![AmLight ExP — Americas Lightpaths Express & Protect]

AmLight Express and Protect (AmLight-ExP):

Enabling Research and Education in the Americas via cooperation and collaboration

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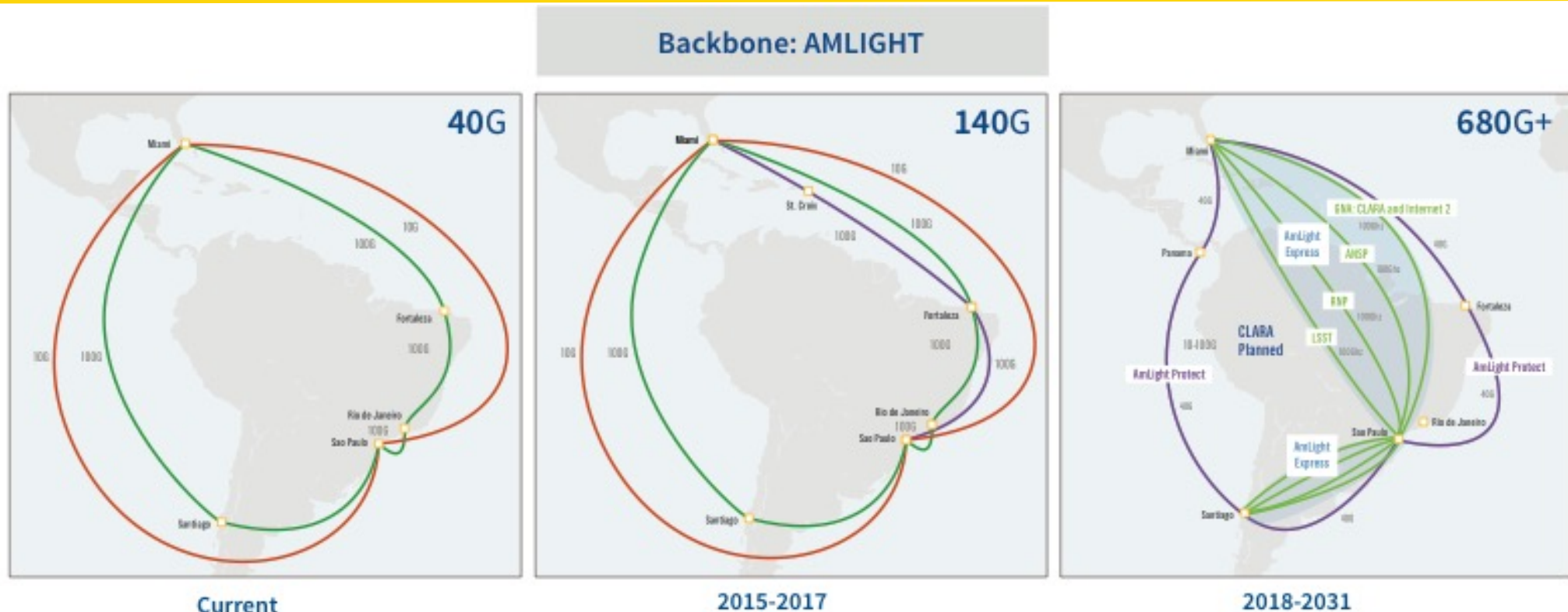Florida International University

Americas Summit of Academic Networks
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Cancun, Mexico

Outline

- AmLight Vision

- Current Status

- Science Driver: LSST

- AmLight-SACS

- Conclusion

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AmLight Express & Protect Vision

Backbone: AMLIGHT

40G	140G	680G+
Current	2015-2017	2018-2031

- Community-operated network infrastructure
- Leased capacity on two submarine cable systems, evolving to a hybrid model that includes spectrum from Boca Raton to Sao Paulo
- Express (spectrum) capacity will provide up to 6 optical channels, which will be lit with 100G transponders today
- Protect (leased) capacity 100G ring will back up the Express capacity

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Partners and Goals

- AmLight-ExP interconnects the U.S. to key aggregation points in South and Central America (Brazil, Chile, Panama)

