AtlanticWave-SDX:

Motivation, Goals, Status, Activities
NSF Award #OAC-1451024

Americas Research Platform (AmRP) Working Group meeting

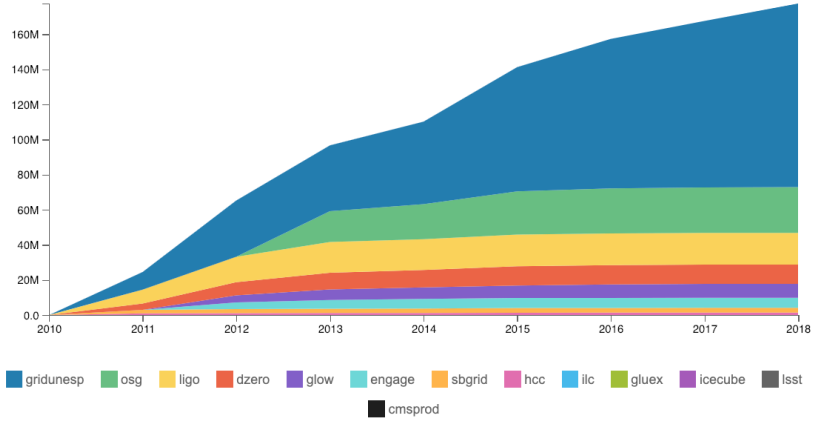
September 17, 2019

Outline

- Motivation
- Partners
- AtlanticWave-SDX Architecture
- AtlanticWave-SDX User Interfaces
- Results

