



Americas Lightpaths (AmLight) Update



**GLIF 13th Annual Global LambdaGrid
Workshop**

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Nanyang Technological University, Singapore

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AmLight: International Collaboration of NRENS and GOLEs

- AmLight is an NSF IRNC Production Network (ProNet) award for USA-Latin America science & engineering research and education, ACI-0963053
- AmLight enhances science research and education in the Americas by:
 - Interconnecting key points of aggregation
 - Providing operation of production infrastructure
 - Engaging U.S. and western hemisphere science and engineering research and education communities
 - Creating an open instrument for collaboration
 - Maximizing benefits of all collaborating organizations



AmLight: International Collaborating Organizations

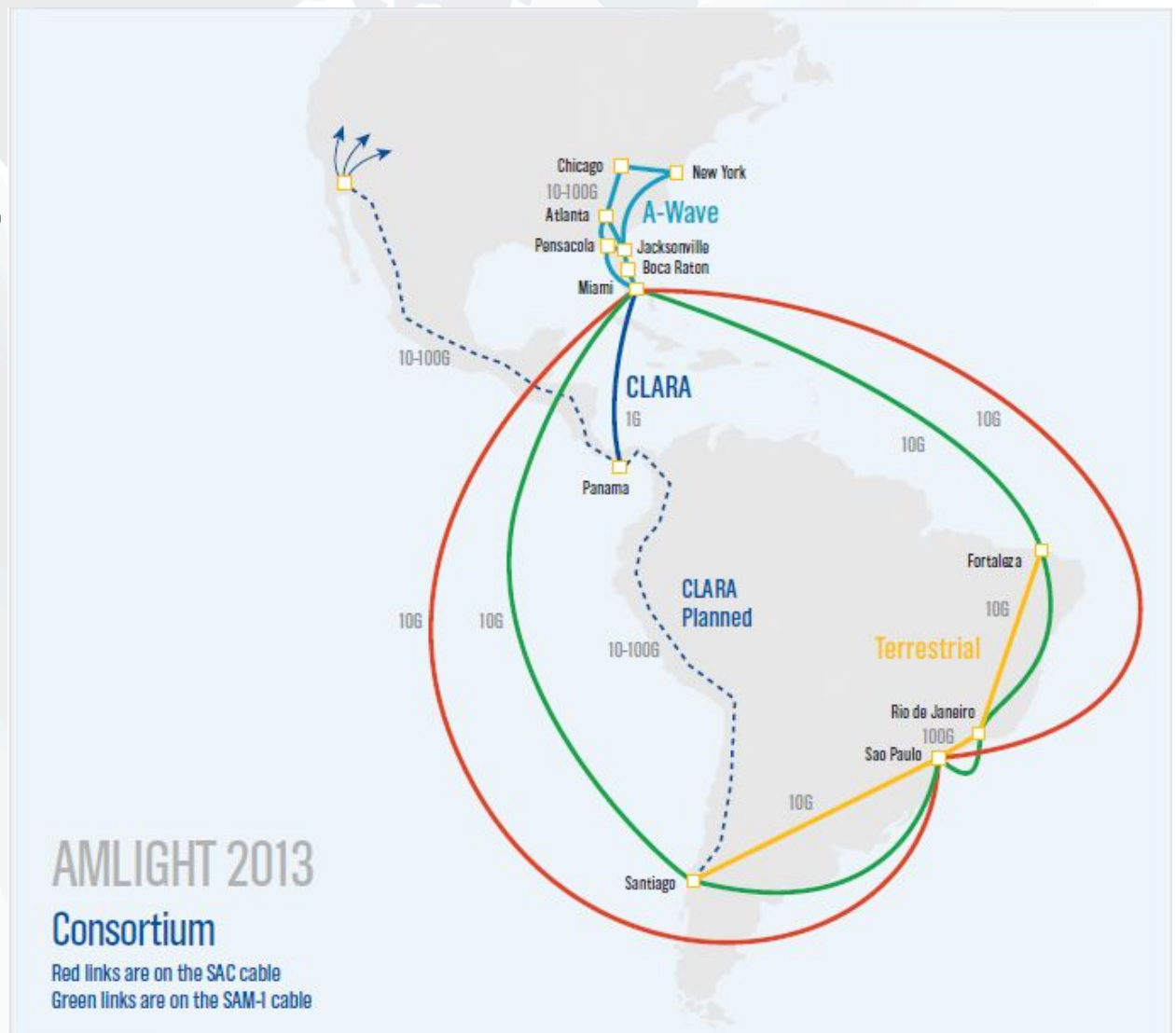


- Florida International University (AMPATH @ FIU)
- Corporation for Education Network Initiatives in California (CENIC)
- Lonestar Education and Research Network (LEARN)
- Academic Network of Sao Paulo (ANSP-FAPESP)
- Association of Universities for Research in Astronomy (AURA)
- Cooperación Latino Americana de Redes Avanzadas (CLARA)
- Corporación Universitaria para el Desarrollo de Internet (CUDI)
- Red Universitaria Nacional (REUNA)
- Rede Nacional de Ensino e Pesquisa (RNP)
- Florida LambdaRail
- Internet2
- Southeastern Universities Research Association (SURA)
- AtlanticWave Exchange Points
- National LambdaRail