- 5-year Cooperative Agreement with the U.S. National Science Foundation

- Cooperative and collaborative partnerships with ANSP, RNP, CLARA, REUNA, AURA, FLR, and Internet2

- Continue evolving a rational network infrastructure using both optical spectrum and leased capacity

AmLight ExP Network Infrastructure in January 2019

- 100G ring Miami-Fortaleza, Fortaleza-Sao Paulo, Sao Paulo-Santiago, Santiago-Panama City, Panama City-Miami

- 10G ring from Miami-Sao Paulo-Miami for protection (red)

- 10G Miami-Santiago for protection

- 100G and 10G rings are diverse, operating on multiple submarine cables

- Total upstream capacity presently at 230Gbps

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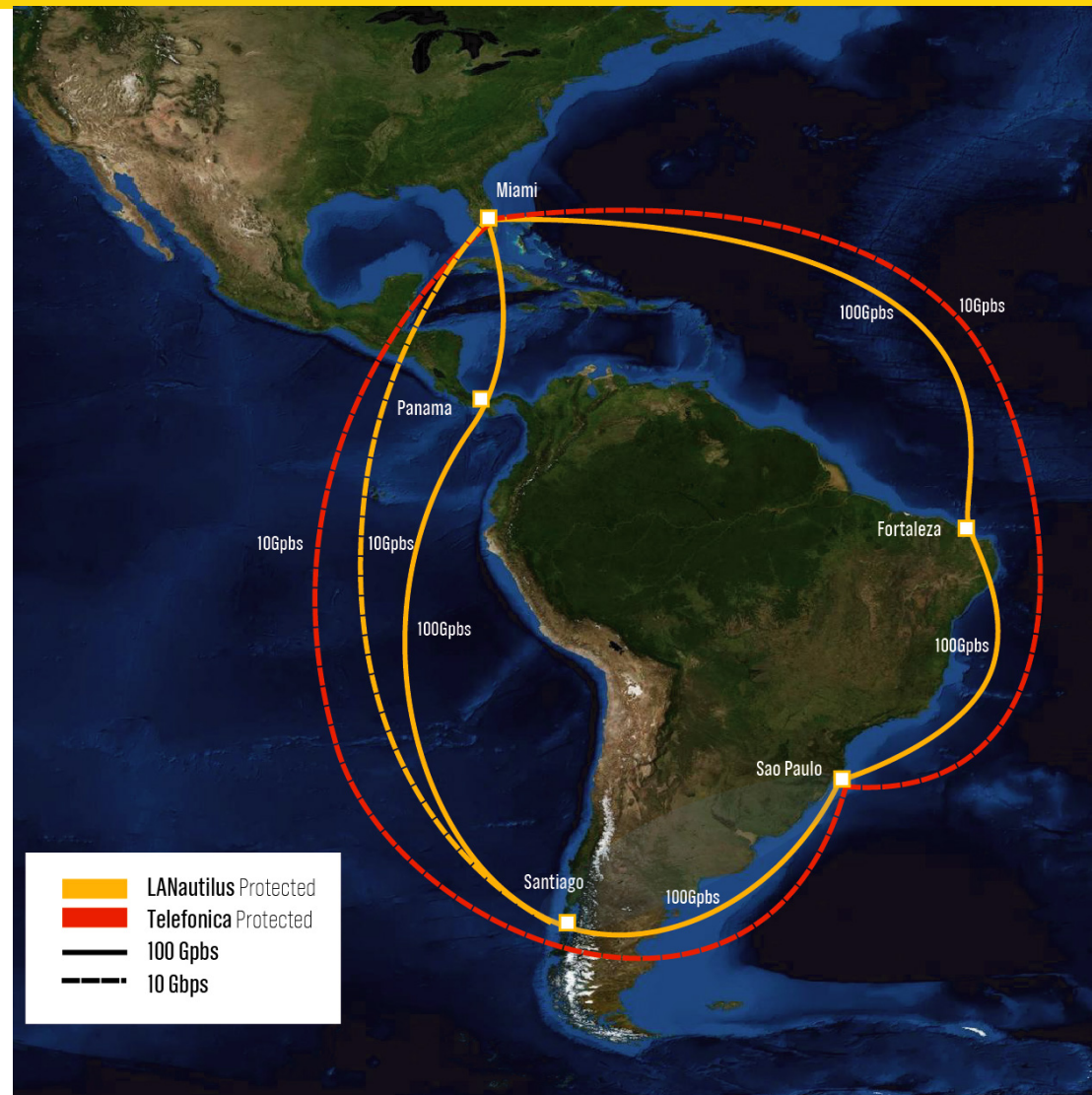
# AmLigh- ExP Network Infrastructure Today