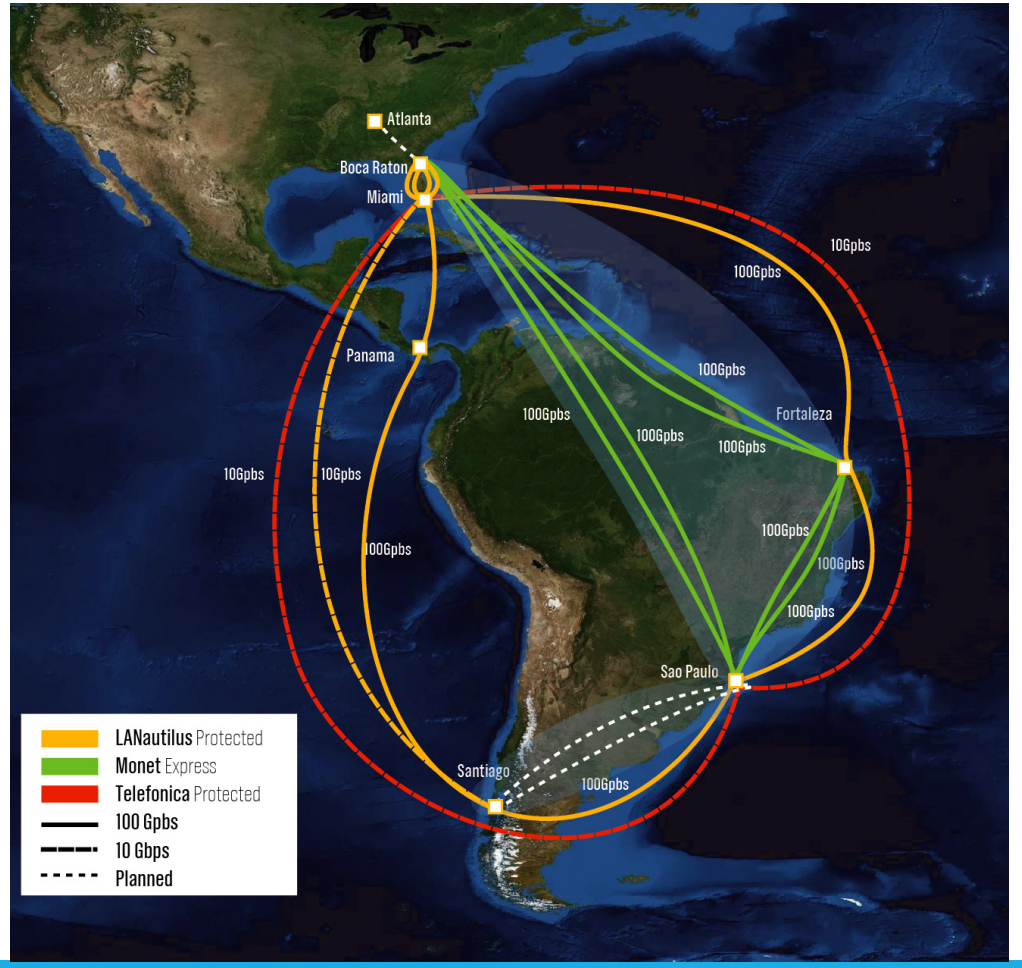
Motivation

- Science instruments in South America are increasing in number
  - Atacama Large Millimeter Array (ALMA)
  - Dark Energy Camera (DECam)
  - Large Synoptic Survey Telescope (LSST)
    - Under construction
    - First light 2022
  - Giant Magellan Telescope (GMT)
    - Under construction
    - First light 2024
- Center for Scientific Computing in Sao Paulo, Brazil
  - LHC Data Analysis & processing
  - Processing for Open Science Grid (OSG), and other international instruments
  - Received 2,614 TB in flows from U.S. sources in 2017
  - Transmitted 792 TB in flows to U.S. destinations



Motivation (2): Paradigm shift in south-north network capacity

- Increasing AmLight network resilience and capacity
  - Activating Express:
    - Boca Raton, Fortaleza, Sao Paulo
    - 6 (green lines) x 100G links
      - 4 managed by RNP
      - 2 managed by FIU/ANSP/LSST
  - Aggregate bandwidth capacity landing in Miami will be 530Gbps
- Expanding AmLight network
  - Adding PoP in Boca Raton

