

AtlanticWave-SDX: Connecting FABRIC to remote instruments and research facilities in Florida, Latin America, and Africa

Jeronimo Bezerra, Italo Valcy, Luis Marin, Sai Krishna, Marcos Schwarz, Yufeng Xin, and Julio Ibarra

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Outline

- The Challenge
 - Connecting researchers to remote science resources
- What is a Software-defined Exchange Point?
- Introducing the NSF IRNC AtlanticWave-SDX 2.0 project
- List some Major Facilities connected to AtlanticWave-SDX
- A use case
- The tutorial:
 - How to use AtlanticWave-SDX's Layer 2 FABRIC facility port
 - How to use AtlanticWave-SDX's Layer 3 FABRIC facility port



The Challenge: Finding and Connecting to external resources

- FABRIC has several resources available to experimenters, from GPU and FPGA, to P4 switches and fast disks.
- FABRIC has developed the concept of Facility Ports to connect to external resources, for instance remote instruments and data lakes.
- However, sometimes, there are several network domains between FABRIC and an external resource
 - Finding and connecting to those resources could become a complex activity
- Several initiatives have been created to improve research and education networks connectivity, from dynamic provisioning to public APIs
 - However, in most cases, experimenters still need to contact NOC to get a path deployed
- In this talk, we are going to present the AtlanticWave-SDX project and its approach to simplifying connecting experimenters, network operators, major facilities, and remote instruments.



Global Connectivity



GLIF Map - 2017 AtlanticWave sox INTERNATIONAL DISTRIBUTED SOFTWARE-DEFINED EXCHANGE

Connectivity in the U.S. (The Quilt + Internet2)



What is a Software-defined Exchange Point (SDX)?

- Research and Education Networks (RENs) leverage Open Exchange Points (OXPs) to create the R&E fabric across the globe
- There are no standards to define how OXPs should operate:
 - Multiple service provisioning solutions
- Establishing multi-domain circuits across multiple OXPs is still a challenge:
 - AutoGOLE (now AutoGOLE/SENSE) was created to enable inter-domain provisioning
 - No path protection, NSI is 10+ years old, and still not deployed by most RENs and OXPs
- Software-defined Exchanges (SDX) was an approach to bring the power of SDN to OXPs:
 Aiming to enable complex services, including multi-domain provisioning, and enhance integration between OXPs.



NSF IRNC AtlanticWave-SDX 2.0

- AtlanticWave-SDX: A Distributed Production SDX, supporting research, enhancing operations, and interoperability testing at national and international scales.
 - NSF IRNC Award# OAC-2029278 (Dec 2020 to Nov 2025)

Goals:

- Improving the distributed SDX between the U.S., South America, and Africa
- Evolving the development, integration and deployment of the AtlanticWave-SDX controller
- Coordination and engagement towards the adoption of the AtlanticWave-SDX



AtlanticWave-SDX: Connecting Science Resources



Major Facilities connected to AtlanticWave-SDX

PATh nodes in Miami and Chile*

- Addresses the needs of the rapidly growing community of faculty and students who are embracing Distributed High Throughput Computing (dHTC) technologies and services to advance their research. <u>https://path-cc.io</u>
- NRP cluster (4 nodes)
 - Provides access to cutting-edge technologies in AI, high-performance computing, data storage, and networking. <u>https://nationalresearchplatform.org</u>

- Worldwide Large Hadron Collider Computing Grid (WLCG) Tier 2 datacenter at UNESP/SPRACE, Brazil
- Several telescopes in Chile, including
 - Vera Rubin Observatory
 - Atacama Large Millimeter Array (ALMA)
 - GEMINI South Telescope
- Open Science Grid (OSG) Origins and Caches
 - UNESP/SPRACE and FIU
- CPTEC Center for Weather Forecast in Brazil
- HPC nodes in Brazil and South Africa



Other Resources connected to AtlanticWave-SDX

Testbeds:

- FABRIC Node at Florida International University with a 100G facility port
- RARE P4 testbed
 - Testbed created to focus on determining if a routing software platform solution can fit R&E use cases. https://wiki.geant.org/display/RARE
- AmLight SDN testbed
 - Testbed created to enable researchers to try new SDN approaches over a production infrastructure
- AutoGOLE/SENSE
- Instruments @ AtlanticWave:
 - Network Tester/Packet Generator
 - In-band Network Telemetry (INT) datasets
 - Data Transfer Nodes (DTNs)



Connecting FABRIC to AtlanticWave, a use case: Deliverying production telemetry to FABRIC DPUs

- Cyber Training on Accelerating Infrastructure Workloads using Next-Generation SmartNICs and DPUs (Award # 2417823)
- PI team: Elie Kfoury (PI), Ana Hunsinger and Jorge Crichigno (Co-PI) (University of South Carolina)
- Getting access to production telemetry data can benefit the project.
- Project's DPUs are available but we need to get the data there.
- Using FABRIC's facility port plus AtlanticWave-SDX is the simplest approach.



What's this tutorial about?

- How to use FABRIC's Facility Ports and AtlanticWave-SDX to get to AtlanticWave's remote resources and scientific instruments
- How to use the AtlanticWave-SDX's Python library, SDX-Lib
- Two use cases using FABRIC's facility port to AtlanticWave:
 - Connecting to NRP with a dedicated L2VPN
 - Connecting to AtlanticWave's perfSONAR node using a L3VPN/IP



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 - PI: Julio Ibarra/FIU
 - Co-PIs: Yufeng Xin/RENCI, Heidi Morgan/USC-ISI, Lisandro Granville/UFRGS, Jeronimo Bezerra/FIU





AtlanticWave-SDX 2.0: Improving network services for Major Facilities and R&E networks using Dynamic Orchestration and Service Provisioning.

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