- **Express Ring:** Boca Raton, Fortaleza, Sao Paulo
  - 6 (green lines) x 100G links
    - 4 managed by RNP
    - 2 managed by FIU/ANSP/LSST

- **100G Protect Ring:** Miami-Fortaleza, Fortaleza-Sao Paulo, Sao Paulo-Santiago, Santiago-Panama, and Panama-Miami (solid orange)

- 10G ring from Miami-Sao Paulo-Miami for protection (red dashed)

- 10G Miami-Santiago for protection (orange dashed)

- 100G and 10G rings are diverse, operating on multiple submarine cables

- **Total upstream capacity presently at 630Gbps!**

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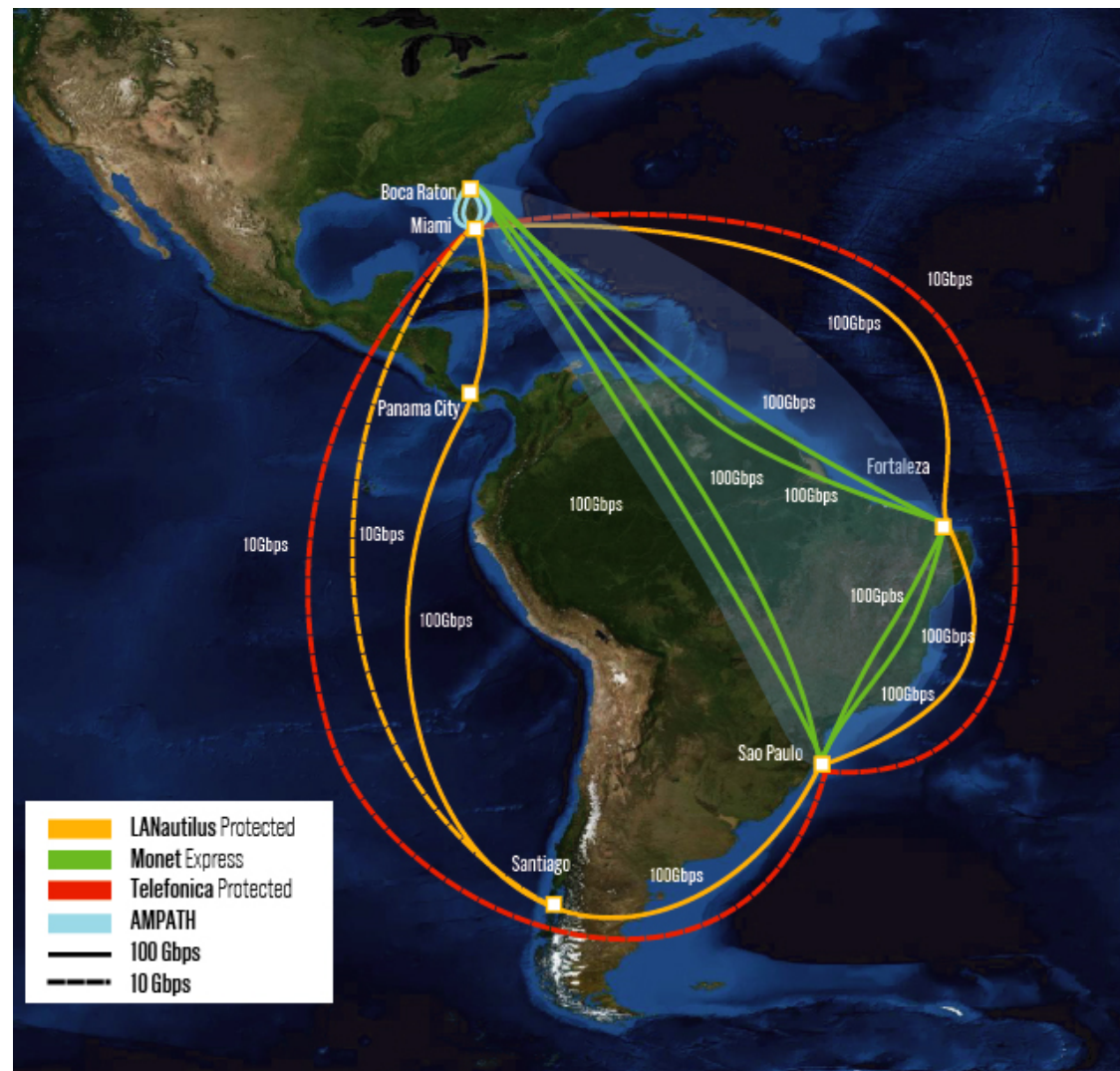
Large Synoptic Survey Telescope (LSST)