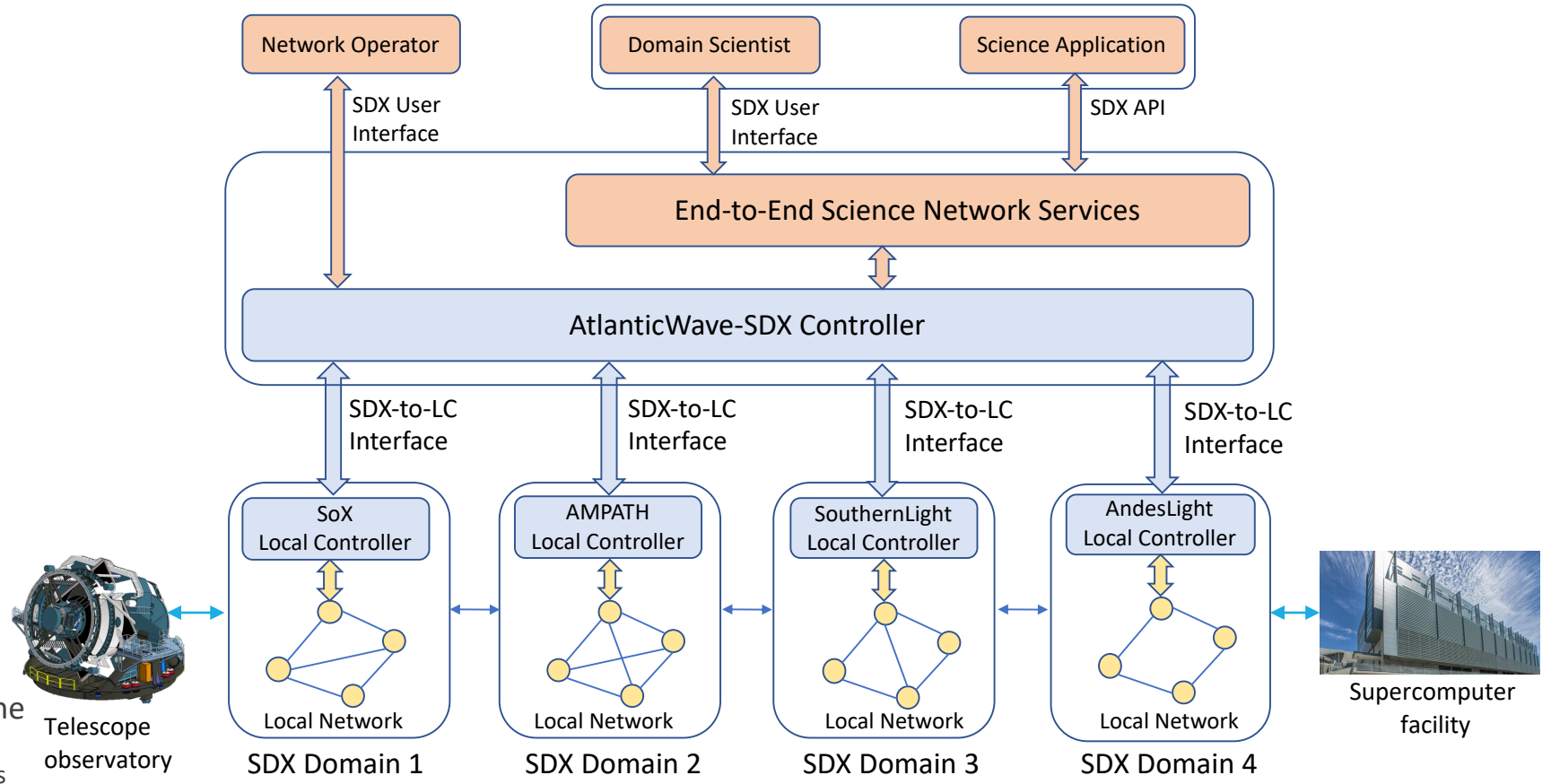


Partners and Collaborators

- Florida International University (FIU)
- University of Southern California Information Sciences Institute (USC-ISI)
- Georgia Institute of Technology (GT)
- Renaissance Computing Institute at UNC (RENCI)
- Academic Network of Sao Paulo (ANSP)
- Association of Universities for Research in Astronomy (AURA)
- Rede Nacional de Ensino e Pesquisa (RNP, Brazil)
- Red Universitaria Nacional (REUNA, Chile)
- Florida LambdaRail
- Internet2

AtlanticWave-SDX Architecture

- AW-SDX is split into multiple layers:
- The AW-SDX Controller:
  - Controls SoX, AMPATH, SouthernLight, and AndesLight
  - Interfaces with external requests
  - Generates requests to LC
- Local Controllers (LC):
  - Each site has a LC and local switches (data plane)
  - LCs translate rules into switches low-level interface
    - OpenFlow, Proprietary APIs, P4 API (future)
- Users (network operators and domain scientists), and science applications
  - Request end-to-end science network services from the AW-SDX controller
  - Consume end-to-end services composed by the AW-SDX controller
    - Abstracted by the End-to-End Science Network Services component