AmLight 2013 Topology

- ANSP: 2x 10G links
S Paulo – Miami
 - (W) via Santiago (LAN)
 - (E) direct (Telfonica)
- RNP: 2x 10G links
S Paulo – Miami
 - (W) direct (Telefonica)
 - (E) via Rio de Janeiro & Fortaleza (LAN) (+ redundant terrestrial links)
- RedCLARA:
 - 1G link Panama – Miami (LAN)
 - 10G terrestrial link Santiago – S Paulo





OpenWave 100G project



- OpenWave is under NSF IRNC ProNet AmLight award
- Deploys experimental 100G between US and Brazil
- Experiments on how to deploy a 100G trans-oceanic alien wave on a highly constrained operational undersea cable system
- Experiments how to operate a 100G wave at 9,800km that spans North and South America



OpenWave Project Partners



- NSF and the IRNC program
- FIU via the AmLight Project
- FAPESP, via the ANSP project
- RNP, Brazil's NREN
- PadTec, optical equipment manufacturer
- Latin American Nautilus, undersea cable operator
- Florida LambdaRail (FLR)
- Internet2

OpenWave Challenges

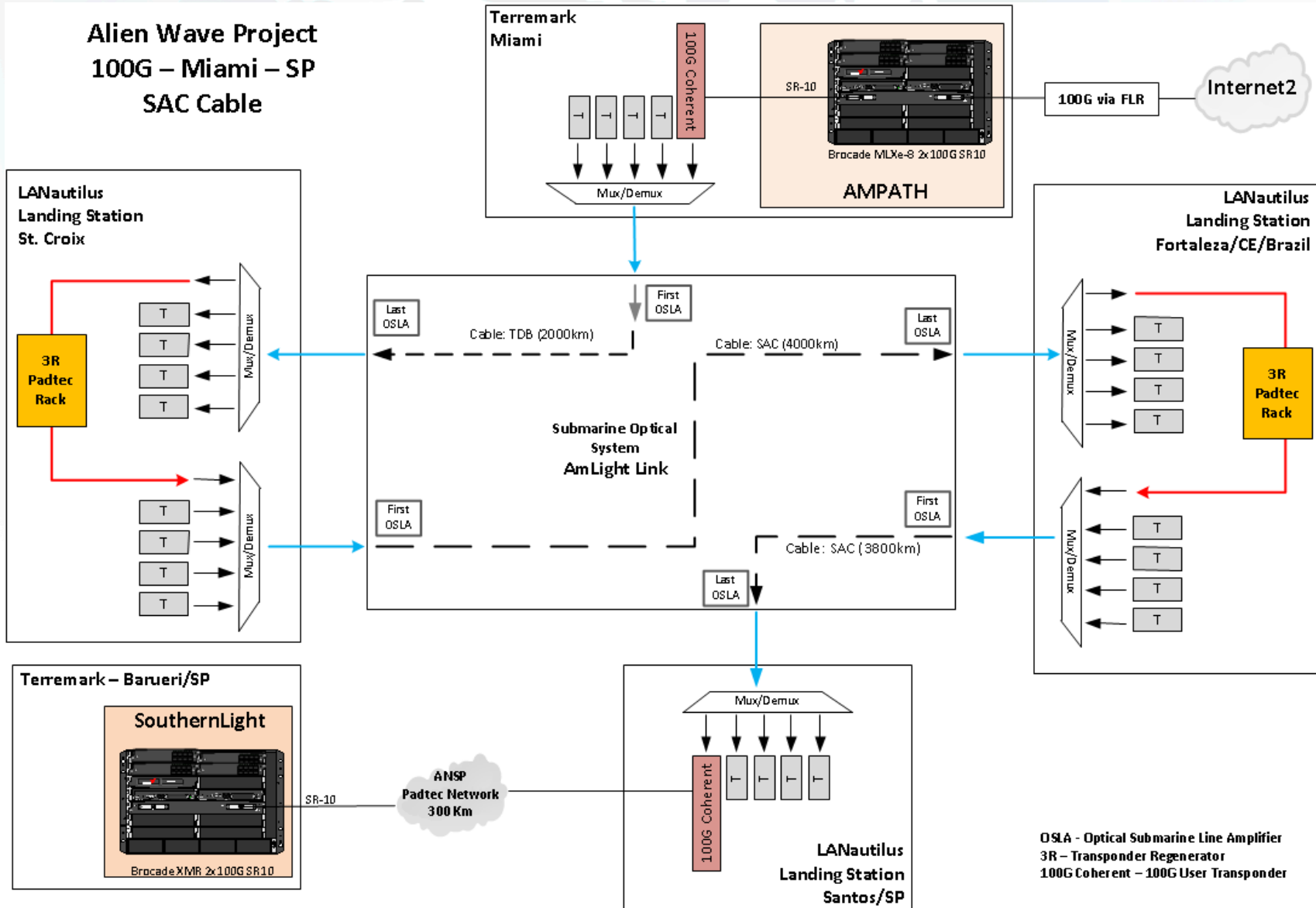
- Introduction of a Coherent 100G system in an intensity modulation long distance undersea optical system
- OpenWave will create a testbed to discover how to overcome the nonlinear phase noise problem impairments on this undersea cable system
- Impact is the potential of introducing a novel approach for upgrading production undersea optical fiber systems, and
- Facilitating academic access to submarine optronics