- LSST is a large-aperture, wide-field, ground-based optical telescope under construction in northern Chile

- The 8.4 meter telescope will take a picture of the southern sky every 27 seconds
  - producing a 13 Gigabyte data set

- Each image must be transferred to the archive site at NCSA in Champaign, Illinois, within 5 seconds
  - Reason: for processing to be completed in time to generate "transient alert" notifications to the worldwide astronomical community within 60 seconds

- In response to LSST's transient alert requirements, the network must be scalable, highly available, reliable, and provide high-throughput and guaranteed bandwidth
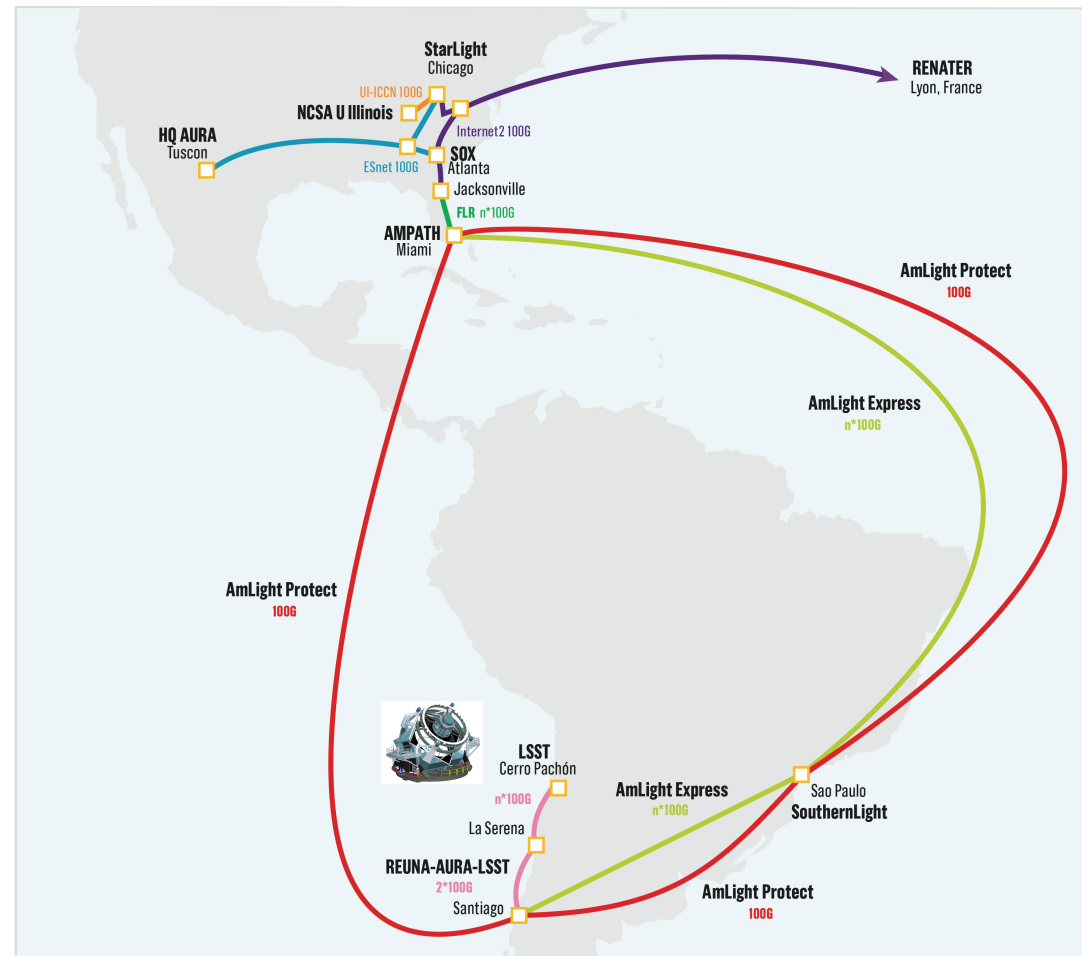
Challenge: LSST Use Case

