland, Germany
- MeerKAT is a precursor to the SKA
  - Will be merged into the SKA1 (2020)
  - SKA will be the largest array telescope in the southern hemisphere (2024)
  - Currently data at a rate of 3.5 Gbps

- SKA will generate
  - 160Gbits per second from each radio dish to a central processor
  - High frequency dishes will produce ten times the current global internet traffic!
  - Phase two will include telescopes from New Zealand, Botswana, Ghana, Kenya, Mauritius, Madagascar, Mozambique, Namibia and Zambia.
- The SKA will generate 960,000 Tb/day

https://www.ska.ac.za/science-engineering/meerkat/about-meerkat/

https://www.skatelescope.org

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 Africa, the USA, Germany, Poland, India, the UK, and New Zealand
- SAAO Hosted Research Telescopes: BiSON, KELT-South, LCOGT, MONET, Solaris, SuperWASP-South

- SALT generates 5-50 GB/night, with future instrumentation ~250 GB/night

Science Drivers: Genomic, Proteomic and HIV Research

- A number of South African Universities and Research Institutions including University of Cape Town, University of Witwatersrand, University of the Western Cape, Centre for Proteomic & Genomic Research, The Medical Research Council and the Agricultural Research Council are interacting with Research Entities globally in these fields.

- Participation of UbuntuNet and WACREN:
  - Access to a wealth of Research undertakings by their Member NRENs
  - Letters of Collaboration from the CEO's
  - Cape Town is an aggregation point for these networks until more can be opened

NIH Projects in Africa. Source: https://report.nih.gov/award/#tab4

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Conclusions from AARCLight Planning

- We can add network resiliency and reduce latency between Africa and the US
- AmLight-ExP connection WACS –SACS required in Sangano cable land station.
- The interconnection node will be supported by a switch with 100G interfaces.
- Angonix Data Center in Sangano, Angola near Luanda is operated by Angola Cables
- NEC Transponders are native to the SACS / WACS systems
- AmLight-ExP is obtaining NEC Transponders 1 for Fortaleza and 1 for Sangano
- We are lighting SACS now at 100G Ethernet for R&E Network Usage
- FIU and TENET have signed an MOU to interconnect SACS to WACS
- Benefits to US astronomical science and other disciplines immediate

THANK YOU!

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AMPATH PATHWAY OF THE AMERICAS
AmLight ExP International Distributed Exchange Point
AtlanticWave SDX INTERNATIONAL DISTRIBUTED SOFTWARE-DEFINED EXCHANGE
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