OpenWave Design

- Experiment consists of three submarine segments:
 - Miami/USA to St. Croix (2000 km)
 - St. Croix to Fortaleza/BR (4000 km)
 - Fortaleza/BR to Sao Paulo/BR (3800 km)
- 3R Regeneration at St. Croix and Fortaleza
- Spectrum of 50 GHz will be used with guard bands at 25 GHz each

OpenWave Network

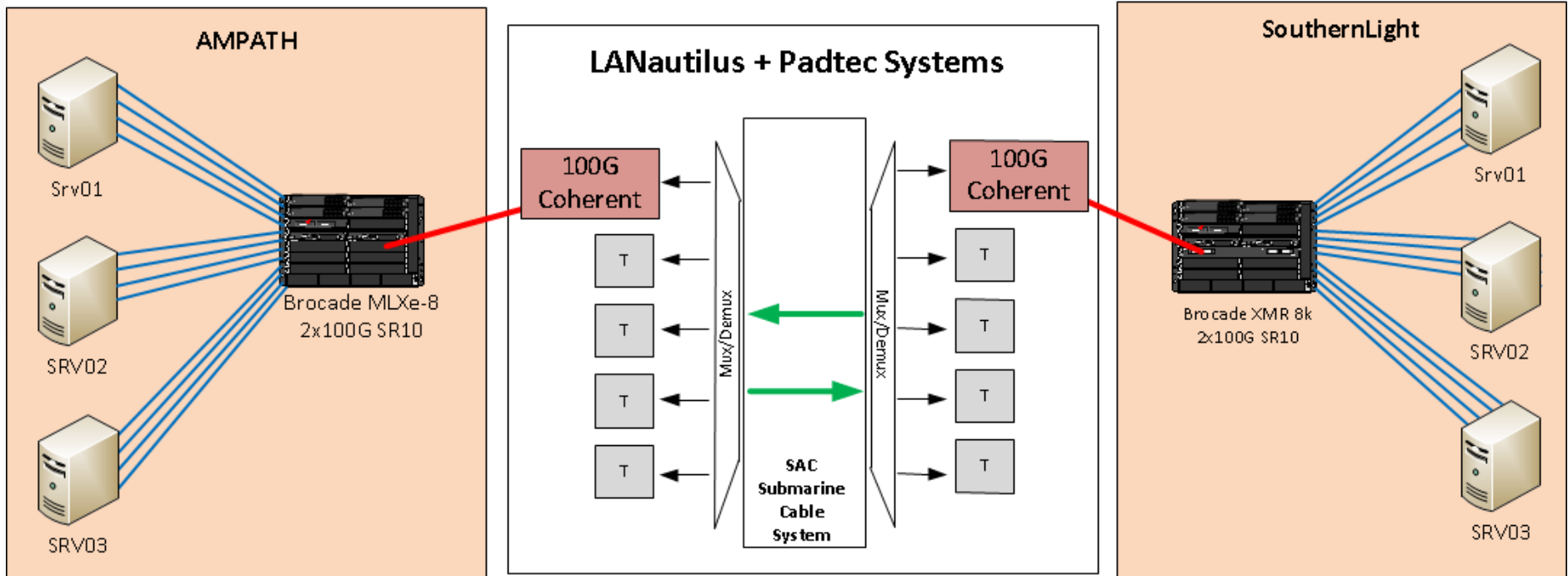
Alien Wave Project 100G – Miami – SP SAC Cable



Network Performance Tests

- Two phases
 - First: Optical testbed deployed by Padtec
 - Second: Application testbed deployed by AmLight
- Second (Application) testbed:
 - 3 servers each side with 4 x 10G NICs
 - 12 x UDP and TCP 10G flows in both directions
- Data Transport Layer Tests
 - Verify that hybrid network services can be properly supported

100G Testbed AMPATH/Mia to SouthernLight/SP



12 TCP or UDP Flows with 10Gbps each



Thank You!