■ **LSST is being constructed in northern Chile**

■ Every 27 seconds throughout the night, LSST will take a 6.4GB picture of the sky, process it, generate transient alerts (6.3GB) from this picture, and then send a 13GB data set to NCSA, at Urbana-Champaign, Illinois

- From the 27-seconds window, only 5 seconds are available for data transmission

- Multi-traffic types with different priorities (db sync, control, general Internet traffic) must be supported

A testbed of the LSST Network was built for Super Computing 2018
- Verified the network design
- Tested network throughput per-segment
- Tested DTN performance

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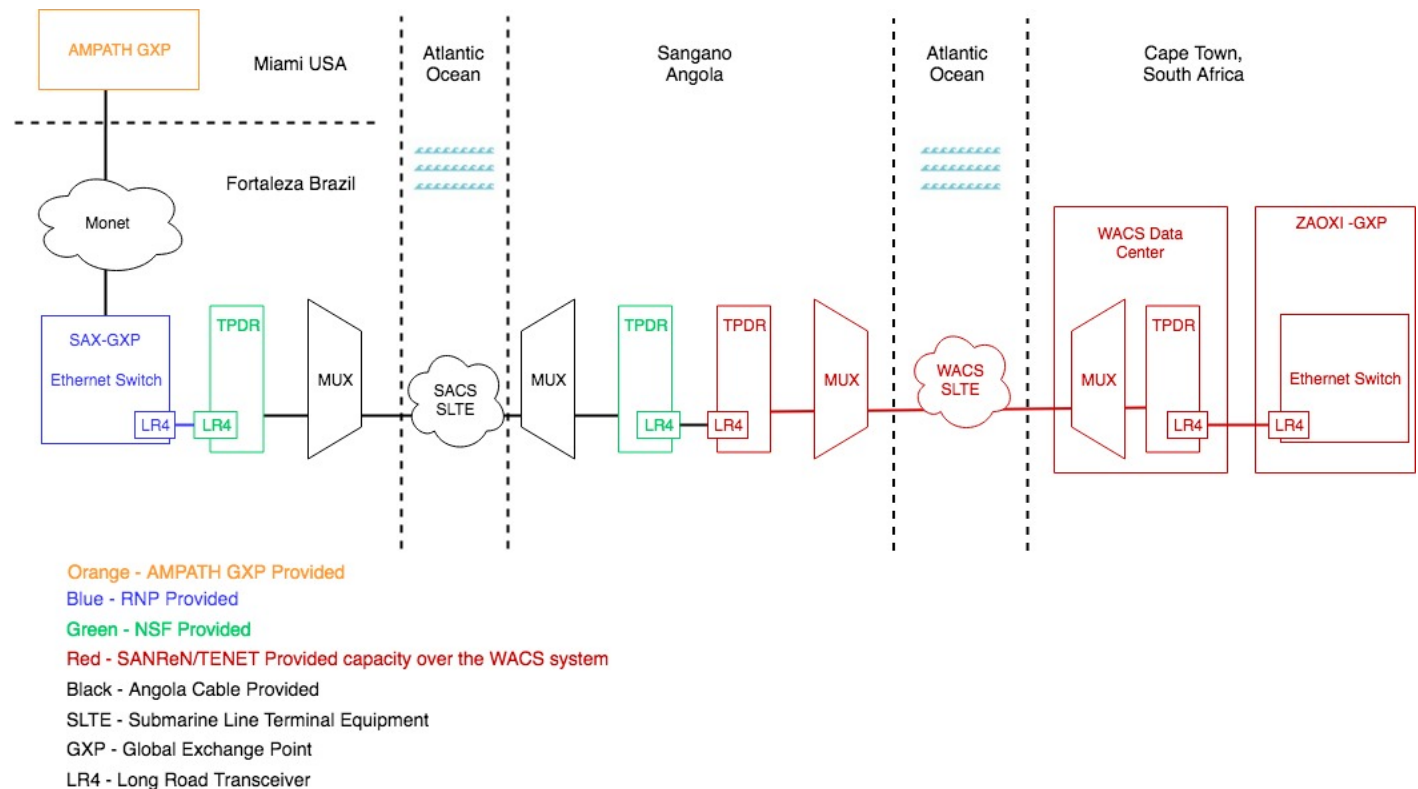Americas Lightpaths **Express & Protect**
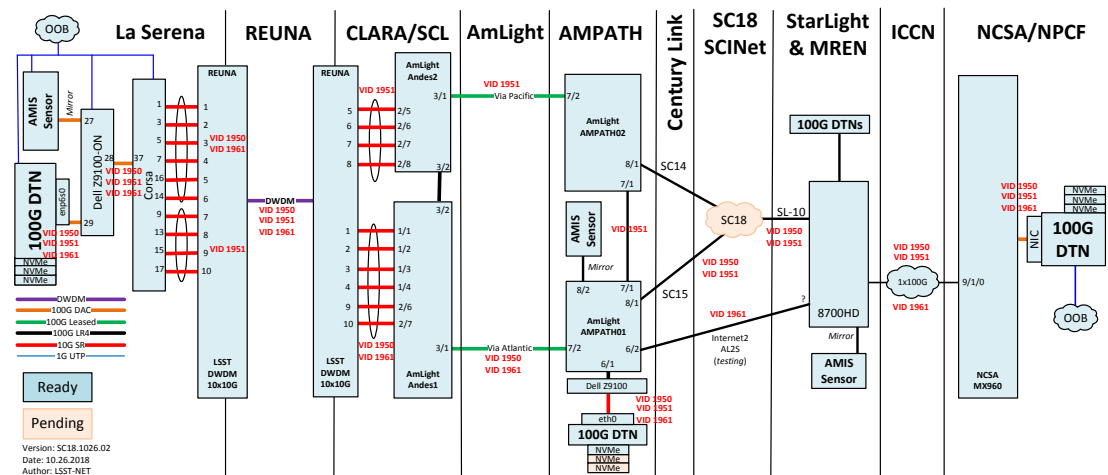
Network infrastructure resources in the Southern Hemisphere