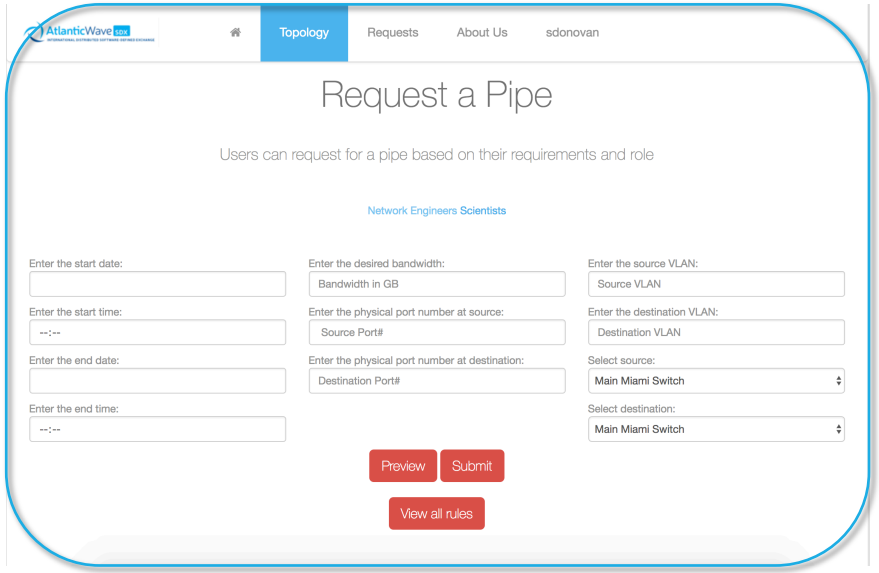


Network Engineer and Domain Scientist Interfaces

User requests via WEB UI or REST calls

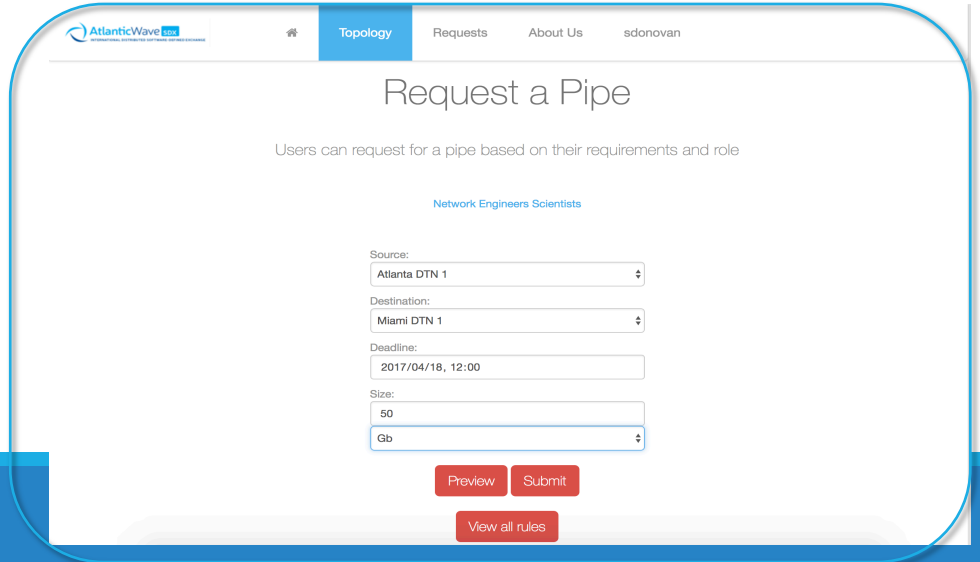
Interface for Network Engineers and Domain Scientists

Exploring integration with SENSE orchestrator
For an alternative user interface




```
{"dtntunnel":
   {"quantity":"7TB",
    "deadline":"2016-10-30T23:59:59",
    "srcdtn":"gt-dtn",
    "dstdtn":"fiu-dtn"}}
```

```
{"l2tunnel":
   {"starttime":"2016-10-12T23:20:50",
    "endtime":"2016-10-13T23:20:50",
    "srcswitch":"atl-switch",
    "dstswitch":"mia-switch",
    "srcport”:5,
    "dstport”:7,
    “srcvlan":1492,
    "dstvlan":1789,
    "bandwidth":1}}
```



AW-SDX Testbed @RENCI

Performance tests:

1. Submit L2Tunnel requests sequentially to one site as the source and other sites as the destination.
2. Submit requests randomly for each site as source and other sites as destination

		30 Connections From RENCI	30 Connections From DUKE	30 Connections From UNC	30 Connectior From NCS
SDX Controller		2 sec	2 sec	2 sec	2 sec
RENCI	LC-RENCI	16 sec	14 sec	22 sec	14 sec
	RENCI-S1	139 flows	80 flows	139 flows	80 flows
DUKE	LC-DUKE	21 sec	21 sec	18 sec	17 sec
	DUKE-S1	94 flows	120 flows	94 flows	120 flows
UNC	LC-UNC	18 sec	21 sec	14 sec	18 sec
	UNC-S1	52 flows	40 flows	132 flows	40 flows
NCSU	LC-NCSU	11 sec	7 sec	12 sec	24 sec
	NCSU-S1	52 flows	40 flows	52 flows	120 flows

		23 L2Tunnel Connections	52 L2Tunnel Connections	88 L2Tunnel Connections	120 L2Tunnel Connectio
SDX Controller		1 sec	4 sec	6 sec	9 sec
RENCI	LC-RENCI	8 sec	15 sec	48 sec	46 sec
	RENCI-S1	95 flows	175 flows	279 flows	419 flows
DUKE	LC-DUKE	8 sec	23 sec	26 sec	36 sec
	DUKE-S1	94 flows	198 flows	282 flows	414 flows
UNC	LC-UNC	8 sec	17 sec	24 sec	31 sec
	UNC-S1	64 flows	88 flows	164 flows	252 flows
NCSU	LC-NCSU	14 sec	21 sec	29 sec	24 sec
	NCSU-S1	64 flows	128 flows	200 flows	252 flows

3. Requests submitted sequentially for each site as the source and other sites as destination

		100 Requests (3 endpoints)	100 Requests (4 endpoints)
SDX Controller		9 sec	10 sec
RENCI	LC-RENCI	26 sec	10 sec
	RENCI-S1 RENCI-S2	269 flows 311 flows	319 flows 611 flows
DUKE	LC-DUKE	10 sec	15 sec
	DUKE-S1	614 flows	814 flows
UNC	LC-UNC	20 sec	13 sec
	UNC-S1	612 flows	612 flows
NCSU	LC-NCSU	9 sec	16 sec
	NCSU-S1	462 flows	612 flows