- 225GHz of spectrum on Monet committed in AmLight-ExP project

- 40GHz of spectrum on SACS is available to the R&E community

- TENET operates 220G 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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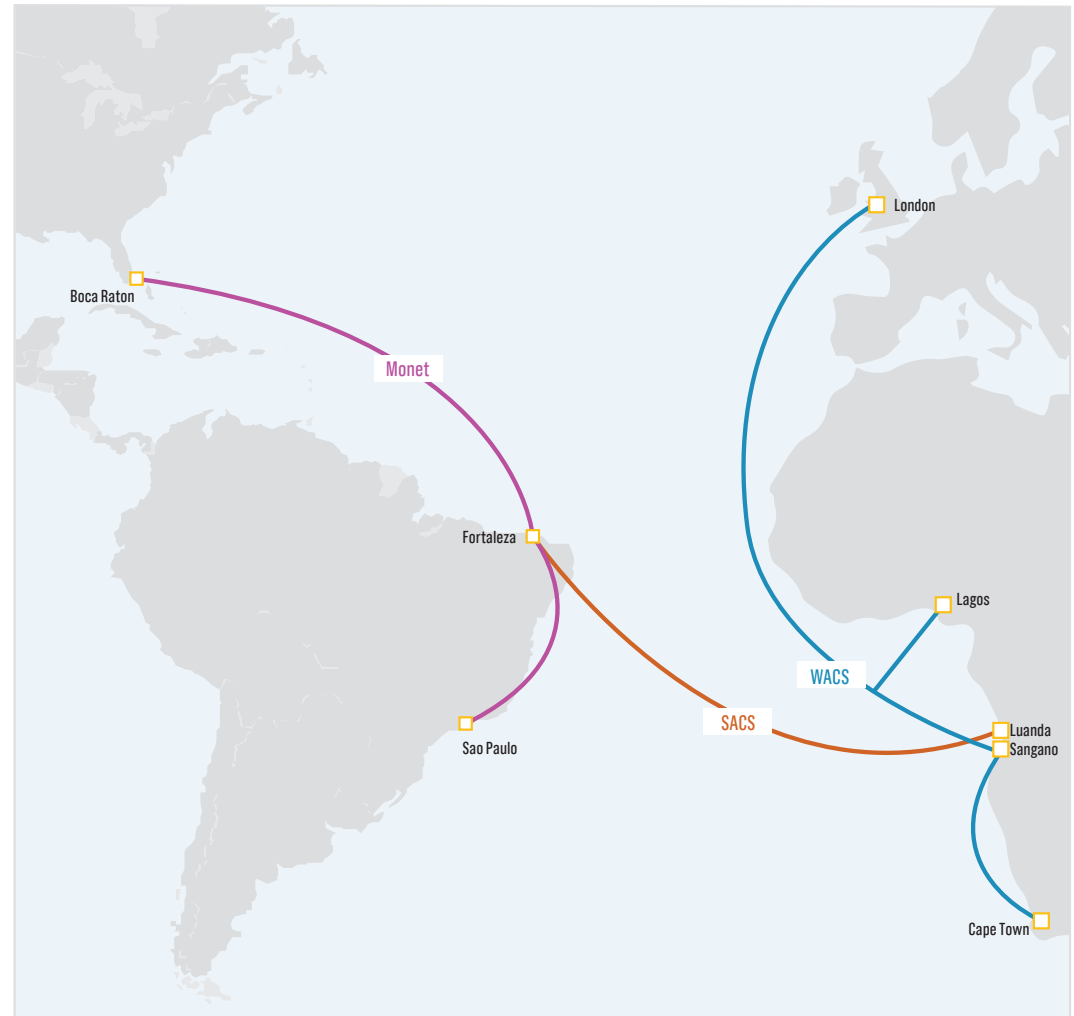
AmLight-SACS

- **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**

Orange - AMPATH GXP Provided
Blue - RNP Provided
Green - NSF Provided
Red - SANReN/TENET Provided capacity over the WACS system
Black - Angola Cable Provided
SLTE - Submarine Line Terminal Equipment
GXP - Global Exchange Point
LR4 - Long Road Transceiver

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

Timeline for AmLight-ExP and AmLight-SACS

- 2019
  - Spectrum activation, Boca Raton to Sao Paulo, (completed)
  - Extend AMPATH GXP to Boca Raton (completed)
  - Deploy 20Gbps Atlanta to Chicago, Esnet

- 2020
  - Activate spectrum on SACS, then build AmLight-SACS link
  - Activate spectrum, Sao Paulo to Santiago
  - Deploy new SDN Controller for AmLight-ExP
  - Activate 200Gbps, Atlanta to Chicago, Esnet

- 2021
  - Activate spectrum, Boca Raton to Atlanta

- 2022
  - LSST Operations starts

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Thank You!

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  - Cooperación Latino Americana de Redes Avanzadas (CLARA)
  - Association of Universities for Research in Astronomy (AURA)
  - Florida International University
  - Latin American Research and Education community
  - The many national and international collaborators who support our efforts

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